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Abstract: Cholesterol plays a vital role in human body. Its unbalanced homeostasis, however, leads to health related problems. The elevated blood cholesterol levels are now considered a classic coronary risk factor and are suspected to lead to coronary artery diseases, causing 2.6 millions of deaths each year. Here, we develop a two-compartment mathematical model to investigate cholesterol transport in the circulatory system and its *de novo* synthesis in the liver. The model is described with a set of two simultaneous linear differential equations, which solutions yield changes over time of the cholesterol levels in the liver (compartment I) and bloodstream (compartment II). We show the applicability of the model to investigate the processes associated with the high blood cholesterol, e.g. lowering the cholesterol levels by inhibiting *de novo* cholesterol synthesis. Taking advantage of the analytically derived relationships for the steady state (equilibrium), we show how the model could aid diagnosis of high blood cholesterol by identifying whether the disturbances in the cholesterol homeostasis are due to impaired transport from the liver to the bloodstream, or vice versa.

Keywords: cholesterol, metabolic syndrome, mathematical modelling, compartment