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ORIGINAL ARTICLE

Association between weather seasonality and blood parameters in riverine populations of the Brazilian Amazon☆,☆☆

Poliany C.O. Rodrigues[a,*], Eliane Ignotti[a], Sandra S. Hacon[b]

[a] Universidade do Estado de Mato Grosso (UNEMAT), Faculdade de Ciências da Saúde (FCS), Cáceres, MT, Brazil
[b] Fundação Oswaldo Cruz (FIOCRUZ), Escola Nacional de Saúde Pública (ENSP), Departamento de Endemias Samuel Pessoa (DENSP), Rio de Janeiro, RJ, Brazil

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KEYWORDS
Iron homeostasis;
Biomarkers;
Climate change

Abstract
Objective: To analyze the seasonality of blood parameters related to iron homeostasis, inflammation, and allergy in two riverine populations from the Brazilian Amazon.
Methods: This was a cross-sectional study of 120 children and adolescents of school age, living in riverine communities of Porto Velho, Rondonia, Brazil, describing the hematocrit, hemoglobin, ferritin, serum iron, total white blood cell count, lymphocytes, eosinophils, C-reactive protein, and immunoglobulin E levels in the dry and rainy seasons. The chi-squared test and the prevalence ratio were used for the comparison of proportions and mean analysis using paired Student's *t*-test.
Results: Hemoglobin (13.3 g/dL) and hematocrit (40.9%) showed higher average values in the dry season. Anemia prevalence was approximately 4% and 12% in the dry and rainy seasons, respectively. Serum iron was lower in the dry season, with a mean of 68.7 mcg/dL. The prevalence of iron deficiency was 25.8% in the dry season and 9.2% in the rainy season. Serum ferritin did not show abnormal values in both seasons; however, the mean values were higher in the dry season (48.5 ng/mL). The parameters of eosinophils, lymphocytes, global leukocyte count, C-reactive protein and immunoglobulin E showed no seasonal differences. C-reactive protein and immunoglobulin E showed abnormal values in approximately 7% and 60% of the examinations, respectively.

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* Corresponding author.
E-mail: polianyrodrigues@unemat.br (P.C. Rodrigues).

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Conclusion: Hematological parameters of the red cell series and blood iron homeostasis had seasonal variation, which coincided with the dry season in the region, in which an increase in atmospheric pollutants derived from fires is observed.

PALAVRAS-CHAVE
Homeostasia do ferro;
Biomarcadores;
Mudanças climáticas

Relação da sazonalidade climática com parâmetros sanguíneos de ribeirinhos residentes na Amazônia brasileira

Resumo
Objetivo: Analisar a sazonalidade climática de parâmetros sanguíneos relacionados à homeostase do ferro, inflamação e alergia em duas populações ribeirinhas da Amazônia Brasileira.
Método: Realizou-se um estudo transversal em 120 crianças e adolescentes em idade escolar, residentes em comunidades ribeirinhas de Porto Velho, Rondônia. Foram analisados hematócrito, hemoblogina, ferritina, ferro sérico, leucometria global, linfócitos, eosinófilos, proteína C-reativa e Imunoglobulina E nas estações seca e chuvosa. Utilizou-se o qui-quadrado e a razão de prevalência para a comparação das proporções, além do teste t de student pareado para a análise de médias.
Resultados: Hemoglobina (13,3 g/dL) e hematócrito (40,9%) apresentaram maiores valores médios no período de seca. A prevalência de anemia foi cerca de 4% e 12% na seca e na chuva, respectivamente. O ferro sérico foi menor no período de seca com média de 68,7 mcg/dL. A prevalência de deficiência de ferro foi em média 25,8%, na seca, e 9,2%, na chuva. A concentração sérica de ferritina não apresentou valores alterados em ambos os períodos, no entanto os valores médios apresentaram-se mais elevados na seca (48,5 ng/mL). Os parâmetros dos eosinófilos, linfócitos, leucometria global, proteína C-reativa e Imunoglobulina E não apresentaram diferenças sazonais. A Proteína C-reativa e a Imunoglobulina E apresentaram valores alterados em cerca de 7% e 60% dos exames realizados, respectivamente.
Conclusão: Os parâmetros hematológicos da série vermelha e a homeostasia ferro sanguíneo apresentaram variação sazonal, que coincide com o período de seca na região, no qual observa-se aumento dos poluentes atmosféricos derivados das queimadas.

Introduction

In 2010, Brazil faced a severe drought throughout the country. In the so-called ''deforestation arc,'' the drought directly interfered in the increase of forest fires. In the municipality of Porto Velho, the highest proportion of forest fires occurred in August and September and, consequently, a high concentration of the mean levels of particulate matter (PM) was observed, recorded by the air monitoring station in Porto Velho, with an approximate peak of 240 $\mu g/m^3$ in the month of September. In 2011, PM concentrations did not exceed the monthly mean of 10 $\mu g/m^3$ during the entire rainy season.[1]

The scientific literature currently presents several toxicological mechanisms through which PM can cause health damage, mainly damage to the respiratory and cardiovascular systems, triggered by inflammatory, immunological, and genotoxicity responses.[2] The effects involve an inflammatory response with a serum increase in C-reactive protein and cytokines[3–5] and increased airway reactivity through immunoglobulins,[6] as well as alterations in several hematological parameters such as increased eosinophil adhesion[7] and altered leukocyte count,[8,9] hemoglobin, and hematocrit.[10,11]

The Brazilian Amazon region historically suffers from forest fires during the dry season. In these regions, some ecological studies have shown that biomass burning is one of the main risk factors for increased morbidity and mortality due to respiratory diseases in children and the elderly, especially in the ''deforestation arc.''[12–14] More recently, mortality rates from cardiovascular disease in the elderly were associated with exposure to $PM_{2.5}$.[15]

Therefore, the present study aimed to analyze the climatic seasonality of blood parameters related to iron homeostasis, inflammation, and allergy in the southern Brazilian Amazon region, characterized by high levels of atmospheric pollutants from forest fires in the dry season, since no studies assessing the behavior of hematological