Predicting Insulin Absorption and Glucose Uptake during Exercise in Type 1 Diabetes SPENCER FRANK, University of California Berkeley, LING HINSHAW, RITA BASU, Division of Endocrinology, Mayo Clinic, ANDREW SZERI[1], Univ of California - Berkeley, ANANDA BASU[2], Division of Endocrinology, Mayo Clinic — A dose of insulin infused into subcutaneous tissue has been shown to absorb more quickly during exercise, potentially causing hypoglycemia in persons with type 1 diabetes. We develop a model that relates exercise-induced physiological changes to enhanced insulin-absorption(k) and glucose uptake(GU). Drawing on concepts of the microcirculation we derive a relationship that reveals that k and GU are mainly determined by two physiological parameters that characterize the tissue: the tissue perfusion rate(Q) and the capillary permeability surface area (PS). Independently measured values of Q and PS from the literature are used in the model to make predictions of k and GU. We compare these predictions to experimental observations of healthy and diabetic patients that are given a meal followed by rest or exercise. The experiments show that during exercise insulin concentrations significantly increase and that glucose levels fall rapidly. The model predictions are consistent with the experiments and show that increases in Q and PS directly increase k and GU. This mechanistic understanding provides a basis for handling exercise in control algorithms for an artificial pancreas.

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