Transcriptional regulation of small intestinal genes involved in carbohydrate digestion and absorption via histone code

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The small intestinal gene expression of disaccharidases and monosaccharide transporters, such as sucrase-isomaltase (SI) and sodium-dependent glucose cotransporter (SGLT1), is higher in rodents fed a high-starch/low-fat (HS) diet than in those fed a low-starch/high-fat (LS) diet; however, the transcriptional regulatory mechanism is unclear. In the present study, the author investigated whether the HS diet-induced induction of SI and SGLT1 in rat jejunum is coordinately regulated by histone methylation, histone methyltransferases (KMTs), histone demethylases (KDMs) and O-GlcNAcylation of proteins.

The author found in this study that intake of the HS diet led to an increased mono-/di-/tri-methylation of histone H3 at K4 in both the promoter/enhancer and transcriptional regions of SI and SGLT1 genes in rat jejunum. Moreover, HS diet intake induced jejunal expression of O-GlcNAc transferase (OGT). On the other hand, gene expression of KMTs and KDMs was unaffected by the HS diet.

Recent studies have reported that the GlcNAcylation of HKT by OGT is associated with induction of histone H3 at K4 methylation through the enzyme activation. Therefore, the results of the present study suggest that the induction of SI and SGLT1 genes in the jejunum by HS diet is not associated with the alteration of KMTs and KDMs gene expression, but attributable to a coordinate regulation of O-GlcNAcylation of proteins and histone H3 at K4 methylation on these genes.