Content of copper, lead and cadmium in some local vegetable samples from the South of Thailand

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Abstract: The analysis of copper, lead and cadmium in some local vegetable samples from Nakhon Si Thammarat(Mueang District) in the South of Thailand such as *as Anacardium occidentale*, *Feroniella lucida* (Scheff.) Swingle, *Diplazium esculentum*, *Emilia sonchifolia*(L.)Dc. and *Glochidion Perakense* Hook.f. were evaluated. The Local Vegetable samples were prepared according to the AOAC(2005) and then analyzed by atomic absorption spectrophotometry. The results revealed that copper, lead and cadmium were found in the range of 0.005-0.136, 0.010-0.066 and 0.001-0.021 mg/kg respectively, the percentage recovery were found at 85.30-100.75, 87.26-89.18 and 84.00-85.50 % respectively. The results showed that none of the samples exceeded the standards of the Ministry of Health, which found that standards for contamination of heavy metals in the Ministry of Health (Vol. 98) has defined a copper, lead and cadmium have not exceeded the 20, 10 and 0.3 mg/kg, respectively. The results this research study can be used as database for food safety.

1. Introduction

Vegetables are foods that people commonly eat in the form of fresh vegetables and seasonings or in enhancing the taste of food more appetizing. These foods are highly nutritious. They are rich in vitamins, minerals and fiber and certain nutrients, which are all beneficial to the body and enhances the flavor of food to eat even more.[7]

Local vegetables are a popular alternative to bring a man to help enhance the flavor of food. Especially in southern Thailand that have a culture of eating with vegetables resident as a component in many foods, such as noodles, Khao Yam, beef kidney, curry or eating fresh as a large part of southern spicy, it is eaten along with vegetables.

The nature and characteristics of the terrain, the climate of the South is suitable for the growth of local vegetables due to high moisture. The local vegetables do not grow naturally in places like wild men on the field of water resources and agricultural lands of the villagers. But the locals planted near a community in order to facilitate the consumers. The communities in the province that has local vegetation species such as *Anacardium occidentale*, *Feroniella lucida* (Scheff.) Swingle, *Diplazium esculentum*, *Emilia sonchifolia*(L.)Dc. and *Glochidion Perakense* Hook.f..

Nakhon Si Thammarat, a province where the population is dense. With the use of chemical substances, particularly heavy metals, such as copper, lead and cadmium, used in the assembly of such a vital air cover crops, livestock or other careers.

However, people still lack of the knowledge to deal with the substance, which remained active. In most cases, released into the environment surrounding community. The heavy metal residues, they fall on the ground. Water, especially

adjacent to vegetable growing. These vegetables may be absorbed into the poisonous roots. And then accumulated in the trunk or stuck in different parts of the stem. When the vegetables are eaten frequently. The heavy metals are accumulated in the body.[2-5,8-10]

Copper toxicity is a much overlooked contributor to many health problems; including anorexia, fatigue, premenstrual syndrome, depression, anxiety, migraine headaches, allergies, childhood hyperactivity and learning disorders.[3]

The toxic effects of lead, on people exposed to lead in the course of their work. Short-term exposure to high levels of lead can cause brain damage, paralysis, anemia and gastrointestinal symptoms. Longer-term exposure can cause damage to the kidneys, reproductive and immune systems in addition to effects on the nervous system. The most critical effect of low-level lead exposure is on intellectual development in young children and, like mercury, lead crosses the placental barrier and accumulates in the fetus. Infants and young children are more vulnerable than adults to the toxic effects of lead, and they also absorb lead more readily. Even short-tem, low-level exposures of young children to lead is considered to have an effect on nervous behavioral development. Consumption of food containing lead is the major source of exposure for the general population.[1-2]

The principal toxic effect of cadmium is its toxicity to the kidney, although it has also been associated with lung damage (including induction of lung tumors) and skeletal changes in occupationally exposed populations. Cadmium is relatively poorly absorbed into the body, but once absorbed is slowly excreted, like other metals, and accumulates in the kidney causing renal damage.[1-2,6]

Thus, the heavy metals, copper, lead and cadmium, in the samples of five kinds of some local vegetables such as *Anacardium occidentale*, *Feroniella lucida* (Scheff.) Swingle, *Diplazium esculentum*, *Emilia sonchifolia*(L.)Dc. and *Glochidion Perakense* Hook.f. from Nakhon Si Thammarat (Mueang District) in the South of Thailand, between August 2014 and January 2015 were studied.

2. Materials and Methods

2.1 Sample collection

A total of 5 some local vegetable samples were collected from Nakhon Si Thammarat (Mueang District) of the south in Thailand such as *Anacardium occidentale*, *Feroniella lucida* (Scheff.) Swingle, *Diplazium esculentum*, *Emilia sonchifolia* (L.) Dc. and *Glochidion Perakense* Hook.f. The first sample was starting collected from August 2014, and until January 2015. Total samples were all six times.

2.2 Sample preparation

The standard procedure described in AOAC (2005) was followed for the preparation of samples for analysis of heavy metals. Accurately at the weight of 1 g test portion, into glazed, high-form porcelain crucible. Ash 2 h at 550^{o}C, and let cool. Wet ash 10 drops H_2O, and Carefully add 3-4 mL HNO_3(1+1) on . Evaporate excess HNO_3 on hot plate set at 100-120^{o}C. Return crucible to furnace and ash addition 1 h at 550^{o}C. Cool crucible, dissolve ash in 10 mL HCl (1+1), and transfer quantitatively to 50 mL Volumetric flask.

2.3 Analytical procedure

Copper, lead and cadmium in some local vegetable samples from Nakhon Si Thammarat (Mueang District) in the south of Thailand were analyzed using atomic absorption spectrophotometer (Perkin–Elmer, 3110). Data were rounded off suitably according to the value of standard deviation from measurements in triplicate.

3. Results & Discussion

The content of copper in some local vegetable samples such as *Anacardium occidentale*, *Feroniella lucida* (Scheff.) Swingle, *Diplazium esculentum*, *Emilia sonchifolia* (L.) Dc. and *Glochidion Perakense* Hook.f. was found in the range of 0.010 to 0.067, 0.005 to 0.076, 0.011 to 0.036, 0.010 to 0.105 and 0.005 to 0.136 mg/kg respectively. (in Table 1)

The content of lead in some local vegetable samples such as *Anacardium occidentale*, *Feroniella lucida* (Scheff.) Swingle, *Diplazium esculentum*, *Emilia sonchifolia* (L.) Dc. and *Glochidion Perakense* Hook.f. was found in the range of 0.014 to 0.046, 0.025 to 0.037, 0.028 to 0.066, 0.010 to 0.046 and 0.023 to 0.032 mg/kg respectively. (in Table 2)

Table 1. The content of copper(mg/kg) in some local vegetable samples from Nakhon Si Thammarat (Mueang District) in the south of Thailand, between August 2014 and January 2015.

Month/Year	*Anacardium occidentale*	*Feroniella lucida* (Scheff.) Swingle	*Diplazium esculentum*	*Emilia sonchifolia* (L.) Dc.	*Glochidion Perakense* Hook.f.
Aug 14	0.011	0.005	0.023	0.011	0.005
Sap14	0.010	0.005	0.018	0.010	0.009
Oct 14	0.017	0.027	0.011	0.048	0.040
Nov 14	0.061	0.047	0.017	0.032	0.136
Dec 14	0.042	0.076	0.027	0.105	0.017
Jan 15	0.067	0.041	0.036	0.067	0.026

Table 2. The content of lead(mg/kg) in some local vegetable samples from Nakhon Si Thammarat(Mueang District) in the south of Thailand, between August 2014 and January 2015.

Month/Year	*Anacardium occidentale*	*Feroniella lucida* (Scheff.) Swingle	*Diplazium esculentum*	*Emilia sonchifolia* (L.) Dc.	*Glochidion Perakense* Hook.f.
Aug 14	0.014	0.027	0.033	0.027	0.028
Sap14	0.017	0.025	0.028	0.022	0.026
Oct 14	0.025	0.027	0.040	0.027	0.023
Nov 14	0.046	0.028	0.046	0.033	0.026
Dec 14	0.034	0.037	0.066	0.046	0.032
Jan 15	0.026	0.036	0.046	0.010	0.026

The content of cadmium in some local vegetable samples such as *Anacardium occidentale*, *Feroniella lucida* (Scheff.) Swingle, *Diplazium esculentum*, *Emilia sonchifolia* (L.) Dc. and *Glochidion Perakense* Hook.f. were found in the range of 0.001 to 0.021, 0.001 to 0.010, 0.001 to 0.012, 0.001 to 0.012 and 0.001 to 0.008 mg/kg respectively (Table 3). Moreover, the results showed that high amounts of copper, lead and cadmium, which is equal to 0.136, 0.066 and 0.021 mg/kg respectively found in *Glochidion Perakense* Hook.f., *Diplazium esculentum* and *Anacardium occidentale*, respectively, in November 2014, December 2014 and August 2014 respectively (Figure 1, 2 and 3 respectively). Copper has the lowest value of 0.005 mg / kg in August2014, found in *Feroniella lucida* (Scheff.) Swingle and *Glochidion Perakense* Hook.f. and *Feroniella lucida* (Scheff.) Swingle found in September2014(Figure 1). Lead was the lowest for the month of January 2015 was 0.010 mg / kg found in *Emilia sonchifolia* (L.) Dc. (Figure 2). Minimum amount of

cadmium found in *Anacardium occidentale* (September 2014), *Feroniella lucida* (Scheff.) Swingle (October 2014), *Diplazium esculentum*(October 2014), *Emilia sonchifolia*(L.)Dc. (September 2014) and *Glochidion Perakense* Hook.f. (October 2014), which is equal to 0.1 grams (Figure 3).

Table 3. The content of cadmium(mg/kg) in some local vegetable samples from Nakhon Si Thammarat (Mueang District) in the south of Thailand, between August 2014 and January 2015.

Month/Year	*Anacardium occidentale*	*Feroniella lucida* (Scheff.) Swingle	*Diplazium esculentum*	*Emilia sonchifolia*(L.)Dc.	*Glochidion Perakense* Hook.f.
Aug 14	0.021	0.010	0.010	0.012	0.008
Sap14	0.001	0.002	0.003	0.001	0.002
Oct 14	0.003	0.001	0.001	0.002	0.001
Nov 14	0.013	0.004	0.002	0.004	0.003
Dec 14	0.003	0.008	0.008	0.009	0.006
Jan 15	0.004	0.006	0.012	0.009	0.006

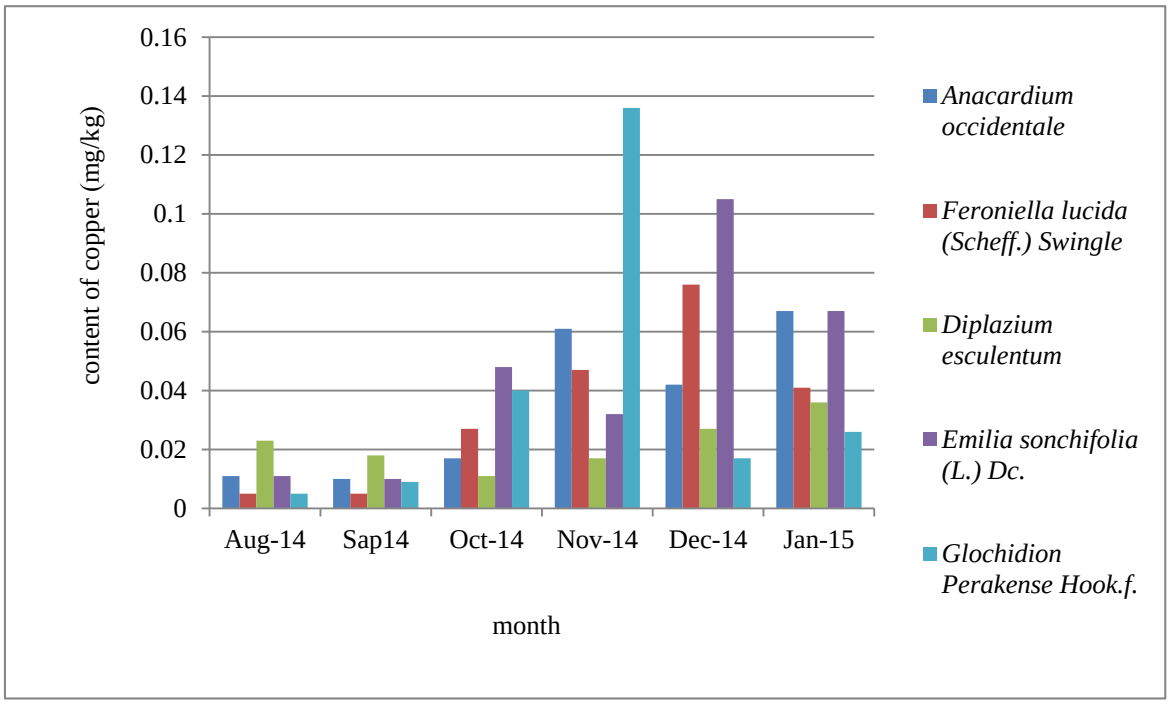

Figure 1. The content of copper in some local vegetable samples from Nakhon Si Thammarat(Mueang District) in the south of Thailand, between August 2014 and January 2015.

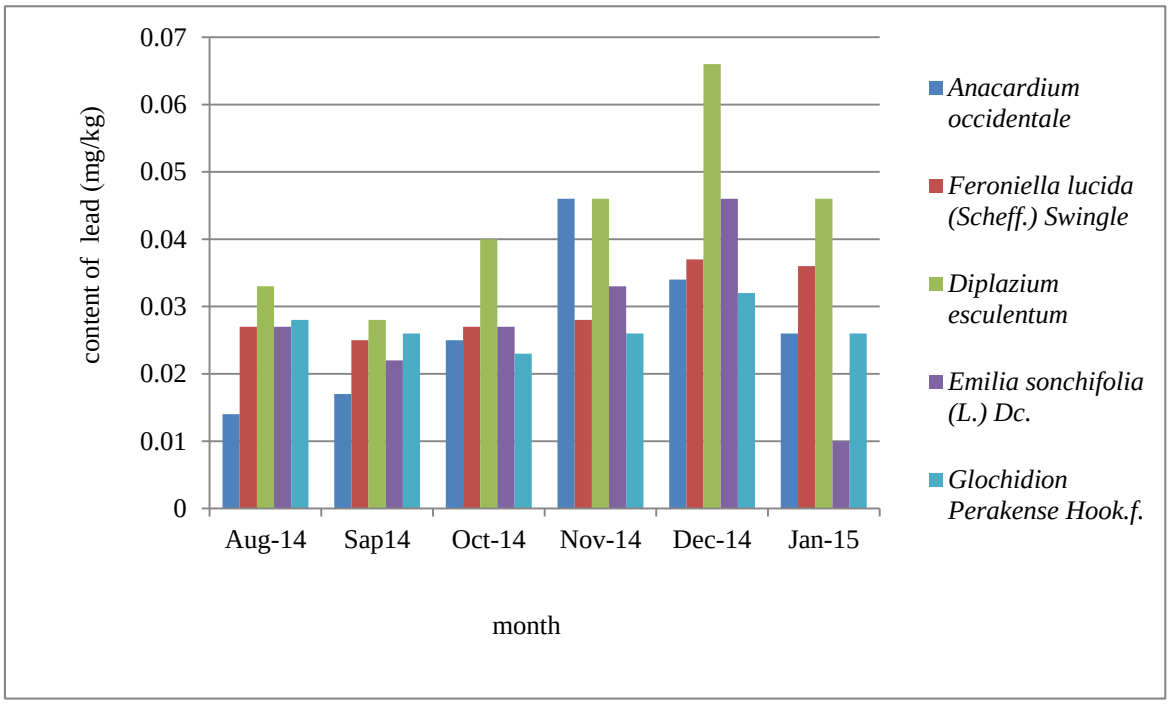

Figure 2. The content of lead in some local vegetable samples from Nakhon Si Thammarat(Mueang District) in the south of Thailand, between August 2014 and January 2015.

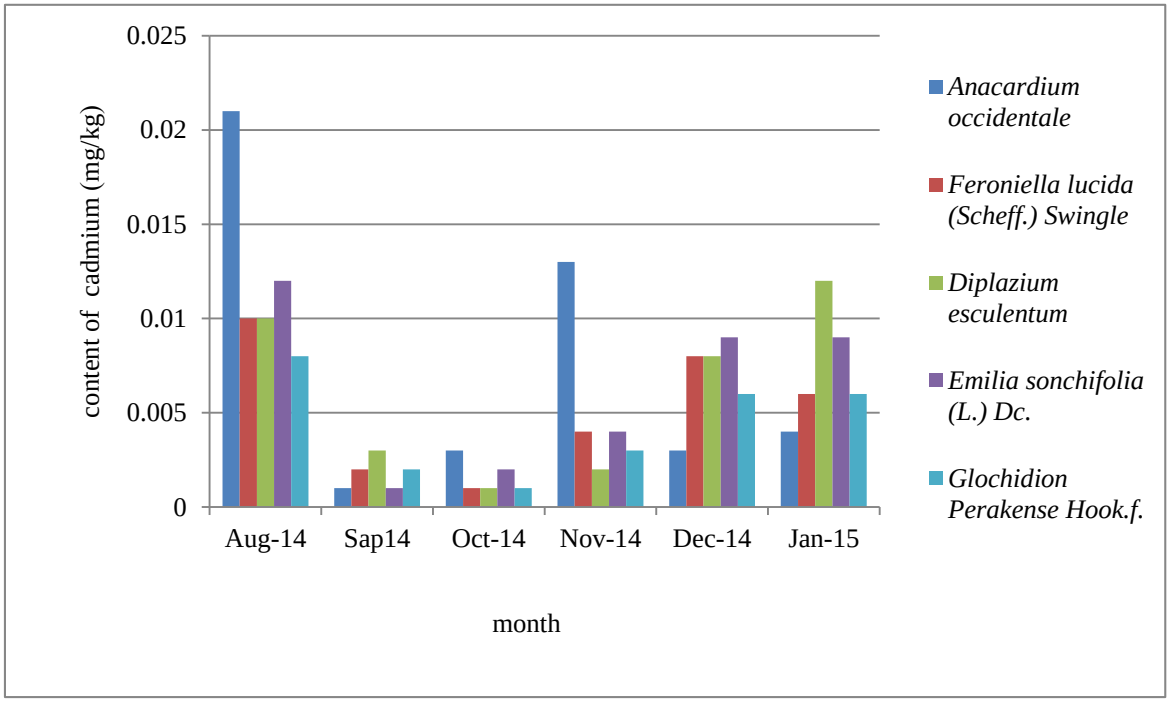

Figure 3. The content of cadmium in some local vegetable samples from Nakhon Si Thammarat(Mueang District) in the south of Thailand, between August 2014 and January 2015.

Table 4. The percentage recovery of copper, lead and cadmium in Some Local vegetable samples from Nakhon Si Thammarat (Mueang District) in the south of Thailand, between August 2014 and January 2015

heavy metals	percentage recovery [%]
copper	85.30-100.75
Lead	87.26-89.18
cadmium	84.00-85.50

The percentage recovery of copper, lead and cadmium were found at 85.30-100.75, 87.26-89.18 and 84.00-85.50 % respectively (Table 4).
However, The results showed that none of the samples exceeded the standards of the Ministry of Health, which found that standards for contamination of heavy metals in the Ministry of Health (Vol. 98) has defined a copper, lead and cadmium have not exceeded the 20, 10 and 0.3 mg/kg, respectively.

4. Conclusion

The results revealed that copper, lead and cadmium were found in the range of 0.005 - 0.136, 0.010 - 0.066 and 0.001-0.021 mg/kg respectively, the percentage recovery were found at 85.30 - 100.75, 87.26 - 89.18 and 84.00 - 85.50 % respectively. The results showed that none of the samples exceeded the standards of the Ministry of Health, which found that standards for contamination of heavy metals in the Ministry of Health (Vol. 98) has defined a copper, lead and cadmium have not exceeded the 20, 10 and 0.3 mg/kg, respectively. The results this research study can be used as database for food**.**

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