ระดับตะกั่วในเลือดของประชากรในจังหวัดขอนแก่น

Blood lead levels of people in Khon Kaen Province

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บทคัดย่อ

การศึกษานี้ได้ทำการวัดค่าตะกั่วในเลือดของประชากรตัวอย่างในอำเภอชนบท และอำเภอบ้านฝาง ของจังหวัดขอนแก่น ภาคตะวันออกเฉียงเหนือของประเทศไทย ด้วยวิธี เฟลมอะตอมิคแอบซอร์พชั่น สเปคโตรโฟโตมิตรี ค่ามิเดียน (ช่วง) ของตะกั่วในเลือดของประชากร 247 คน เท่ากับ 7.0 (1.5-32)μd/dl ค่าตะกั่วในเลือดของเพศชายไม่แตกต่างจากของเพศหญิง ซึ่งเท่ากับ 7.0 (2-32) และ 7.0 (1.5-32) μd/dl ตามลำดับ ไม่พบค่าตะกั่วในเลือดเปลี่ยนแปลงตามช่วงอายุทั้งประชากรในเพศชาย และเพศหญิง เมื่อเปรียบเทียบตัวอย่างจากผู้ที่มีพฤติกรรมการสูบบุหรี่ กับผู้ไม่สูบบุหรี่ ไม่พบความแตกต่างของค่าตะกั่วในเลือด แม้การศึกษานี้จะพบว่าค่าตะกั่วในเลือดของผู้ที่ดื่มสุรา หรือดื่มกาแฟ / ชา ต่ำกว่าผู้ที่ไม่ดื่ม ส่วนของผู้ที่เคี้ยวหมากสูงกว่าผู้ไม่เคี้ยวหมาก และค่าตะกั่วในเลือดของประชากรในอำเภอชนบทสูงกว่าของประชากรในอำเภอบ้างฝางเล็กน้อย แต่ไม่พบว่ามีความแตกต่างนัยทางสถิติที่ $p<0.05$ ผลการศึกษาครั้งนี้ได้ให้ข้อมูลที่ชี้แนะถึงความสัมพันธ์ของพฤติกรรมที่เป็นปัจจัยเสี่ยงของการเกิดมะเร็งต่อระดับของตะกั่วในเลือด และยังแสดงถึงข้อมูลพื้นฐานค่าตะกั่วในเลือดของประชากรปกติในชนบทของภาคตะวันออกเฉียงเหนือของประเทศไทย

Abstract

Blood lead levels of population live in Chonnabot and Ban Fang districts of Khon Kaen Province the Northeastern Thailand, were measured by flame atomic absorption spectrophotometric method in this study. The median (range) of blood lead levels obtained from 247 samples was 7.0 (1.5-32) μd/dl. The values in males and females were not different, which were 7.0 (2-32) and 7.0 (1.5-32) μd/dl, respectively. There was no age dependence of blood lead in the studied population of both genders. When compared the behaviors and lifestyles of subjects, the blood lead levels of cigarette smokers were not different from non-smokers. We observed lower levels of blood lead in alcohol, and coffee / tea drinkers than in non-drinkers and higher levels of blood lead in betel nut chewers than in non-chewers, but there were no statistical significant differences at $p<0.05$. Similarly, the blood lead levels of subjects from Chonnabot district were relatively higher than those from Ban Fang district with no statistical siginificance. The results provide information that behavior and lifestyle related to cancer risk factors may alter blood lead levels and also demonstrate the baseline data of this metal in blood of normal population resided in the rural area of the Northeast of Thailand.

คำสำคัญ : ตะกั่วในเลือด, ขอนแก่น, ประเทศไทย

Keywords : blood lead, Khon Kaen, Thailand

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Introduction

Lead is a toxic heavy metal that can be contaminated to human by two primary routes, inhalation and ingestion. The absorbed lead can be distributed to various organs and body tissues and mostly deposited in bones. The most common procedure to measure a person's lead intake after exposure is through blood testing. Blood lead level is an indication of lead exposure at the time point in the past.

Exposure to lead has been associated with a number of serious systemic toxicological effects involving the central and peripheral nervous system, blood-forming organs, endocrine and cardiovascular system (Goyer, 1990; Lundstrom et al., 1997; Osterbreg et al., 1997). Lead compounds have also been classified as possibly carcinogenic to humans. (IARC, 1980; 1987). Although blood lead has been followed to monitor the environmental pollution in many areas, the human epidemiological evidence seemed to be still inadequate (Silbergeld et al. 2000; Steenland and Boffeta, 2000). In the United States, blood lead in children is related to residence in older housing (Pirkle et al., 1998; Taha et al., 1999). The studys on level of thirteen trace elements, including blood and serum lead, of Swedish adolescents were reported to have relation to gender, age and socioeconomic status. Higher serum levels of cobalt and copper were found in girls, while higher blood level of lead was shown in boys (Barany et al., 2002). The results of an Italian polycentric study showed that the main factors influencing blood lead levels were gender, age, body mass index, alcohol consumption and smoking habits (Apostoli et al., 2002). Ruangkanchanasetr and Suepiantham (2002) reported an increase in blood lead level of children live in Bangkok with an increase in age.

It is reported that the high incidence of liver cancer in the Northeastern population of Thailand might have a relation to life style, and behavior of dietary intake as well as other risk factors (Vatanasapt et al., 1990a, 1990b; Sriamporn et al., 1993). Our previous studies on population live in Chonnabot and Ban Fang distrits of Khon Kaen Province showed higher levels of serum g-glutamyl transpeptidase, alkaline phosphatase and antioxidant vitamins in cigarette smokers than those of the non-smokers (Sripanidkulchai et al., 2003;2004). Therefore, this study was aimed to determine the blood lead level of adult population live in these two districts.

Materials and Methods

1. Sample collection

The blood samples used in this study were obtained from people in Chonnabot and Ban Fang Districts of Khon Kaen Province who had no disease history and participated in a mobile cancer screening programme during 1990. Those found with any abnormality from a physical investigation, such as oral cavity mass, breast mass, thyroid gland enlargement or from ultrasonography and Pap smear were excluded from this study. Serum g-glutamyl transpeptidase and alkaline phosphatase but lower levels of antioxidant vitamins.

Information of tobacco smoking, betel nut chewing and alcohol drinking was obtained from questionnaires.

Overnight fasting venous blood was drawn, transferred to a test tube and kept in an ice-box. When arrival at the laboratory in the University the samples was kept at 4°C until used for analysis, which was within a week of the sample collection.

2. Determination of lead in whole blood

The method as described for blood lead determination was modified (Perkin Elmer, 1980; Areejitranusorn and Areejitraunson ,1989). Briefly, 0.6 ml of whole blood was mixed with 0.1 ml of 10% triton x-100 solution, then 0.1 ml of 2% ammonium pyrrolidine dithiocarbamate and 0.15 ml of methyl isobutyl ketone were added and vigorously mixed for 5 minutes. After an addition of 0.1 ml of deionized water, the mixture was centrifuged at 700g, for 10 minutes, then the organic layer was collected. The lead concentration was determined by using flame atomic absorption spectrophotometer (Perkin Elmer 2380,USA). The stock standard solution was prepared by dissolving lead nitrate in 0.5% nitric acid and diluted to obtain the working standard solutions at concentrations of 5,20 and 50 μg/dl. For method calibration, these working standard solutions gave linearity of detection. % coefficients of variation (CVs) of 20 repeated determinations were 3.1 and 4.1 for inter- and intra-assay, respectively.

3. Statistical analysis

All the group data were statistically evaluated and significant differences by various factors were determined using non-parametric statistical methods (Hollander and Wolfe, 1973). The results are expressed as μd/dl of median (range) of each group. The level of statistical significance was set at $p<0.05$.

Results

The median of blood lead levels of 247 samples collected from people in Chonnabot and Ban Fang districts of Khon Kaen, the Northeast of Thailand was 7.0 (1.5-32) μg/dl. There was no gender and age differences (Table 1). The median levels of male (124 samples) and female (123 samples) were 7.0 (2-32) and 7.0 (1.5-32) μg/dl, respectively. When dividing the subjects into 4 different age groups, i.e., ≤ 35, 36-45, 46-55 and 56+ years, their blood lead levels were 10.5 (3-21.5), 7.0 (2-32), 10.5 (3-28.5) and 7.0 (1.5-32) μg/dl, respectively.

The analysis of samples of the population in relation to their various behaviors and lifestyles was demonstrated in Table 2. There was no difference of blood lead in smokers and nonsmokers. The values were 7.0 (2-32) and 7.0 (1.5-32) μg/dl, respectively. The median values of blood lead were slightly lower in alcohol drinkers than in non-drinkers which were 7.0 (3.32) and 10.5 (1.5-32) μg/dl, respectively. Similarly, the values of coffee or tea drinkers were slightly lower than in non-drinkers, which were 7.0 (3-24.2) and 10.5 (1.5-32) μg/dl, respectively. The blood lead values of betel nut chewers were slightly higher than those of non-chewing i.e. 8.0 (1.5-32) versus 7.0 (2-32 μg/dl. The median blood lead of subjects in Ban Fang district was slighly higher than those in Chonnabot district, i.e. 10.5 (3-32) versus 7.0 (1.5-32) μg/dl. However, the statistical significant differences were not detected in the study on the population liftstyle and the residential area.

The details on the relationship of gender and age with behaviors and lifestyles were shown in Table3. The smokers and alcohol drinkers were more males than female, whereas betel nut chewers were more females than males. Among the population who smoked or drank, they were mostly 36-45 years old. In contrast, the betel nut chewers were at older age, which were 56+ years old.

Discussion

The results obtained in this study showed the blood lead levels of 247 adults in Khon Kaen, the Northeast of Thailand. The median blood lead values in our study were similar to the values of people resided in Muang Khon Kaen district (Areejitranusorn and Areejitranusorn, 1989), but higher than those reported of Bangkok children (Ruangkanchanasetr and Suepiantham, 2002). These values also were higher than those reported among Swedish girls (Barang, 2002). When compared to the toxicity profile for chronic lead exposure, the values are still under the values for first level toxicity (10-20 μl/dl) (Moshman, 1997).

The relative lower blood lead levels of smokers than non-smokers contradictred to the previous studies in Italy which showed higher levels of smokers than non-smokers. (Apostoli et al., 2002). This may reflect the other factors involving in blood lead levels such as types of residences as reported in USA (Pirkle et al., 1998). The blood lead levels of betel nut chewing subjects were similar to the previous report (Areejitranusorn and Areejitranusorn, 1987). Our results therefore provide information that the cancer risk factors in relation to lifestyle and behavior may alter blood lead levels and also give the base line data of this metal in blood of people in the rural area of the Northeastern Thailand.

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Table 1 Blood lead levels of people in Khon Kaen in various age ranges

Age	Male		Female		Both sexes	
	No	Median (range)*	No	Median (range)*	No	Median (range)*
≤35	8	12.5(3-17)	5	10.5(3-22)	13	10.5(3-21.5)
36-45	56	8.8(2-32)	51	7.0(3-32)	107	7.0(2-32)
46-55	31	10.5(3-29)	39	10.5(3-29)	70	10.5(3-28.5)
56+	29	3.0(3-23)	28	9.3(2-32)	57	7.0(1.5-32)
Total	124	7.0(2-32)	123	7.0(1.5-32)	247	7.0(1.5-32)

* Values expressed in terms of μg/dl.

Table 2 Blood lead levels of people in Khon Kaen with various lifestyles and residential areas

Variables	No (%)	Median (range)*
1. Cigarette		
Smoking	113(45.7)	7.0(2-32)
Non-smoking	134(54.3)	7.0(1.5-32)
2. Alcohol		
Drinking	140(56.7)	7.0(2-32)
Non-drinking	107(43.3)	10.5(1.5-32)
3. Coffee / Tea		
Drinking	52(21.1)	7.0(3-24.5)
Non-drinking	195(78.9)	10.5(1.5-32)
4. Betel nut		
Chewing	68(27.5)	8.0(1.5-32)
Non-chewing	179(72.5)	7.0(2-32)
5. District		
BanFang	50(20.2)	10.5(3.-32)
Chonnabot	197(79.8)	7.0(1.5-32)

* Values expressed in terms of μg/dl.

Table 3 Number and percentage distribution of subjects with various lifestyles by gender and age groups.

Variables	Gender		Age				Total
	Male No (%)	Female No (%)	≤35 No (%)	36-45 No (%)	46-55 No (%)	56+ No (%)	No (%)
Cigarette							
Smoking	111(98.2)	2(1.8)	8(7.1)	50(44.2)	26(23.0)	29(25.7)	113(100)
Non-smoking	13(9.7)	121(90.3)	5(3.7)	57(42.5)	44(32.8)	28(21.0)	134(100)
Alcohol							
Drinking	99(70.7)	41(29.3)	7(5.0)	72(51.4)	28(20.0)	33(23.6)	140(100)
Non-drinking	25(23.4)	82(76.6)	7(6.5)	32(29.9)	42(39.3)	26(24.3)	107(100)
Coffee / Tea							
Drinking	38(73.1)	14(26.9)	0(0)	25(48.1)	18(34.6)	9(17.3)	52(100)
Non-drinking	86(44.1)	109(55.9)	13(6.7)	82(42.0)	52(26.7)	48(24.6)	195(100)
Betel nut							
Chewing	5(7.4)	63(92.6)	0(0)	17(25.0)	20(29.4)	31(45.6)	68(100)
Non-chewing	119(66.5)	60(33.5)	13(7.3)	90(50.3)	50(27.9)	26(14.5)	179(100)