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MATHEMATICAL INVESTIGATION OF OXYGEN TRANSPORT IN INTACT MUSCLES VIS-A-VIS TISSUE METABOLISM

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Abstract: The human muscle tissue is an active cite with varied aerobic consumption. The supply of oxygen to the muscle cells is governed by the demand for oxygen that varies across different metabolic states of the body tissues. Most of the models designed to simulate oxygen flow in the body are based on the assumption of constant rate of oxygen consumption in muscle tissues. This generates a picture contrary to the physiological ambience where the rates vary in response to level of activity in which muscles are involved. In this context, we have taken recourse to a comparative analysis of zero-order, first-order and Michaelis-Menten oxygen consumption rate inside the muscle tissue. The model is based on the reaction-diffusion equation, and the exact solution is obtained and compared with the numerical solution using MATLAB and both are in good agreement.

Keywords and Phrases: Oxygen tension, Oxygen consumption, Finite difference method.

2020 Mathematics Subject Classification: 92-XX, 92BXX, 92B05.

1. Introduction

Our aim in this paper is to focus on the delivery of oxygen into one of the most metabolically active tissues of the human body, i.e., the skeletal muscle. The existing models available in the literature [12, 16, 18] for oxygen transport and consumption in muscle tissues are more theoretical and lack synchrony with the real physiological conditions. Also, the models are usually reliant upon constant