

A STUDY OF HUMAN POPULATION EXPOSED TO HIGH BACKGROUND RADIATION AREA IN NORTHEAST BRAZIL

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ABSTRACT: This research aimed to characterize the hazard scenario of natural radiation – uranium-238 (U), thorium (Th), potassium (K), radon-222 (Rn) and lead (Pb), its relationship with risk factors and potential health effects at Lajes Pintadas city, Rio Grande do Norte state. The mean of U, Th and K was 0.19, 8.32 and 3.78 ppm, respectively. Indoor Rn concentration in air from 39 dwellings ranged 75.78 to 1421.40 Bq/m³ with mean of 314.23 Bq/m³, a value 3x higher than the limits of World Health Organization. Pb levels in 12 water samples – collected from wells, residential taps, local dam and a deactivated mine – were undetectable and an average of 8.33 ± 3.15 mg/Kg of Pb was observed in 6 surface soil samples, being 8x lower than the value described in national regulations by CONAMA. The effective exposure to these elements were determined by calculating the annual effective dose for Rn and measuring Pb and zinc-protoporphyrin (ZPP) in blood. This study found that Lajes Pintadas population received 7.92 mSv/year of ionizing radiation from Rn alone. Together with effective dose from other radioactive sources, we could classify Lajes Pintadas as a medium-high natural radiation area according to parameters described in literature. Furthermore, Pb in blood (PbB) covered a range of 0.60 to 12.00 µg/dL with median of 1.00 µg/dL and a range of 1.25 to 114.20 µg/dL for ZPP, with median of 7.52 µg/dL. 93% of the studied population was within the international guideline of 5.0 µg/dL by Center for Disease Control and Prevention. In this work were found an inverse and non-significant correlation between low levels of PbB and ZPP (Rho= -0.155, p= 0.137), as well as normal levels of hemoglobin in the population (13.37 ± 2.14 g/dL). Therefore, it could be stated that low levels of PbB found were not enough to impair hemoglobin synthesis. Considering sociodemographic variables as risk factors, gender (p= 0.06) and age (p = 0.010) showed statistical significant association with Pb exposure. It is possible to speculate an absence of anthropic exposure to Pb in the studied scenario. Micronuclei cytome assay in exfoliated buccal mucosa cells was used as biomarker of effect/susceptibility of exposure to environmental mutagens. Alcohol consumption and smoking habits did not showed to influence the mutagenic effects observed in this study. However, a significant increase in the risk of miscarriage of more than 4x was observed (odds ratio= 4.20, IC95% = 1.162 – 15.184). The frequency of binucleated and pycnotic cells increased more than 2x and 4x the baseline value, respectively. These results indicated an increase in defective cytokinesis and an increase in oral epithelium cell death through apoptosis. The co-exposure to a diversity of genotoxic agents and the gene-gene and gene-environment interactions could be determinant factors to consider when interpreting these results. Lajes Pintadas was constructed above pegmatite rocks and had active uranium mines in the past. The presence of natural radioactive elements, especially high radon levels could be influencing the observed genetic instability. Future studies is needed to confirm this hypothesis.

KEYWORDS: GENOTOXICITY. NATURAL RADIATION. RISK ASSESSMENT.