SLC5A1 gene

solute carrier family 5 member 1

Normal Function

The *SLC5A1* gene provides instructions for producing a protein called sodium/glucose cotransporter protein 1 (SGLT1). This protein is found mainly in the intestinal tract and the kidneys. It spans the membrane of cells and moves (transports) two sugars called glucose and galactose from outside the cell to inside the cell. Sodium and water are transported across the cell membrane along with the sugars in this process. Glucose and galactose are simple sugars; they are present in many foods, or they can be obtained from the breakdown of other sugars (such as lactose, the sugar found in milk) and carbohydrates in the diet during digestion.

In the intestinal tract, the SGLT1 protein helps take in (absorb) glucose and galactose from the diet. The protein is found in intestinal epithelial cells, which are cells that line the walls of the intestine. These cells have fingerlike projections called microvilli that absorb nutrients from food as it passes through the intestine. Based on their appearance, groups of these microvilli are known collectively as the brush border. The SGLT1 protein is involved in the process of transporting glucose and galactose across the membrane of the intestinal epithelial cells so the sugars can be absorbed and used by the body.

The SGLT1 protein also plays a role in maintaining normal glucose levels in the body. In the kidneys, the SGLT1 protein is located in structures called proximal tubules. These structures help ensure that all nutrients have been extracted from waste fluids before the fluids are released from the body as urine. The SGLT1 protein, and a similar protein called SGLT2, transport glucose from proximal tubules, ensuring that the sugar is absorbed into the bloodstream and not released into the urine. The activity of the SGLT1 protein is the last step of glucose absorption in the kidneys.

Health Conditions Related to Genetic Changes

Glucose-galactose malabsorption

More than 60 mutations in the *SLC5A1* gene have been found to cause glucose-galactose malabsorption. This condition begins in infancy and is characterized by severe diarrhea, resulting in weight loss and dehydration that can be life-threatening. *SLC5A1* gene mutations impair or eliminate the function of the SGLT1 protein. Some

mutations result in a protein that is folded into the incorrect shape, other mutations result in a protein that is abnormally short.

The altered SGLT1 protein's ability to transport glucose and galactose is reduced or absent. The sugars are not fully absorbed by intestinal epithelial cells, but instead accumulate in the intestinal tract. In addition, water that normally would have been transported with the sugars remains in the intestinal tract, resulting in dehydration of the body's tissues and severe diarrhea. In the kidneys, the SGLT1 protein cannot filter glucose; however, other proteins in the proximal tubules, including the SGLT2 protein, are able to absorb enough glucose into the bloodstream, so that glucose in the urine (glucosuria) is mild, if present at all, in people with glucose-galactose malabsorption.

Other Names for This Gene

- D22S675
- Human Na+/glucose cotransporter 1 mRNA, complete cds
- NAGT
- SC5A1_HUMAN
- SGLT1
- solute carrier family 5 (sodium/glucose cotransporter), member 1
- solute carrier family 5 (sodium/glucose transporter), member 1

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of SLC5A1 (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=6523[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28SLC5A1%5BTIAB%5D%29+OR+%28%28NAGT%5BTIAB%5D%29+OR+%28SGLT1%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D)

Catalog of Genes and Diseases from OMIM

- SOLUTE CARRIER FAMILY 5 (SODIUM/GLUCOSE COTRANSPORTER), MEMBER 1; SLC5A1 (https://omim.org/entry/182380)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/6523)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=SLC5A1[gene])

References

- Al-Suyufi Y, ALSaleem K, Al-Mehaidib A, Banemai M, Aldekhail WM, Al-MuhandesA, Mohammed M, Allam R, Jambi A, Ramzan K, Imtiaz F. SLC5A1 Mutations in SaudiArabian Patients With Congenital Glucose-Galactose Malabsorption. J PediatrGastroenterol Nutr. 2018 Feb;66(2):250-252. doi: 10.1097/MPG.0000000000001694. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/28753187)
- Ghezzi C, Loo DDF, Wright EM. Physiology of renal glucose handling via SGLT1, SGLT2 and GLUT2. Diabetologia. 2018 Oct;61(10):2087-2097. doi:10.1007/s00125-018-4656-5. Epub 2018 Aug 22. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/30132032) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6133168/)
- Lam JT, Martin MG, Turk E, Hirayama BA, Bosshard NU, Steinmann B, Wright EM. Missense mutations in SGLT1 cause glucose-galactose malabsorption by traffickingdefects. Biochim Biophys Acta. 1999 Feb 24;1453(2):297-303. doi:10.1016/s0925-4439(98)00109-4. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/10036327)
- Saadah OI, Alghamdi SA, Sindi HH, Alhunaitti H, Bin-Taleb YY, Alhussaini BH. Congenital glucose-galactose malabsorption: a descriptive study of clinicalcharacteristics and outcome from Western Saudi Arabia. Arab J Gastroenterol. 2014Mar;15(1):21-3. doi: 10.1016/j.ajg.2014.01.004. Epub 2014 Feb 1. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/24630509)
- Wright EM, Loo DD, Hirayama BA. Biology of human sodium glucose transporters. Physiol Rev. 2011 Apr;91(2):733-94. doi: 10.1152/physrev.00055.2009. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/21527736)
- Wright EM, Martin MG, Turk E. Intestinal absorption in health anddisease--sugars. Best Pract Res Clin Gastroenterol. 2003 Dec;17(6):943-56. doi:10.1016/s1521-6918(03)00107-0. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/14642859)
- Wright EM, Turk E, Martin MG. Molecular basis for glucose-galactosemalabsorption. Cell Biochem Biophys. 2002;36(2-3):115-21. doi:10.1385/CBB:36:2-3:115. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/12139397)
- Wright EM, Turk E. The sodium/glucose cotransport family SLC5. Pflugers Arch. 2004 Feb;447(5):510-8. doi: 10.1007/s00424-003-1063-6. Epub 2003 May 14. ErratumIn: Pflugers Arch. 2004 Feb;447(5):813-5. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/12748858)
- Wright EM. I. Glucose galactose malabsorption. Am J Physiol. 1998Nov;275(5):G879-82. doi: 10.1152/ajpgi.1998.275.5.G879. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/9815014)

Genomic Location

The *SLC5A1* gene is found on chromosome 22 (https://medlineplus.gov/genetics/chromosome/22/).

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