MONITORING OF LEAD EXPOSURE AMONG MECHANICS IN BANGKOK

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Abstract. Lead is an important heavy metal used in many industrial processes. It plays an important role in the pathogenesis of both acute and chronic toxicity. Mechanics have a high risk of benzene exposure but tend to be a forgotten occupation in Thailand. In this study, monitoring of lead exposure by anodic stripping voltammetry (ASV) for blood lead determination in 72 subjects, 20 control subjects and 52 mechanics was performed. The mean blood lead level in the control group was 6.586 ± 1.476 μg/dl. The mean blood lead level in the mechanics was 8.790 ± 2.646 μg/dl. There was a significant difference between the two groups ($p < 0.05$). Based on this study, considerations for prevention of exposure to lead among mechanics as a public health strategy is recommended.

INTRODUCTION

Lead is an important heavy metal agent used in many industrial processes. It plays an important role in the pathogenesis of both acute and chronic toxicity. Lead intoxication can present as multiple organs involvement (Pagliuca and Mufti, 1990). In severe cases, death can result. Therefore, determination and control lead exposure among the risk workers is very necessary.

Due to the industrialization of Thailand, many occupations involve the risk of lead exposure. Despite, the promotion of pollution control, lead exposure monitoring among the risk workers is still often overlooked. Mechanics represent one risk occupation, having direct contact with lead in daily work but specific control concerning this risk occupation has not been set in Thailand. This study was a pilot one to determine the difference of blood lead level between the non-exposed subjects and mechanics.

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MATERIALS AND METHODS

Subjects

A total of 72 subjects were included in this study. All were non-smokers. The first group, 20 subjects, was the control group with low risk for lead exposure. All were villagers from a rural agricultural area without any nearby factories in Chaiyapoom Province, Thailand. All subjects were interviewed for possible exposure to lead and none reported any.

The second group, comprising the study group 52 subjects, was a group of mechanics. The settings were garages in downtown Bangkok, where the monitored level of air lead was to 0.1 - 0.5 μg /m^3 (Natural Energy Policy Office, Thailand). These workers had to work and live on-site every day.

All subjects were asked for informed consent. Then random blood samples were collected for laboratory analysis from each subject.

Sample collection and preparation

From each subject, a 3 ml blood sample was collected using plastic vacuum tube (Beckton-Dickinson). Collected specimens were

Table 1
Blood lead levels in control and mechanics groups.

Group	Number	Blood lead level (μg/dl)	
		Range	Average
Control group	20	3.9 - 17.0	6.586 ± 1.476
Mechanics group	52	4.0 - 9.0	8.790 ± 2.646

refrigerated at 2 - 8ºC and sent to analytical unit within 2 days.

For each analysis, 100 μl blood sample was added to the tube containing 2.9 ml Metexchange. Then the sample was mixed and analyzed for lead level.

Laboratory analysis

All blood samples were analyzed for lead level anodic stripping volammetry (ASV). In our study, 2 control samples were also analyzed for each run. The ASV system used was the ESA 3010 B. This method for blood lead determination was described briefly as following. ASV is the analytical technique using electrochemical principle. The technique consists of two important steps of analysis as reduction step and stripping step. In reduction step, the former step, lead in blood sample was reduced and caught at the mercury electrode of the analyzer. In stripping step, slowly separation of caught lead from the test electrode due to the anodic change of electrical current was recorded and transformed to determined blood lead level.

Statistical analysis

Mean and standard deviations of blood lead levels in both groups were calculated. The average blood lead levels of each group were compared using the unpaired Student's *t*-test with level $p \leq 0.05$ considered statistically significant.

RESULTS

The mean blood lead level in the control group was 6.586 ± 1.476 μg/dl. The mean blood lead level in the mechanics group was 8.790 ± 2.646 μg/dl. There was a significant difference between the two groups ($p < 0.05$) (Table 1).

DISCUSSION

Lead is an important toxic substance. Its toxicity can cause aberrant function of multiple organs. Therefore, monitoring of its toxicity is very important. Although there are some reports (Limpasenee, 1989; Ruangwises and Ruangwises, 1998) on the lead levels in the air and water in Thailand they not reflect the *in vivo* process.

Blood lead level determination has been accepted as the most reliable biomarker at present (Lee and Meranger, 1980). To determine blood lead level by ASV is an effective method and can be used as a monitoring system for benzene exposure in the workers.

Comparing the average blood lead levels of the mechanics to those of the control group, a significantly higher level was detected in the first group. This result agrees with a previous study (Ankrah *et al*, 1996), indicating the higher blood lead levels among these high risk workers in Ghana.

Mechanics can be classified as an occupation at high risk of benzene exposure. They are constantly in contact with lead contaminated petroleum products during their daily lives. However, this occupation is often forgotten in of specific environmental control strategies. Protective equipment for them such as

gloves and masks are necessary and should be provided and annual check up for blood lead as a marker for lead exposure in these workers is recommended.

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