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Red Blood Cells Deformability: A Chaotic Process

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Abstract : Since erythrocyte deformability analysis is mostly qualitative, the development of quantitative nonlinear methods is crucial for restricting subjectivity in the study of cell behaviour. An electro-optic mechanic system called erythrodeformeter has been developed and constructed in our laboratory in order to evaluate the erythrocytes' viscoelasticity. A numerical method formulated on the basis of fractal approximation for ordinary (OBM) and fractionary Brownian motion (FBM), as well as wavelet transform analysis, are proposed to distinguish chaos from noise based on the assumption that diffractometric data involves both deterministic and stochastic components, so it could be modelled as a system of bounded correlated random walk. Here we report studies on 25 donors: 4 alpha thalassaemic patients, 11 beta thalassaemic patients, and 10 healthy controls non-alcoholic and non-smoker individuals. The Correlation Coefficient, a nonlinear parameter, showed evidence of the changes in the erythrocyte deformability; the Wavelet Entropy could quantify those differences which are detected by the light diffraction patterns. Such quantifiers allow a good deal of promise and the possibility of a better understanding of the rheological erythrocytes aspects and also could help in clinical diagnosis.

Keywords : red blood cells, deformability, nonlinear dynamics, chaos theory, wavelet trannsform
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