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Evaluation of ethnobotanical vegetables and herbs in Samut Songkram province

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Abstract

The research study was conducted to survey the data, which were related to local vegetables and herbs from government and inhabitants, such as cultivation data, processing data, data from interviewer and data of utilization. Then, local vegetables and herbs were sampling, collected and analyzed for nutritive values. The finding showed that local vegetables and herbs were processed and traded in low amount. There were imported from neighboring provinces, such as Rajaburi and Bangkok. The attitude between government officers and local manufacturers were conflicted by government officers were intended to improve quality of products, therefore, local manufacturers were interested to promote health benefits and product styles. The collected samples were angled gourd (*Luffa acutangula* Linn.), holly basil (*Ocimum sanctum*), Seablite (*Suaeda maritima*), karanda (*Carissa carandas* Linn.), Tahitian noni leaves and fruits (*Morinda citrifolia*), Indian camphorweed (*Pluchea indica* Less.), sea holly (*Acanthus ebracteatus* Vahl.), blue thunbergia (*Thunbergia laurifolia* Linn.) and betel pepper (*Piper betle* Linn.), which were analyzed to determine nutritive values, such as, water content, protein, fat, carbohydrate, dietary fibre, calcium, beta-carotenes and vitamin C. From the results, we were suggest that some of local vegetables, seablite was possess highly nutritive values for health benefits, which, were ability to processing as functional foods. In addition, Tahitian noni, blue thunbergia and betel pepper are widely distributed in Thailand, which had high nutritive values when grown up in Samut Songkram area.

Keywords: local vegetables; local herbs; Samut Songkram; nutritive values

1. Introduction

Samut Songkhram is located 72 kilometers from Bangkok, occupies an area of 416 square kilometres and is administratively divided into 3 districts: Amphoe Muang, Amphoe Amphawa, and Amphoe Bang

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Khonthi. Samut Songkhram is the province of fertile land, of plants and food grains, the production source of vegetables and fruits, as well as a vast variety of seafood products [1]. In this study, we attempted to survey the data, which were related to local vegetables and herbs from government and inhabitants, such as cultivation data, processing data, data from interviewer and data of utilization. Then, local vegetables and herbs including angled gourd (*Luffa acutangula* Linn.), holly basil (*Ocimum sanctum*), seablite (*Suaeda maritima*), karanda (*Carissa carandas* Linn.), Tahitian noni leaves and fruits (*Morinda citrifolia*), Indian camphorweed (*Pluchea indica* Less.), sea holly (*Acanthus ebracteatus* Vahl.), blue thunbergia (*Thunbergia laurifolia* Linn.) and betel pepper (*Piper betle* Linn.), which were sampling, collected and analyzed for nutritive values. These studies will provide some information on the nutritional values for supporting the use of these plants for health benefits.

2. Materials and methods

2.1. Plant material collection

The basis data of local vegetables and herbs, such as, cultivated area, last annual yield of production and local expert's interview, which were supported by Samut Songkram agricultural extension office. All the plant specimens were collected from Samut Songkram area. Each specimen was divided into 2 portions. The first portion was sent for the nutritional analysis as fresh samples and the second portion was dried at 45 °C and ground. The latter portion was kept for biological tests on further research study.

2.2. Nutritional values [2]

Proximate analysis

The proximate analysis was carried out according to the methods to be described, or based on the Official Methods of Analysis of AOAC International, 16th ed. [2]. The fresh samples were used for the water content determination. The remaining samples were dried at 105 °C for 3 hours, ground, and then stored in air-tight containers in a cool, dry place for other analyses.

Water content determination

Three to five grams of each sample was dried at 105 °C for 3 hours. The dried sample was then weighed. The water content was calculated as the percentage on the wet weight basis.

Determination of crude protein

Crude protein was determined by Kjeldahl method, using Buchi Digestion Unit (B-435) and Distillation Unit (B-323) (Buchi, Switzerland). Dried sample (0.2 g) was digested with 20 ml of conc. H_2SO_4, using 3 g of the selenium and copper sulfate mixture as the catalyst. The digestion was continued for half an hour after the digestion mixture turned clear green. Then 60 ml of 32% sodium hydroxide solution was added, and the mixture was distilled for 3 minutes. The distillate was collected in a flask containing 60 ml of 2% boric acid solution, with methylene blue and methyl red as the indicators. The distillate was then titrated with 0.1 N H_2SO_4 solution; the end point was purple. Crude protein was calculated as the percentage on the wet weight basis (N × 6.25).

Determination of crude fat

One gram of the dried sample was extracted with 25 ml of petroleum ether in a Goldfisch apparatus (Labconco, U.S.A.) for 3-4 hours. The petroleum ether extract was evaporated to dryness at 105 °C. The residue was weighed and then calculated as the percentage of crude fat on the wet weight basis.

Determination of dietary fiber

Insoluble dietary fiber content was determined according to the AOAC Official Method 991.42 [2]. Amyloglucosidase (conc.) in the amount of 0.1 ml was used instead of 0.3 ml of the normal strength enzyme. Soluble dietary fiber content was determined according to the AOAC Official method by modified as in insoluble dietary fiber determination. The sum of both values was recorded as the total dietary fiber content of each sample.

Determination of total ash content

One gram of each sample was ignited in a muffle furnace at 525 °C until ash was obtained. The residue was weighed and expressed as total ash on the wet weight basis.

Determination of carbohydrate

The carbohydrate content was obtained by difference, subtracting the water content, crude protein, crude fat, total dietary fiber, and total ash contents from 100% w/w.

Determination of calcium

Calcium and Potassium were determined as outlined in AOAC International Methods of Analysis [2]. Calcium was determined by ashing accurately weighed 1 g of dried and ground sample into glazed, high-form porcelain crucible for 2 h in a muffle furnace at 500 ˚C. The ashed sample was left to cool and10 drops of deionised water followed by 3 – 4 ml of nitric acid were added to the sample. Excess nitric acid was evaporated by placing the sample on a hot plate set at 100 – 120 ˚C. The sample was returned to furnace and ashed for additional 1 h and after being cooled, the ash was dissolved in 10 ml hydrochloric acid and transferred quantitatively to 50 ml volumetric acid. In order to counteract chemical interferences, which have been fairly documented to depress calcium absorbance, a releasing agent in form of lanthanum (10,000 µg/ml) was added in all replicates and standards to obviate combined interference effects. For potassium determination, the same procedure as outlined for calcium was followed. Potassium is partially ionized in the air-acetylene flame and to suppress ionization, cesium nitrate (1000 µg/ml cesium) was added in all the solutions including the blank. In case of higher concentrations of potassium in all the samples, original samples were diluted in the range of 300 – 500 times in order to achieve the optimum working conditions for the instrument. Analysis for both calcium and potassium was carried out using atomic absorption spectroscopy set at different wavelengths for the optimum working conditions of the two minerals. The burner height was manually adjusted on the instrument to ensure maximum absorption.

2.3 Determination of vitamin C and β-carotene

Method for vitamin C and β-carotene determination by high performance liquid chromatography (HPLC) were modified from Zhoa, et al. [3] and briefly described as following:

Chemicals and materials

Vitamin C (L-ascorbic acid, purity: 99%) and β-carotene [(±)-alpha-tocopherol, purity: 97%] were obtained from Sigma Chemical Co. (St. Louis, MO, USA). Methanol, acetonitrile and tetrahydrofuran were obtained from Merck KGaA (Darmstadt, Germany). All solvents were of HPLC grade. All reagents were used without further purification. Deionized water, purified by Milli Q system (Millipore, Milford, MA, USA), were used throughout the study. Stock solution of β-carotene was prepared at 10 mg/ml in chloroform. Stock solution of vitamin C was prepared at 10 mg/ml in methanol. All stock solution were protected from light and stored at -20 ˚C. The stock solutions were further diluted with methanol to give a

series of working standards. The working solutions for spiking blank plant samples were prepared fresh daily.

Sample preparation

Samples were spiked with concentrations ranging from 100 to 5000 μg/ml for vitamin C and from 0.25 to 5.0 μg/ml for β-carotene. Vitamin C in plant sample was extracted as follows: protein of dried sample was precipitated with 60% methanol and 1 mM EDTA. Dried sample (0.1 mg) was mixed with 400 μl of 60% methanol/EDTA, incubated for 10 min at 4 ˚C before centrifuging at 12,000 rpm for 8 min. The clear phase was transferred to another polypropylene tube and evaporated to dryness under nitrogen. The dried extracts were dissolved in 100 μl of methanol. β-carotene in dried samples were extracted as follows: Dried sample (0.1 mg) was deproteinized with 100 μl of ethanol and was extracted with 600 μl of chloroform. The extract was shaken for 5 min before centrifuging. The organic layer was extracted and evaporated to dryness under nitrogen. The dried extracts were dissolved in 100 μl of methanol. All reconstituted antioxidants were mixed together before infecting into the HPLC system.

Instrumentation and quantification of vitamin C and β-carotene

The HPLC system (Water 2690 Separation Module) consist of a Water 600E multisolvent delivery system pump, a Waters Ultra WISP 715 autoinjector, and a Waters 996 diode-array detection system set in a range of 200-400 nm vitamin C and β-carotene were separated on the LiChrospher 100 RP-18 column (125 × 4 mm I.D.; particle size, 5 μm) from Merck KGaA KGaA (Darmstadt, Germany), with a mobile phase of methanol-acetonitrile-tetrahydrofuran (75: 20: 5, v/v/v) at flow rate 1.2ml/min. Samples were quantified using peak area of vitamin C and β-carotene, which were corresponded to standard calibration curves. Standard calibration curves were constructed by various known concentration of vitamin C and β-carotene.

3. Results and discussion

3.1 Surveillances for local vegetables and herbs cultivation and usages

The finding showed that local vegetables and herbs were processed and traded, in low amount and cultivated mainly for household used. Only 2 sub-districts of Amphoe Amphawa namely, Phraek Nam Daeng and Wat pradu and 2 sub-districts of Amphoe Bang Khonthi namely, Chom Pluak and Don Manora, were cultivated area of local vegetables and herbs for trading. There were imported from neighboring provinces, such as Rajaburi and Bangkok. Because of the agriculturists were intended to cultivated tropical fruits, such as, lychee, pomelo, guava and coconuts rather than herbs or vegetables. The attitude between government officers and local manufacturers were conflicted by government officers were intended to improve quality of products, therefore, local manufacturers were interested to promote health benefits and product styles. It should be reduce such conflicted urgently by collaboration campaign between government officers and local manufacturers.

3.2 Nutritive values of local vegetables and herbs

According data were provided from Samut Songkram agricultural extension office, we were collected 5 local vegetables, angled gourd (*Luffa acutangula* Linn.), holly basil (*Ocimum sanctum*), seablite (*Suaeda maritima*), karanda (*Carissa carandas* Linn.), Tahitian noni leaves and fruits (*Morinda citrifolia*), and 4 local herbs, Indian camphorweed (*Pluchea indica* Less.), sea holly (*Acanthus ebracteatus* Vahl.), blue thunbergia (*Thunbergia laurifolia* Linn.) and betel pepper (*Piper betle* Linn.) for determination of nutritive values. The nutritive values including calcium, vitamin C and β-carotene constituents of local vegetables and 5 local herbs was shown in Table 1 and 2, respectively.

Table 1. Nutritive values of local vegetables and herbs in Samut Songkram

Sample	Water (%w/w)	Crude protein (%w/w)	Crude fat (%w/w)	Total ash (%w/w)	Dietary fiber (%w/w)			Carbohydrate (%w/w)
					Insoluble	Soluble	Total	
Angled gourd (*Luffa acutangula* Linn.)	92.45 ± 0.13	0.85 ± 0.04	0.22 ± 0.01	0.05 ± 0.01	2.87 ± 0.03	0.46 ± 0.01	3.33 ±0.07	3.10 ± 0.16
Holly basil (*Ocimum sanctum*)	86.53 ± 0.02	4.05 ± 0.01	0.48 ± 0.04	5.16 ± 0.01	0.86 ± 0.05	0.42 ± 0.03	1.28 ±0.07	2.50 ± 0.03
Seablite (*Suaeda maritima*)	83.55 ± 0.17	3.46 ± 0.04	0.15 ± 0.01	4.45 ± 0.01	4.78 ± 0.01	1.43 ± 0.01	6.21± 0.01	2.18 ± 0.02
Karanda (*Carissa carandas* Linn.)	85.51 ± 0.32	0.44 ± 0.05	1.26 ± 0.01	0.51 ± 0.01	92.45 ± 0.13	92.45 ± 0.13	2.79 ±0.16	9.49 ± 0.09
Tahitian noni (leaves) (*Morinda citrifolia*)	76.56 ± 0.21	4.71 ± 0.16	1.42 ± 0.11	1.97 ± 0.12	3.15 ± 0.02	1.19 ± 0.01	4.34 ±0.01	11.00 ± 0.09
Tahitian noni (fruits) (*Morinda citrifolia*)	90.23 ± 0.19	0.38 ± 0.02	0.23 ± 0.01	0.52 ± 0.04	3.92 ± 0.13	2.39 ± 0.13	6.31 ±0.11	2.33 ± 0.07
Indian camphorweed (*Pluchea indica* Less.)	87.53 ± 0.02	1.79 ± 0.05	0.49 ± 0.13	0.20 ± 0.01	0.89 ± 0.01	0.45 ± 0.13	1.34 ±0.05	8.65 ± 0.12
Sea holly (*Acanthus ebracteatus* Vahl.)	88.23 ± 0.08	3.11 ± 0.06	0.25 ± 0.04	2.59 ± 0.03	1.87 ± 0.13	0.60 ± 0.13	3.47 ±0.01	2.35 ± 0.01
Blue thunbergia (*Thunbergia laurifolia* Linn.)	80.15 ± 0.26	5.36 ± 0.17	1.12 ± 0.01	4.49 ± 0.04	3.21 ± 0.13	2.04 ± 0.13	4.25 ±0.16	4.63 ± 0.04
Betel pepper (*Piper betle* Linn.)	85.42 ± 0.11	3.21 ± 0.01	0.8 ± 0.01	2.09 ± 0.02	1.74 ± 0.01	0.59 ± 0.01	2.33 ±0.01	6.15 ± 0.02

Table 2. Calcium, β-carotene and vitamin C contained in local vegetables and herbs

Sample	Calcium (mg/ 100 g)	β-carotene (µg/ 100g)	Vitamin C (µg/ 100g)
Angled gourd (*Luffa acutangula* Linn.)	7.23 ± 0.011	34.76 ± 0.015	16.18 ± 0.029
Holly basil (*Ocimum sanctum*)	32.46 ± 0.013	812.14 ± 0.031	27.94 ± 0.021
Seablite (*Suaeda maritima*)	2,471.37 ± 0.054	3,545.16 ± 0.093	15.69 ± 0.074
Karanda (*Carissa carandas* Linn.)	12.51 ± 0.071	54.76 ± 0.052	11.05 ± 0.043
Tahitian noni (leaves) (*Morinda citrifolia*)	469.71 ± 0.065	45,784.02 ± 0.092	3.48 ± 0.035
Tahitian noni (fruits) (*Morinda citrifolia*)	51.49 ± 0.049	1,598.40 ± 0.047	85.71 ± 0.043
Indian camphorweed (*Pluchea indica* Less.)	250.91 ± 0.023	1,225.32 ± 0.051	30.17 ± 0.012
Sea holly (*Acanthus ebracteatus* Vahl.)	3,261.14 ± 0.036	1,117.52 ± 0.023	20.03 ± 0.041
Blue thunbergia (*Thunbergia laurifolia* Linn.)	14.78 ± 0.035	2,756.35 ± 0.012	2.73 ± 0.006
Betel pepper (*Piper betle* Linn.)	1.56 ± 0.029	76,642.94± 0.081	140.78± 0.028

From the results, we were suggest that some of local vegetables, seablite was possess highly nutritive values for health benefits, which, were ability to processing as functional foods. In addition, Tahitian noni, blue thunbergia and betel pepper are widely distributed in Thailand, which had high nutritive values (http://en.wikipedia.org/wiki/Noni) when grown up in Samut Songkram area.

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