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ORIGINAL ARTICLE

Blood lead levels in a group of children: the potential risk factors and health problems[☆]

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KEYWORDS

Blood lead levels;
Children;
Lead exposure;
Abnormal behavior;
Short stature;
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Abstract

Objective: To investigate blood lead levels (BLLs) in schoolchildren in two areas of Egypt to understand the current lead pollution exposure and its risk factors, aiming to improve prevention policies.

Subjects and method: This was a cross-sectional study in children ($n=400$) aged 6–12 years recruited from two areas in Egypt (industrial and urban). BLLs were measured using an atomic absorption method. Detailed questionnaires on sources of lead exposure and history of school performance and any behavioral changes were obtained.

Results: The mean BLL in the urban area of Egypt (Dokki) was $5.45 \pm 3.90 \mu\text{g}/\text{dL}$, while that in the industrial area (Helwan) was $10.37 \pm 7.94 \mu\text{g}/\text{dL}$, with a statistically significant difference between both areas ($p < 0.05$). In Dokki, 20% of the studied group had BLLs $\geq 10 \mu\text{g}/\text{dL}$, versus 42% of those in Helwan. A significant association was found between children with abnormal behavior and those with pallor with BLL $\geq 10 \mu\text{g}/\text{dL}$, when compared with those with BLL $< 10 \mu\text{g}/\text{dL}$ ($p < 0.05$). Those living in Helwan area, those with bad health habits, and those living in housing with increased exposure were at a statistically significantly higher risk of having BLL $\geq 10 \mu\text{g}/\text{dL}$.

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56**PALAVRAS-CHAVE**

Níveis de chumbo no sangue;
Crianças;
Exposição ao chumbo;
Comportamento anormal;
Baixa estatura;
Egito

Conclusion: Lead remains a public health problem in Egypt. High BLLs were significantly associated with bad health habits and housing with increased exposure, as well as abnormal behavior and pallor.

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Níveis de chumbo no sangue em um grupo de crianças: possíveis fatores de risco e problemas de saúde

Resumo

Objetivo: Investigar os níveis de chumbo no sangue (NCSs) em crianças em idade escolar em duas áreas do Egito para entender a atual exposição à poluição por chumbo e seus fatores de risco, para melhorar as políticas de prevenção.

Indivíduos e método: Esse foi um estudo transversal em crianças (400) com idades entre 6–12 anos recrutadas de duas áreas no Egito (industrial e urbana). Os NCSs foram medidos por um método de absorção atômica. Foram obtidos questionários detalhados sobre as fontes de exposição ao chumbo e o histórico de desempenho escolar e quaisquer alterações comportamentais.

Resultados: O NCS na área urbana do Egito (Dokki) foi $5,45 \pm 3,90 \mu\text{g/dL}$, ao passo que na área industrial (Helwan) foi $10,37 \pm 7,94 \mu\text{g/dL}$, com uma diferença significativa entre ambas as áreas ($p < 0,05$). Na área de Dokki, 20% do grupo estudado apresentaram NCSs $\geq 10 \mu\text{g/dL}$, ao passo que na área de Helwan foi 42%. Foi encontrada uma associação significativa entre as crianças com comportamento anormal e aquelas com palidez com NCS $\geq 10 \mu\text{g/dL}$, em comparação àquelas com NCS $< 10 \mu\text{g/dL}$ ($p < 0,05$). Aquelas que moram na área de Helwan aquelas com hábitos de saúde ruins e aquelas que moram em moradias com maior exposição estiveram significativamente em alto risco de apresentar NCS $\geq 10 \mu\text{g/dL}$.

Conclusão: O chumbo ainda é um problema de saúde pública no Egito. Altos NCSs foram significativamente associados a hábitos de saúde ruins e moradia com maior exposição, bem como, comportamento anormal e palidez.

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Introduction

Blood lead level (BLL) is a major health hazard, especially in children, which warrants its frequent monitoring in order to avoid lead exposure as much as possible.¹ Lead has been used in many products such as paint, pipes, and ceramics, and remains a public hazard. The main sources of lead and its pollution are mining operations, battery recycling plants, and smelting,^{2,3} as well as old lead-based peeled or chipped paint, especially during renovations of old houses,^{4,5} contact with contaminated dust or soil,⁶ lead in plumbing, automobile exhaust, by-products of both mining and metal working, and various consumer products.^{7,8} E-scrap recycling is an emerging area of concern as a source of occupational exposures among workers and a source of take-home exposures.⁹

Lead is not known to serve any physiological function, but it exists in almost all biological systems. It is absorbed via different routes; however, ingestion of contaminated dietary constituents accounts for the majority of lead toxicity in children.¹⁰ Children are more likely to be exposed than adults due to a high rate of inhalation and more intestinal absorption. Intense, high-dose exposure to lead causes acute symptomatic poisoning, characterized by colic, anemia, and depression of the central nervous system that may

result in coma, convulsions, and death. Low BLLs are now known to affect multiple organs in the absence of apparent symptoms. Toxicity with low lead levels *in utero* and during childhood constitutes brain and nervous system damage. Exposure to low BLL (less than $10 \mu\text{g/dL}$) affects also the immune, reproductive and cardiovascular systems. Recent research indicates that, at blood levels of $5 \mu\text{g/dL}$ or lower, neurobehavioural damage is liable to occur. It appears that brain injury can happen at any blood level threshold.^{11–13}

The goals of the present study were to evaluate the extent of lead exposure in schoolchildren, whose age ranged from 6 to 12 years, in industrial and urban areas in Egypt and to investigate the possible influencing factors in order to clarify the current problem of lead exposure and to improve methods of prevention and control.

Subjects and methods

Two hundred primary school children were randomly chosen in an industrial area in Egypt (Helwan); the same number of primary school children was selected in an urban area in Egypt (Dokki). The study was approved by the Medical Ethical Committee of National Research Centre, Dokki, Cairo, Egypt. Parental consents were obtained. Parents who

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