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A MATHEMATICAL MODEL FOR SWALLOWING OF THE VISCOELASTIC FOOD BOLUS THROUGH OESOPHAGUS

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Abstract

The present investigation is to study a mathematical model for swallowing of visco-elastic fluids through the oesophagus. Jeffrey model is used for viscoelastic fluids. The geometry of walls of oesophagus is considered as sinusoidal wave, propagating along the length of tube. Solutions of governing equations are obtained by using a long wavelength and low Reynolds number approximations. The expressions of axial velocity, transverse velocity, pressure gradient, volume flow rate and local wall shear stress are obtained in closed form. The effects of _1 (i.e. ratio of relaxation time to retardation time) on the pressure, local wall shear stress, maximum flow rate are discussed. It is found that the swallowing of viscoelastic food bolus is easier than that of food bolus of Newtonian nature. Further pressure decreases with increasing _1 for fixed average flow rate, whereas maximum averaged flow rate is identical with _1.

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Key Words : Peristalsis, Axi-symmetric flow, Jeffrey-fluid, Oesophagus.