การวิเคราะห์คุณค่าทางโภชนาการและสารต้านอนุมูลอิสระของถั่วแปบและผักแปม

Investigation of Nutritional Composition and Antioxidant Activity of *Lablab purpureus* (L.) Sweet and *Acanthopanax trifoliatus* Merr.

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บทคัดย่อ

งานวิจัยนี้ มีวัตถุประสงค์เพื่อวิเคราะห์คุณค่าทางโภชนาการและฤทธิ์ต้านอนุมูลอิสระของถั่วแปบและผักแปม ซึ่งเป็นพืชพื้นบ้านที่ใช้ประโยชน์ในจังหวัดเชียงราย การวิเคราะห์คุณค่าทางโภชนาการด้วยวิธีการ Association of Official Analytical Chemists (AOAC) ผลการวิเคราะห์พืชทั้ง 2 ชนิด พบปริมาณ ไขมัน โปรตีน คาร์โบไฮเดรต ใยอาหารและเถ้า อยู่ในช่วง 1.98 - 3.56, 20.77 - 26.15, 37.37 - 50.53, 10.77 - 22.75 และ 6.49 - 9.93 กรัมต่อ 100 กรัมน้ำหนักแห้ง ตามลำดับ นอกจากนี้ พืชทั้ง 2 ชนิด ยังพบแร่ธาตุ 12 ชนิด (N, P, K, Ca, Mg, Mn, S, B, Na, Fe, Zn และ Cu) ในอัตราส่วนที่แตกต่างกัน สำหรับการวิเคราะห์สารต้านอนุมูลอิสระและปริมาณสารฟีนอลิก พบว่า ผักแปมมีฤทธิ์ต้านอนุมูลอิสระ 26.81 ไมโครโมล TE/กรัม และปริมาณสารฟีนอลิก 9.42 มิลลิกรัม GE/กรัม ที่สูงกว่าถั่วแปบ

คำสำคัญ: ผักแปม สารต้านอนุมูลอิสระ ถั่วแปบ คุณค่าทางโภชนาการ

ABSTRACT

This research was purposed to investigate nutritional composition and antioxidant activity of *Lablab purpureus* (L.) Sweet and *Acanthopanax trifoliatus* Merr., the useful local plants in Chiang Rai. Nutritional analysis was based on Association of Official Analytical Chemists (AOAC) method. The result revealed that both plants contained fat, protein, carbohydrates, crude fiber and ash in ranges of 1.98 - 3.56, 20.77 - 26.15, 37.37 - 50.53, 10.77 - 22.75 and 6.49 - 9.93 g per 100 g DW, respectively. Moreover, both plants also provided different ratios of 12 minerals (N, P, K, Ca, Mg, Mn, S, B, Na, Fe, Zn and Cu). For antioxidant and total phenolic analysis, it was found that *A. trifoliatus* Merr. represented antioxidant activity with the value of 26.81 µmol TE/g and phenolic content with the value of 9.42 mgGE/g higher *L. purpureus* (L.) Sweet

Keywords: *Acanthopanax trifoliatus* Merr., antioxidant, *Lablab purpureus* (L.) Sweet, nutritional composition,

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Introduction

There are many local plants that were distributed worldwide. Wild plants were documented but less known about macro- and micronutrient (Grivetti and Ogle, 2000). Edible wild plants could provide nutritional composition with mineral content and medicinal values. The earlier elemental analysis of nutritional value of some fodder plant species was achieved. It was found to contain proteins, crude fiber, fats and oils, moisture, ash content carbohydrates and 16 elements (Na, Mg, Al, Si, P, S, Rb, K, Ca, Fe, Mn, Ti, Ni, Cu, Zn and Cl) (Bahadur et al., 2011). In addition, nutritional investigations of some local vegetables from Delta State, Nigeria were carried out. The results revealed that vegetables contained amounts of nutrients such as crude protein, crude lipid, carbohydrate, moisture, ash, crude fiber, and mineral elements (Na, Ca, K, Mn, Fe, Zn, P and Cu) thus they could be beneficial for consumption as dietary supplements (Agbaire and Emoyan, 2012). Moreover, nutritional composition analysis and DPPH radical scavenging properties of *Paederia foetida* and *Erechtites hieracifolia* have reports. Both vegetables contained minerals and antioxidant activities with IC_{50} value in a range of 4.53 - 8.46 mg/mL (Srianta et al. 2012). Antioxidant capacities of selected native Australian herbs and spices were also examined, revealing that all of plants exhibited antioxidant activities (Konczak et al., 2010).

Lablab purpureus (L.) Sweet and *Acanthopanax trifoliatus* Merr. (Figure 1) were local plants found in Chiang Rai province located in the north of Thailand and commonly consumed by local people. Therefore, it was interesting to study both plants in terms of nutritional composition, mineral content and antioxidant activity as they were local plants that provided nutrition sources. This study could provided the development of local plants of the commercial products in the future.

(a)

(b)

Figure 1. (a) *Lablab purpureus* (L.) Sweet (b) *Acanthopanax trifoliatus* Merr.

Methods

Nutritional and mineral information

L. purpureus (L.) Sweet and *A. trifoliatus* Merr. were harvested from Chiang Sean district, Chiang Rai province. Both of samples were dried and the proximate analysis was performed by AOAC method to obtain the composition of fat, protein, carbohydrates, crude fiber and ash (AOAC, 2000). Total nitrogen (N), phosphorus (P), boron (B) and sulfer (S) were measured with Kjedahl, Vanadomolybdate, Azomethine-H and $BaCl_2$ method, respectively. Atomic Absorption Spectroscopy (AAS)

method was used to quantify calcium (C), magnesium (Mg), iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn). Potassium (K) and sodium (Na) were quantified by Atomic Emission Spectroscopy (AES) method.

Total phenolic content and antioxidant activity

L. purpureus (L.) Sweet and *A. trifoliatus* Merr. were dried, weighed, ground and extracted by methanol. Then, the sample solution was filtered and evaporated to make a crude extract. The extract was dissolved in methanol. DPPH (1,1-diphenyl-2hydrazy) radical scavenging method was used to quantify antioxidant activity by the method slightly modified from Brand-Williams *et al.* (1995) and Miliauskas et al. (2004). The absorbance (515 nm) was recorded by a UV/visible light spectrophotometer. Trolox was used as a standard antioxidant. The experiment was performed in triplicate and expressed in μmol TE/g. The total phenolic content was determined by using Folin-Ciocalteu reagent with a gallic acid calibration curve as previously described on Hossain et al., 2015. The absorbance was measured at 760 nm. The total phenolic concentration was calculated as mg of gallic acid/ g extract and performed in triplicate.

Results

Nutritional and mineral information

Different nutrient compositions were presented in Table 1. *L. purpureus* (L.) Sweet consisted of protein, fat, carbohydrate, crude fiber and ash content with the value of 26.15, 1.98, 37.37, 22.75 and 6.49 g per 100 g dry weight, respectively, whereas *A. trifoliatus* Merr. provided protein, fat, carbohydrate, crude fiber and ash in amounts of 20.77, 3.56, 50.53, 10.77 and 9.93, respectively. Mineral composition of *L. purpureus* (L.) Sweet and *A. trifoliatus* Merr. was represented in Table 2. Both of plants was composed of different ratios of 12 minerals (N, P, K, Ca, Mg, Mn, S, B, Na, Fe, Zn and Cu).

Table 1. Nutrient composition of local plant

Nutrient composition (g per 100 g dry weight)	Types of local plants	
	L. purpureus (L.) Sweet	***A. trifoliatus Merr.***
Protein	26.15±0.061[a]	20.77±0.062[b]
Fat	1.98±0.040[b]	3.56±0.056[a]
Carbohydrate	37.37±0.044[b]	50.53±0.053[a]
Crude fiber	22.75±0.062[a]	10.77±0.043[b]
Ash	6.49±0.046[b]	9.93±0.050[a]

Statistical significance was determined by analysis of t-test with adjustment for multiple comparisons with Turkey's test. Values are means ± standard deviation of triplicate determinations. Values in the same row with different superscripts are significantly different ($P \leq 0.05$).

Table 2. Mineral content of local plants

Mineral content	*L. purpureus (L.) Sweet*	*A. trifoliatus Merr.*
Nitrogen (%)	4.20±0.043[a]	3.36±0.040[b]
Phosphorus (%)	0.50±0.053[a]	0.44±0.053[a]
Potassium (%)	2.71±0.062[b]	3.16±0.026[a]
Calcium (%)	0.81±0.036[b]	2.62±0.053[a]
Magnesium (%)	0.51±0.056[a]	0.60±0.072[a]
Manganese (mg/kg)	30.99±0.082[b]	76.13±0.351[a]
Sulfur (%)	0.17±0.006[a]	0.15±0.005[b]
Boron (mg/kg)	13.92±0.065[a]	11.18±0.055[b]
Sodium (mg/kg)	413.10±0.818[b]	453.20±1.400[a]
Iron (mg/kg)	34.49±0.678[b]	97.30±0.913[a]
Zinc (mg/kg)	36.32±0.095[b]	45.74±0.513[a]
Copper (mg/kg)	9.78±0.096[b]	13.95±0.098[a]

Statistical significance was determined by analysis of t-test with adjustment for multiple comparisons with Turkey's test. Values are means ± standard deviation of triplicate determinations. Values in the same row with different superscripts are significantly different ($P \leq 0.05$).

Total phenolic content and antioxidant activity

Total phenolic content and antioxidant activity were presented in Table 3. The result revealed that *A. trifoliatus* Merr. showed the highest antioxidant activity (26.81 umol TE/g) and total phenolic content (9.42 mg GE/g). For *L. purpureus* (L.) Sweet, it exihibited DPPH radical scavenging activity and total phenolic content of 3.24 µmol TE/g and 2.75 mg GE/g, respectively.

Table 3. Total phenolic content and antioxidant activity of local plants

Types of plants	***DPPH radical scavenging activity (µmol TE/g)***	***Total phenolic content (mg GE/g)***
L. purpureus (L.) Sweet	3.24±0.095[b]	2.75±0.096[b]
A. trifoliatus Merr.	26.81±0.065[a]	9.42±0.065[a]

Statistical significance was determined by analysis of t-test with adjustment for multiple comparisons with Turkey's test. Values are means ± standard deviation of triplicate determinations. Values in the same column with different superscripts are significantly different ($P \leq 0.05$).

Discussion

Nutrient composition of *L. purpureus* (L.) Sweet and *A. trifoliatus* Merr. consisted of fat, protein, carbohydrates, crude fiber and ash in the range of 1.98 - 3.56, 20.77 - 26.15, 37.37 - 50.53, 10.77 - 22.75 and 6.49 - 9.93 g per 100 g dry weight, respectively. Both of plants contained 12 minerals (N, P, K, Ca, Mg, Mn, S, B, Na, Fe, Zn and Cu). *A. trifoliatus* Merr. also exhibited the total phenolic content and DPPH radical scavenging

activity (9.42 mg GE/g and 26.81 umol TE/g) higher than *L. purpureus* (L.) Sweet.

Both of plants contained higher amounts of protein (20.77 - 26.15 g per 100 g dry weight) than other plants that were earlier examined. For example, proximate analysis of *Caralluma tuberculata,* which is a famous traditional medicinal plant in Pakistan, was investigated revealed the lower value protein content (5.26 g per 100 g dry weight) (Ahmad *et al.,* 2014). In addition, proximate composition of *Amaranthus hybridus* L. leaves was studied and it was presented to have protein content of 17.92 g per 100 g dry weight (Akubugwo et al., 2007). Besides, total protein (91.9 mg/g) of *Trianthema portulacastrum* L., a wild edible plant from Pakistan (Khan et al., 2013), was less than that found in both of plants. *L. purpureus* (L.) Sweet contained 22.75 g crude fiber per 100 g dry weight which was a higher amount than those found in some of plant species such as *A. hybridus* L. and *C. tuberculata* which provided crude fiber of 8.61 and 19.42 g per 100 g dry weight, respectively (Akubugwo et al., 2007; Ahmad *et al.,* 2014). Moreover, *L. purpureus* (L.) Sweet also presented higher protein content (26.15 g per 100 g dry weight) than that of three varieties of Rugare (*Brassica oleracea* var. acephala) that had protein content in a range of 20.71 - 21.76 g per 100 g dry weight (Mariga et al., 2012).

The amounts of some kinds of minerals from local plants in this investigation were higher than the other corresponding plants. It was found that both of plants represented higher amounts of Na, K, Ca, Mg, Fe, Zn and P than *Amaranthus hybridus* L. leaves (Akubugwo et al., 2007). In addition, some of minerals (Ca, Zn and Fe) from 15 improved varieties of cowpeas in Tanzania were less than those found in *L. purpureus* (L.) Sweet and *A. trifoliatus* Merr (Mamiro et al., 2011). *L. purpureus* (L.) Sweet and *A. trifoliatus* Merr contained high amount of Zn (36.32 - 45.74 mg/kg). It was found that both plants provided higher quantity than *Allium hookeri*, an ethnic medicinal food plant used among Adi tribes of India, which had the Zn content of 23.5 mg/kg (Payum et al., 2015). Macro-mineral composition (N, K, Na and P) of both plants revealed to be higher than edible wild plants from Northeast India such as *Diospyros peregrine*, *Holboellia latifolia*, *Illicium griffithii*, *Persea fructifera* and *Malus sikkimensis* (Saha et al., 2014).

L. purpureus (L.) Sweet and *A. trifoliatus* Merr. presented the potent antioxidant activity. *A. trifoliatus* Merr. exhibited the highest DPPH radical scavenging activity and total phenolic compound. Antioxidant activity of *A. trifoliatus* Merr. (26.81 umol TE/g) was higher than some plant species such as *Piper nigrum* L. (12.42 umol TE/g) (Lu *et al.,* 2011). In addition, it was found that total phenolic compound of *A. trifoliatus* Merr. (9.42 mg GE/g) was higher than thyme (*Thymus vulgaris* L.), sage (*Salvia officinalis* L.), and marjoram (*Origanum majorana* L.) extracts (5.20 - 8.10 mg GE/g) (Roby et al., 2013). Moreover, *A. trifoliatus* Merr. was also reported to have higher total phenolics than *Foeniculum vulgare* (6.76 mg GE/g), *Angelicae dahuricea* (7.86 mg GE/g), *Fructus amomi* (8.99 mg GE/g) and *Cuminum cyminum* (9.00 mg GE/g) (Lu et al., 2011).

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