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THE INTERSECTION OF CLIMATE CHANGE, LEAD EXPOSURE AND HEALTH IMPACTS

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კლიმატის ცვლილების ზეგავლენა გარემოში ტყვიის შემცველობაზე და ამ ფაქტორთა ზემოქმედება ადამიანის ჯანმრთელობაზე

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რეზიუმე

გარემოს დაბინძურების ფაქტორებიდან ტყვიის შემცველობა გარემოში კვლავ რჩება მსოფლიო ჯანდაცვის აქტუალურ პრობლემად. კერძოდ, გლობალური დათბობა და მისგან გამომდინარე ექსტრემალური ბუნებრივი მოვლენები, როგორცაა წყალდიდობა, გვალვა და ა.შ. არსებით გავლენას ახდენს ტყვიის შემცველი მტვრის მიგრაციაზე ნიადაგში, წყალსა და ჰაერში. ტემპერატურის მატება ზრდის ტყვიის შემცველობას მცენარეებში, რაც იწვევს მისი შემცველობის მატებას საკვებში, საყოფაცხოვრებო პროდუქტებსა და ნივთებში. ეს ყოველივე კი პირდაპირ კავშირშია სხვადასხვა სახის ჯანმრთელობის პრობლემების გამოვლინების სიხშირესთან.

Introduction – Due to occupational risks and environmental contamination, lead exposure remains a major global health concern. This review provides an overview of recent research on lead's environmental dynamics, health effects, detection methods, and clinical care for preventive actions.

Methods – To provide a comprehensive overview of this topic, we summarized key points from various sources, including case studies, literature reviews, and governmental information.

Environmental Dynamics of Lead in the Context of Climate Change – Understanding lead's dynamics amid climate change is crucial due to its health impacts. Climate change can increase lead dust mobility through altered soil moisture and evapotranspiration. Extreme weather events like floods and droughts affect lead distribution, with floods reducing waterborne lead and droughts increasing dust-borne lead. Higher levels of lead were discovered in crowded metropolitan areas in a 2010 study conducted in Tbilisi, Georgia (see Table 1).

Table #1. Lead content in leaves and soil in different regions of Tbilisi (mg/kg)

Type of plant	Leaves	Soil (under the tree)
<i>Aesculus hippocastanum</i> (Tbilisi Botanical Garden)	0,57	40,06
<i>Quercus castaneifolia</i> (Tbilisi Botanical Garden)	0,40	54,89
<i>Tilia begoniifolia</i> (Tbilisi Botanical Garden)	0,30	55,15
<i>Aesculus hippocastanum</i> (Tbilisi. Rustaveli Ave, near the Theater Rustaveli)	0,96	484,84
<i>Platanus acerifolia</i> (Tbilisi Kostava Ave., Metro station "Rustveli")	0,84	200,08
<i>Tilia begoniifolia</i> (Tbilisi. Vazha-Pshavela Ave., Metro st. "Delisi")	0,38	56,76

Seasonal changes increase the mobility and bioavailability of lead, which could be dangerous in the event of global warming. Despite reduced industrial use and health interventions, lead remains a global health concern, especially in industries like lead-based paint, metalworking, and battery manufacturing. Chronic low-level exposure, particularly in areas with lax controls, poses cardiovascular risks such as hypertension and atherosclerosis. Ongoing research and policy efforts are crucial to mitigating these persistent health threats [1,2].

Systemic Approach to Lead and Its Pathophysiology; Nervous System, Anemia and Blood, Renal system - Lead exposure from polluted food, water, soil, or work environments can severely damage the liver, brain, teeth, and bones. Lead inhibits heme production, causing anemia; 11.1% of Taiwanese industrial workers exposed to lead have this condition. A bpb criterion of 15 µg/dL for females and 25 µg/dL for males is recommended to reduce anemia risk. Lead exposure is also linked to acute and chronic nephropathy, impairing glomerular filtration rate (GFR) and increasing chronic kidney disease (CKD) risk [3].

Lead Toxicity Effects of Lead Exposure During Pregnancy, Health Effects in Children - Lead exposure during pregnancy poses risks to fetal brain and organ development. Low-calcium diets increase lead absorption, affecting the fetus. Preventive measures include a balanced diet, avoiding lead sources, and maintaining a lead-safe home. High lead exposure can cause acute effects like convulsions and coma, and long-term issues such as behavioral and intellectual impairments. Even low-level lead poisoning affects behavior, IQ, and academic performance. Treatment involves chelation therapy, environmental cleanup, and, for severe cases, hospitalization and supportive care [4].

The genetic effects of lead - Lead exposure can cause chromosomal abnormalities and DNA damage, affecting immunity, the nervous system, and reproduction. While lead compounds like phosphate and acetate may be cancerous, evidence is mixed. Research on lead-induced chromosome damage is inconsistent and complicated by factors like co-exposure to other metals and smoking [5].

Lead Exposure's Effects on Immunity and Vulnerability in Children - Lead exposure damages the immune system by altering immunoglobulin levels, lymphocyte counts, macrophage activity, and shifting T helper cells to Th2 responses. It worsens delayed-type hypersensitivity and modifies immune responses by increasing IL-4 and decreasing IFN-γ. Children are especially vulnerable due to their developing organs. Susceptibility to lead poisoning varies with genetics, age, nutrition, medical conditions and exposure factors [6].

Lead in Dentistry - Lead in dentistry causes Burton lines, weakens enamel, increases caries risk, and reduces saliva flow in children. It leads to oxidative damage, lowers saliva pH, disrupts bone components, inhibits oral microbiota, delays mineralization, and worsens dental issues. Long-term exposure results in cheilitis, fissures, ulcers, and epithelial desquamation [7].

Lead in foods and traditional medicines - Lead contamination in candies can come from tamarind, chili powder, improper processing, and lead-containing wrappers. Spices from countries like Georgia, Bangladesh, and Morocco are also risky, with Georgian Kviteli Kvavili having the highest lead concentration at 48,000 ppm. Traditional and complementary medicines from some countries can pose significant health risks due to lead. The WHO defines traditional medicine as practices, including manual techniques and natural medications, aimed at improving health [8,9].

Conclusion - The prioritization of primary prevention through environmental cleanup, improved public health measures, and breakthroughs in detection and treatment approaches is vital in the endeavors to protect public health and establish lead-safe settings.

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SUMMARY

Among the factors of environmental pollution, lead contamination remains a pressing global health issue. Global warming and associated extreme weather events, such as floods and droughts, significantly impact the migration of lead-containing dust in soil, water, and air. Rising temperatures also increase lead accumulation in plants, leading to higher concentrations of this toxic metal in food, household products, and others. Consequently, this situation is directly linked to an increased frequency of various health problems.

Keywords: Lead, Health, Food, Climate change

