



A Preliminary Screening of Cd and Pb Concentrations in the Some Traditional Chinese Herbal Medicines Bought From Selected Shops in Peninsular Malaysia

Chee Kong Yap^{1*}, Wan Hee Cheng², Nurelly Mohd Rihan¹, Rosimah Nulit¹, Hishamuddin Omar¹ and Shamarina Shohaimi¹

¹Department of Biology, Faculty of Science, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia

²Inti International University, Persiaran Perdana BBN, 71800 Nilai, Negeri Sembilan, Malaysia

*Corresponding Author: Chee Kong Yap, Department of Biology, Faculty of Science, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia, E-mail: yapckong@hotmail.com

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ABSTRACT

A total of 20 Traditional Chinese Herbal Medicine (TCHM) was bought randomly from shops in three states of Peninsular Malaysia. All of these samples were analyzed for Cd and Pb concentrations. It was found that all the TCHM samples were found to be below the Pb maximum permissible limit by WHO (1999) except for Cold Relief Pills, Herbal Tea, Seng Lian Cough Pills and Flu Pills. For Cd, all TCHMs exceeded the WHO (1993) guideline, except for Ginseng Pills, Green Pills and Intamol. Therefore, these TCHM products should be given public serious concern. However, due to inconsistency in batch-to-batch production, it is still difficult to conclude that the TCHM products are safe from heavy metal contamination. Future regular monitoring of the products is deemed necessary.

Keywords: Heavy Metals; Traditional Chinese Herbal Medicines; Malaysia

INTRODUCTION

Cadmium (Cd) is a common toxic heavy metal contaminant in traditional medicines and it is a human carcinogen. Food accounts for approximately 90% of Cd exposure in which non-smoking members of the general population. The use of herbal medicines containing Cd may add to the Cd exposure associated with consuming a normal diet. Both the United Nations Food and Agriculture Organization (FAO) and the World Health Organization (WHO) have established safe dietary exposure levels for Cd [1].

Lead (Pb) ranks as one of the most serious environmental poisons all over the world amongst toxic heavy metals with no known biological function useful for the human body [2,3]. Reported that the analysis of the powdered herbal medicine procured from ayurveda practitioner was found to have high content of Pb responsible for the Pb toxicity. According to a review [3], Pb in the environment remains to be a matter of grave concern for the public health as it accounts for 0.6 % of the global burden of disease, with the highest burden in WHO South-East Asia region [2,4].

The common industrial uses of Cd are Cd batteries, plastics, pigments, and plating while the principal toxic effects are kidney damage, lung cancer, and bone disorder in human. For Pb, the common industrial uses are batteries, wire and cable, and alloys while the principal toxic effects are neurological effects, hematopoietic system damage, and reproductive effects in human.

In modern days, Traditional Chinese Herbal Medicine (TCHM) has become an indispensable part of the Chinese society, both as a daily supplement for vitality and an alternative apart from modern medicines [5]. Moreover, the prescription of formulas and selection of TCHM especially emphasizes an old and inflexible methodology. Due to the extensive benefits of TCHM, this form of medication has been a primary choice when it comes to healthcare in many developed countries. Its popularity among many developed countries was reflected in the blooming international trade of TCHM on a worldwide scale [6].

The control of heavy metal contents in TCHM products, particularly Cd and Pb residues, has been an international concern [7]. The increasing incidence of severe and fatal metal poisoning in the public has somewhat tarnished the overall image of TCHM products [8], the allowance limit of heavy metals content in traditional medicines had been established and imposed as registration criteria for traditional medicines in Malaysia.

Therefore, there is a need to screen the heavy metal levels in the TCHM in Malaysia since these TCHM products that is available in the market are imported where the safety consumption of these products were generally unknown. The safety issue of TCHM is an essential scientific subject of interest [9] which revolves the potential toxicity, risk and benefit of the TCHM product [10].

Many studies can be found in the literature regarding Cd and Pb levels in Herbal Medicines (HM), indicating the health concerns on these two toxic metals to human body [11], there has been an increasing growth in popularity of Over-The-Counter (OTC) health foods, and medicinal products from plants or other natural sources in developed countries. These OTC herbal products may be contaminated with excessive or banned pesticides, microbial contaminants, heavy metals, chemical toxins, and for adulterated with orthodox drugs [12] collected three-hundred-thirty-four samples representing 126 species of Chinese Herbal Medicines (CHMs), throughout China and examined for four heavy metals including Cd and Pb, [13] collected few local samples of certain herbs and determined for four heavy metals including Cd and Pb. They found that heavy metals were found below detection limits in all the samples [14] assessed the levels of heavy metal contamination in commonly consumed herbal medicine in Malaysia and the effects of boiling on these contamination levels. They investigated four commonly consumed Chinese herbal medicine in Malaysia- "Eight Treasure Herbal Tea", "Herbal Tea", Xiyangshen and Dangshen. They revealed that heavy metals including Cd and Pb were detected from all the samples, generally in low concentrations (<1 mg/L). They concluded that herbal medicines generally have heavy metal contaminants [15]

A direct assessment of blood heavy metal concentrations of frequent users of Chinese medicines (CM), who had been taking prescribed CM at least 6 days per week for not less than 3 months, to determine whether their intake of CM could cause an increased load of toxic heavy metals in the body. In particular, Cd was the most frequently found in the contaminated samples [16] analyzed 35 commonly used medicinal plants in India by exploring the possibilities of translocation of Cd and Pb into humans and animals. They found that Pb concentration in 54.29% of medicinal plants and Cd concentration in 77.14% of medicinal plants exceeded the maximum permissible level designated by the World Health Organization. The information on the heavy metal contents in the TCHM sold in Malaysian markets is lacking.

Thus, the aim of this study was to determine the Cd and Pb concentrations in the TCHM sold from several markets in Kuala Lumpur, Selangor and Johore, of Peninsular Malaysia.

MATERIALS AND METHODS

About 20 TCHM samples of different therapeutic effects were bought from several markets in Kuala Lumpur, Selangor and Johore between April and July 2005. All the samples were randomly purchased and selected. All these TCHM products are commonly used by many Malaysians. Samples bought were taken back to the laboratory and stored at room temperature. Ingredients and medicinal properties for the collected samples are presented in Table 1.

The samples were cleaned and removed of any particulates that came with the herbal were removed. Samples were then dried at 105°C for least 16 h until constant dry weight was achieved. Dried samples were shaken vigorously through a 0.5 mm stainless steel sieve to achieve homogeneity. Three replicates of each TCHM sample were analyzed for Cd and Pb.

Extraction of heavy metals from TCHM samples was performed by using the acid digestion method. Dried TCHM samples (1 gram each) were digested in a combination of concentrated nitric acid (69%) and perchloric acid (60%) at 4:1 ratio, at 40°C for the first hour and 140°C for the next 3 hours.

Digested samples were then diluted with double distilled water and filtered through Whatman No.1 filter paper before they were stored for metal determination later on. Determination of Cd and Pb in the digested samples was carried out by using an Atomic Absorption Spectrophotometer (AAS) Model Analyst 800. For quality control, all glass wares used were acid-washed to avoid contamination. In addition to that, the procedural blanks were analyzed together with the samples. The data from the AAS were verified by certified reference materials (IAEA Soil-5) and the recoveries for the two metals were of satisfactory (80-120%).

RESULTS AND DISCUSSION

The Cd concentrations ranged from BDL to 4.30 µg/g dry weight (dw), with the highest concentration in Seng Lian Cough Pills (Table 2). All TCHM products in this study exceeded the limit of Cd concentrations in phytotherapeutic formulations set [17] which is 0.30 µg/g dw, except for Ginseng Pills, Green Pills and [18] recommended the reference maximum limits of Cd in Chinese herbs in China as 0.30 mg/kg. [19] reported a Cd range of 0.105-0.314 mg/L (based on boiled and non-boiled decoctions) in four commonly consumed Chinese herbal medicine (CHM) in Malaysia namely "Eight Treasure Herbal Tea", "Herbal Tea", Xiyangshen (*Radix panacis quinquefolii*) and Dangshen (*Radix codonopsis*), which were bought randomly from two shops in Kuala Lumpur (but the sampling dates were not specified) [20] detected higher concentrations of Cd from boiled decoctions in samples *Radix panacis quinquefolii* (herbal plant parts used for 'Xiyangshen') and *Radix codonopsis* (herbal plant parts used for 'Dangshen-root'), exceeding slightly the 0.3 mg/L permissible level [12]. The higher concentrations of Cd in herbal medicine appeared to be a common finding. High Cd levels were also detected in 79 samples of various herbal medicines in Italy (up to 0.75 mg/L) [15]. This could be attributed to most plants naturally had active Cd uptake via roots which then accumulated in the plant tissues [21,22] investigated five herbal medicines in Korea that are used frequently in clinical practice and serve as representative products for monitoring Cd contamination in herbs: *Atractylodes macrocephala* (dried rhizome), *Phellodendron amurense* (dried bark), *Coptis chinensis* (dried rhizome), *Polyporus umbellatus* (dried sclerotium), and *Pinellia ternata* (dried tuber). Samples of were obtained obtained from a local market in South Korea and they reported a Cd range of 0.51-2.25 mg/kg dw for the five herbal medicines above.

The Pb concentrations ranged from BDL (below detection limit) to 25.9 µg/g dry weight (dw), with the highest concentration in Herbal Tea (Table 2). All TCHMs in this study were below the limit of Pb concentrations in phytotherapeutic formulations set by

[17] which is 10.0 µg/g dw, except for Herbal Tea, Seng Lian Cough Pills, Cold Relief Pills and Flu Pills. However, [20] found that Pb concentrations in boiled and non-boiled samples of Chinese Herbal Medicines were 1.028 and 0.750 mg/L, well within the permissible level of 10 mg/L [12,18] investigated the baseline contents and establish the reference maximum limits of Pb in Chinese herbs in China as 5.0 mg/kg [24].

A massive amount of pharmaceutical products containing *Smilax luzonensis* had been screened for the presence of Pb. The result of this screening has identified more than 14% of the products failing to meet the quality requirement for traditional medicines in Malaysia. The Malaysian NPCB [25] proposed allowable maximum permissible limit for Pb as 10 µg/g in which the Pb limit is also similarly proposed [17] in any phytotherapeutic formulations. Therefore, the Pb levels in the four TCHM products (Herbal Tea, Seng Lian Cough Pills, Cold Relief Pills and Flu Pills) in the present study that exceeded 10.0 µg/g dw should be given a grave public concern. However, the biological diversity of plant chemical in the sources of THCM products as well as the production process rendered difficulties in the safety assessment on TCHM preparations [26].

The TCHM products in the present study cannot be considered unsafe even though their Pb levels do not meet the requirement of traditional medicines in Malaysia due to the inconsistency in batch-to-batch production [24].

CONCLUSION

Based on samples collected from selected shops in Peninsular Malaysia, all the TCHM samples were found to be below the Pb maximum permissible limit [17] except for Cold Relief Pills, Herbal Tea, Seng Lian Cough Pills and Flu Pills. For Cd, all TCHMs exceeded the [2] guideline, except for Ginseng Pills, Green Pills and Intamol. Therefore, these TCHM products should be given public concern. However, it is still difficult to conclude whether the TCHM products are safe from heavy metal contamination because of batch-to-batch inconsistency. These metals must be monitored to reduce the risk of bioaccumulation of Cd and Pb in human body upon consumption.

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Table 2: Concentrations (mean ± standard error, µg/g dry weight) of Cd and Pb in the Chinese tradition herbal medicines bought from selected shops in Peninsular Malaysia.

Medicines	Cd	Pb
Herbal Tea	1.20 ± 0.33	25.9 ± 13.74
Ginseng Pills	BDL	2.59 ± 0.06
Ban Kah Chai	0.41 ± 0.16	6.82 ± 0.43
Li Chee Powder	0.95 ± 0.05	5.11 ± 1.04
Green Pills	0.20 ± 0.16	1.35 ± 0.29
Bo Ji Wan	0.76 ± 0.10	3.95 ± 1.10
Chee Ke Wan	0.41 ± 0.16	5.01 ± 0.88
Chee Suat Tan	0.93 ± 0.38	6.82 ± 0.43
Seng Lian Cough Pills	4.30 ± 0.09	19.10 ± 1.28
Intamol	0.20 ± 0.10	5.72 ± 2.57
Guan Ying Chian	0.70 ± 0.21	6.60 ± 1.51
Pang Nian Jin	0.85 ± 0.17	7.01 ± 0.91
Cold Relief Pills	1.79 ± 0.13	12.13 ± 0.12
Flu Pills	1.22 ± 0.29	17.44 ± 0.82
Biau Leng San	2.47 ± 0.30	7.58 ± 1.97
Oh Ouh Pau	2.46 ± 0.19	3.98 ± 0.36
Chee San Medicated Powder	1.21 ± 0.22	BDL
Stomachache Powder	1.20 ± 0.29	2.66 ± 0.90
Soo Hup Wan Tiny Pills	2.20 ± 0.39	4.42 ± 1.52
Tou Seah San (Baby)	1.51 ± 0.24	BDL
Hung Lien Shang Ching Pien	BDL	BDL
Minimum	4.30	25.9
Maximum		
BDL = Below Detection Limit		

Table 1: Chinese Herbal Medicines under investigation; name, ingredients and medicinal properties. Note: Information is gathered from the label of each Chinese Herbal Medicines.

No.	Name of product/ samples	Ingredients	Medicinal properties
1	Herbal tea	Tea leaves, radix and <i>Mentha arvensis</i>	Sore throat, headache and fatigue
2	Ginseng Pills	American ginseng	Fatigue and blood pressure
3	Ban Kah Chai	Peppermint oil and <i>pogostemonis</i>	Stomachache and diarrhea
4	Li Chee Powder	<i>Pulsatilla chinensis</i> and <i>Paenia lactiflora</i>	Mild diarrhea
5	Green Pills	Essential oil and radix	Fever
6	Bo Ji Wan	<i>Cordyceps sinensis</i>	Excessive sputum, cough and cold
7	Chee Ke Wan	Essential oil and radix	Diarrhea and flu
8	Chee Suat Tan	Radix and gypsum	Throat ulcer
9	Seng Lian Cough Pills	Radix and essential oil	Cough
10	Intamol	Essential oil and radix	Fever
11	Guan Ying Chian	Bark of "Guan Ying Chian"	Fatigue and blood pressure
12	Pang Nian Jin	Bark of "Pang Nian Jin"	Fatigue and relief cold
13	Cold Relief Pills	Rhizome <i>Belancandae</i> and essential oil	Cold relief
14	Flu Pills	Essential oil	Flu
15	Biau Leng San	<i>Artemisia</i> , malt and <i>coptis</i>	Woman stomachache
16	Oh Ouh Pau Chee San Medicated Powder	<i>Mentha</i> herb and <i>radix angelica</i>	Improving appetite
17	Stomachache Powder	<i>Mentha</i> herb and <i>radix angelica</i>	Stomachache and flatulence
18	Soo Hup Wan Tiny Pills	Essential oil and rhizome <i>cymbopogon</i>	Indigestion and vomiting
19	Tou Seah San (Baby)	<i>Poria cocos</i> and <i>semen Plantago asiatica</i>	Stomachache
20	Hung Lien Shang Ching Pien	Essential oil and ginseng	Reducing heat

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