Lifestyle influences metabolism via DNA methylation

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An unhealthy lifestyle leaves traces in the DNA. These may have specific effects on metabolism, causing organ damage or disease. Scientists of Helmholtz Zentrum München have now identified 28 DNA alterations associated with metabolic traits. This world-first epigenome-wide association study (EWAS) of modified genes and metabolites has been now published in the journal *Human Molecular Genetics*.

In the course of life, aging processes, environmental influences and lifestyle factors such as smoking or diet induce biochemical alterations to the DNA. Frequently, these lead to DNA methylation, a process in which methyl groups are added to particular DNA segments, without changing the DNA sequence. Such processes can influence gene function and are known as epigenetics. Scientists of the Institute of Genetic Epidemiology (IGE) and the Research Unit Molecular Epidemiology (AME) at Helmholtz Zentrum München are seeking to determine what association exists between these epigenetic processes and the health consequences, in particular for the metabolism.

To this end, the team led by Christian Gieger (IGE) and Melanie Waldenberger (AME), in in collaboration with Karsten Suhre of Weill Cornell Medical College in Qatar analyzed blood samples from more than 1800 participants of the KORA study. In doing so, they analyzed more than 457,000 loci in the DNA as to biochemical alterations and compared them with the concentrations of 649 different metabolites. The analysis showed that the methylation of 28 DNA segments changed a number of important metabolic processes.

In the relevant DNA regions there were also already known disease-related genes: for example, the TXNIP gene that regulates glucose metabolism and is associated with the development of diabetes mellitus. Appropriately, with the methylated TXNIP there were altered concentrations of metabolites from the lipid and glucose metabolism. Also genes that are known to be biochemically altered due to smoking affect different metabolic activities, and specifically those with corresponding biological functions.

"This study gives us new insights into how lifestyle factors can influence metabolism via the resulting alterations in the DNA," said Gieger, research group leader at the IGE. "We can now use these results to develop new diagnostic and therapeutic approaches for lifestyle-related diseases such as diabetes."

More information: Petersen, A.-K. et al. (2013). Epigenetics meets metabolomics: An epigenome-wide association study with blood serum metabolic traits, *Human Molecular Genetics*, DOI: 10.1093/hmg/ddt430

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