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Fruit-Eating Bats from the Atlantic Forest Suffer Oxidative and Tissue Damage as a Result of Pollution from Iron and Aluminium Ore Mining

Victor Terra*

Department of Foresty, University of Lagos, Nigeria

Abstract

Mining is a key industry for economic expansion, but it also presents serious environmental pollution issues. The globally significant biodiversity of the Atlantic Forest is under serious threat due to tailings dam containment failures, which have contaminated the environment. Fruit-eating bats are crucial pollinators and seed dispersers for the regeneration of forests. This study compares individuals from a preserved Atlantic Forest fragment (FFA) to examine the effects of iron ore mining areas (FEOA) and aluminum ore mining areas (ALOA) on two keystone species of bats: Artibeus lituratus and Sturnira lilium. The accumulation of aluminum (Al), calcium (Ca), iron (Fe), and barium (Ba) in the liver, as well as calcium and iron in the muscles, was higher in bats from FEOA.

Keywords: Mining; Ecosystem; Forest animals

Introduction

In addition, these animals displayed increased oxidative damage to the liver and kidneys linked to renal inflammation and liver fibrosis. Oxidative stress was also seen in the muscle and brain. Higher levels of brain oxidative stress, liver fibrosis, kidney inflammation, and Ca and Ba accumulation were observed in ALOA bats, as well as higher levels of Ca, Zinc (Zn) and Ba accumulation in their muscles. According to our research, mining operations for iron and aluminum ore have a negative impact on bat tissues, which could endanger the preservation of biodiversity in the Atlantic Forest [1,2].

Methodology

Many nations' socioeconomic development is significantly influenced by mining. But it's also regarded as one of the anthropogenic activities with the greatest environmental impact and pollution. Metal and metalloid pollution, as well as the devastation of wildlife habitats, are two of the main issues surrounding the effects of mining. Brazil's reserves of valuable metals, including iron and bauxite, make it a major player in the mining sector. However, the difficulties in striking a balance between sustainability and economic development in Brazil's mining industry are exemplified by the tailings dam containment failures related to bauxite, iron, gold, and mining. Numerous ecosystems have been harmed by these dam failures, and significant local rivers have become contaminated [3-5].

The scientific community has been alerted to the need for ecosystem preservation and discussions about the environmental damage caused by mining in various vital Brazilian ecosystems, including the Atlantic Forest, by the two most recent incidents that occurred in the Atlantic Forest in 2015 and 2019.

The second-largest rainforest in South America, the Atlantic Forest ecosystem is regarded as a hotspot for biodiversity conservation because of its high degree of fragmentation, elevated species richness, and endemism. Despite this, the Atlantic Forest is one of the planet's most threatened and devastated ecosystems. Certain animals are essential to the regeneration of degraded forest environments. For instance, bats play vital ecological roles with wide-ranging effects as essential components of terrestrial ecosystems [6-8].

Millions of bats live in colonies, and because of their varied diets, they offer a range of ecological and economic services. Fruit-eating bats are crucial pollinators and seed dispersers who contribute significantly to the restoration of degraded areas. The Atlantic Forest is home to the little yellow-shouldered bat (Sturnira lilium) and the great fruit-eating bat (Artibeus lituratus. These two species are regarded as keystone species because they disperse pioneer plant seeds and have a wide range of foraging. A. lituratus, in contrast to other seed-dispersing animals with a limited capacity for colonization, actually colonizes restored areas during the early stages of restoration [9,10].

Result

Bats' large home ranges, varied eating habits, and longevity make them more vulnerable to environmental pollutants like metals and metalloids. Although metal bioaccumulation in bats has been meticulously measured by prior research, especially in insectivorous species, the ecological and environmental risks associated with this phenomenon have not been sufficiently investigated. It is imperative to examine the physiological consequences of metal accumulation in tissues, as numerous metal-binding proteins, like glutathiones and metallothioneins, might not accurately represent the detrimental effects of metals.

Discussion

Upon collecting inectivorous bats from metal-polluted areas, researchers observed metal bioaccumulation, DNA damage, and oxidative stress in the blood, lung damage, and emphysema. In spite of this, compared to other bats with diverse eating habits, fruit-eating bats have distinct exposure routes and feeding habits with high antioxidant content. Because the antioxidant response of the organs can vary, research done on insectivorous bats is not indicative of fruit-eating bats. The few studies that looked into the toxicity of metals to

***Corresponding author:** Victor Terra, Department of Foresty, University of Lagos, Nigeria, E-mail: victe99@yahoo.com

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fruit-eating bats concentrated on flying foxes, or Pteropodidae family members.

Our study provides novel insights into two bat species that are essential to the restoration of the Atlantic Forest. This is the first study to look into two species of frugivorous bats that are important to the restoration of the Atlantic Forest and are used as models in research on the effects of aluminum and iron mining areas. In the face of hazardous materials and their far-reaching effects, we hope to shed light on these bats' ecological resilience as well as the larger implications for biodiversity conservation and environmental health.

Conclusion

Our objective was to examine the levels of metal tissue concentration, oxidative stress, and histopathological damage in fruit-eating bats that inhabit areas that mine iron ore and aluminum ore. Histological examination can reveal tissue damage resulting from xenobiotic-induced cellular redox imbalance in animals. Histological evaluations and analyses of oxidative damage biomarkers work well together to assess the impact of pollutants on different animal tissues and have been used in numerous research studies. Particularly hazardous metals have the ability to cause redox imbalance through a variety of mechanisms, including lowering the concentration of detoxifying enzymes, increasing the generation of reactive oxygen species, and decreasing the activity of antioxidant enzymes.

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