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Blood lead levels among police officers in Lima and Callao, 2004

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Abstract

Lead contamination is a public health problem of world-wide scope that negatively affects the health of especially women and children. Nevertheless, studies on lead contamination and its impact on health in Peru are limited. The objective of the present study was to determine blood lead levels (BLL) of traffic police officers in Lima and Callao compared with values in police officers working indoors and with data obtained in 1992.

The study was performed in May–June 2004 and included 52 traffic officers and 50 officers working in police stations in the north, center and east of Lima and Callao, Peru. Both groups were of similar age. The dependent variables were arterial blood pressure and BLL obtained in each officer. In addition a questionnaire was applied to evaluate risk factors for lead exposure.

In 2004, the average BLL in traffic police officers was higher ($44.7 \pm 6.1\,\mu g/l$) than that of indoor police officers ($39.3 \pm 8.2\,\mu g/l$) ($p = 0.0001$). However, none of the police officers had BLL of over $100\,\mu g/l$. No differences were observed in the location of the residences of the participants and the respective traffic density. Those over 30 years of age had a higher risk of having a BLL over $42\,\mu g/l$ than younger officers (odds ratio (OR) = 4.45). Traffic police officers had a higher risk of BLL $> 42\,\mu g/l$ (OR = 4.80).

Compared with data from 1992 obtained from the literature, an important reduction has been observed in 2004. This may be a consequence of the policy to eliminate leaded gasoline in Peru. However, it is still necessary to monitor this policy to ensure the elimination of lead in gasoline.

Keywords: Lead; Traffic police officers; Drivers; Blood pressure; Outdoor workers

Introduction

Lead is a metal which has been associated with human activities for the last 6000 years (Papanikolau et al., 2005). However, lead is toxic to humans affecting the hemopoietic, nervous, cardiovascular, reproductive systems and the urinary tract (Papanikolau et al., 2005; Ademuyiwa et al., 2005; Al-Saleh et al., 2005; Karita et al., 2005; Eibensteiner et al., 2005). Sources of lead exposure are mines, lead smelters, or battery recycling facilities, or areas where leaded gasoline is widely used (Eibensteiner et al., 2005; Mathee et al., 2006).

Peru is a developing country where leaded gasoline is still used in different parts although there is a process of phasing it out. Traffic police officers in areas where

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leaded gasoline is used comprise a potential indicator population (Eibensteiner et al., 2005). In Peru, the Ministry of Transport and Communications on 14 July 1998, stated by Supreme Decree the elimination of leaded 95 octane gasoline and a reduction of lead in the 84 octane gasoline from 1.16 to 0.84 g/l. These were accomplished on October 1998. Peru has initiated steps toward the complete removal of lead from gasoline targeted for 2005. It is possible that reductions in blood lead levels (BLL) among urban workers in the last years may be observed. In 1992, BLL of 225 μg/l ± 89.8 (mean ± standard deviation) (range: 117–577 μg/l) were observed in professional drivers in Lima, the capital of Peru (Cubas and Cano, 1993). In 2004 the present study measured BLL in traffic police officers in Lima, Peru, and data were compared with those obtained in police officers working in offices, and with those reported in 1992.

Some authors have found raised arterial blood pressure in workers exposed to lead (Kasperczyk et al., 2005), whereas other did not find differences (Ademuyiwa et al., 2005). The present study will also determine whether arterial blood pressure was related to BLL.

Methods

Design and study population

This cross-sectional study was conducted in May–June 2004 to characterize BLL among traffic police officers in Lima and Callao, Peru. The city is not located near lead smelters or mines, and leaded gasoline should be considered as the major source of lead exposure in the community. It is assumed that traffic police officers are highly exposed to vehicular exhaust (Eibensteiner et al., 2005).

Officers working in the north, center (downtown) and east of Lima and the zone of Callao were studied. In order to be eligible to participate officers had to: (1) work during the period of the study controlling traffic or in the police station, (2) reside in Lima or Callao for a period not less than 1 year, and (3) work for at least 1 year as traffic police officer or in the police office. All selected officers voluntarily agreed to participate in the study (100% rate of participation).

The study protocol was approved by the Institutional Review Board at the Universidad Peruana Cayetano Heredia.

Questionnaire survey

The eligible police officers were asked to complete a questionnaire and to donate blood samples. A measurement of the arterial blood pressure was also obtained for each participant. The environmental epidemiologic questionnaire was previously validated through expert judgments and in a pilot study.

The questionnaire was designed to include sociodemographic data of the interviewed as well as to identify sources for lead contamination to which they were exposed in their homes, during transport to work, and at work. The questionnaire had five sections: BLL and arterial blood pressure; sociodemographic data (age, sex, place of birth, marital status, residence district, place of work); non-occupational exposure to environmental lead (place of residence, traffic around place of residence, means of transport, environmental contamination sources around place of residence, and vehicles at home); occupational exposure to lead (working activity, working routine, work place, traffic around work place, environmental contamination sources around work place, gun use, and cosmetic use); and habits at home (food consumption, and hand washing practice).

Blood samples

The blood sample was obtained by vein puncture (vacutainer) and it was collected in tubes containing EDTA (anticoagulant). Disposable materials were used for each participant and they were lead free.

The anodic voltimetry technique (lead Care) was used to determine BLL. Analyses were conducted at the laboratory of investigation and development (LID) at the Faculty of Sciences and Philosophy of the Universidad Peruana Cayetano Heredia. Data of BLL obtained with this equipment were found to be accurate within 0.0–420 μg/l (Taylor et al., 2001). The field personal used gloves; the blood sample collection and the lead measurement were performed on a table with a lead-free cover. All measurements were made at environmental temperature.

In every fifth sample, lead blood levels were measured in duplicate as a quality control measure.

Blood pressure

Systolic and diastolic arterial pressures were measured on the left arm in each subject in a seated position after a resting period of 10 min.

Variables

Independent variables included exposure to environmental contamination sources such as lead, house location, traffic near home, ways of daily transportation, sources of environmental contamination near the house and work location, use of materials containing lead, and age. The dependent variable was BLL