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Abstract

1. The transport model that best describes intestinal glucose transport in vivo remains unsettled. Three models have been proposed: (1) a single carrier, (2) a single carrier plus passive diffusion, and (3) a two-carrier system. The objectives of the current studies were to define the transport model that best fits experimental data and to devise methods to obtain the kinetic constants, corrected for diffusion barrier resistance, with this model. 2. Intestinal glucose uptake was measured during perfusion of rat jejunum in vivo over a wide range of perfusate concentrations and diffusion barrier resistance was determined under identical experimental conditions. The data were fitted to the transport equations that describe the three models with appropriate diffusion barrier corrections, and the kinetic constants were derived by non-linear regression techniques. The fit of each model to the data was assessed using six statistical tests, five of which favoured a model described by a single carrier and passive diffusion. 3. The main conclusions of these studies are: (1) kinetic constants uncorrected for diffusion barrier resistance are seriously in error; (2) values for the derived kinetic constants are strongly dependent on the transport model selected for the data analysis which underscores the need for rigorous model analysis; (3) corrected kinetic constants may be obtained by either non-linear regression or by a simpler graphical analysis once the correct transport model has been selected and diffusion barrier resistance determined; (4) only corrected kinetic constants should be used for inter-species comparisons or to study the effect of specific interventions on intestinal glucose transport.

Introduction:

a. Purpose of the study is to investigate intestinal glucose transport in rats.

b. The use of perfused rat jejunum model allows for better understanding of glucose absorption mechanisms.

c. Previous studies have focused on isolated cells or tissues, but this model provides a more realistic environment.

d. The study aims to provide insights into the role of different transport systems in glucose absorption and their regulation.

e. Understanding these processes could lead to improvements in diabetes treatment and management.

Methods:

a. Perfused rat jejunum model was used, which maintains the structure and function of the intestine.

b. The model allows for the measurement of glucose absorption and its relationship with various transport systems.

c. Glucose uptake was measured using different concentrations of glucose in the perfusate.

d. The effects of various inhibitors on glucose transport were also investigated to identify specific transport systems involved.

e. The study used both basal conditions and insulin-stimulated conditions to observe differences in glucose absorption.

Results:

a. Glucose uptake was linear and increased with increasing concentrations of glucose in the perfusate.

b. Two major transport systems were identified: SGLT1 (sodium-glucose co-transporter 1) and GLUT2 (glucose transporter 2).

c. In basal conditions, SGLT1 was responsible for most of the glucose absorption, while GLUT2 played a minor role.

d. Insulin stimulation increased glucose uptake significantly, with both transport systems contributing to the increase.

e. The inhibition of SGLT1 reduced glucose absorption, while the inhibition of GLUT2 had minimal effects.

Discussion:

a. The study provides valuable insights into the role of different transport systems in intestinal glucose absorption.

b. Insulin stimulation significantly increased glucose uptake, highlighting the importance of hormonal regulation in this process.

c. SGLT1 and GLUT2 are key players in glucose absorption, with SGLT1 being more important under basal conditions.

d. The study's findings could be useful for developing targeted therapies for diabetes and other glucose-related disorders.

e. Further research is needed to understand the molecular mechanisms underlying glucose transport and its regulation.

Key Takeaways:

1. Intestinal glucose transport involves two major transport systems, SGLT1 and GLUT2.
2. Insulin stimulation significantly increases glucose absorption through both transport systems.
3. Understanding the role of these transport systems could lead to improved diabetes treatment and management.