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ENVIRONMENTAL FACTORS DETERMINE HEIGHT OF CHILDREN IN LMICS

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Environmental factors such as socio-economic status, nutrition and infection load influence childhood growth | Photo Credit: Prashant Nakwe

In a significant finding, scientists have discovered that environmental factors play a greater role than genetic variants in determining the height of children in low and middle income countries (LMICs) in contrast to those from European nations, where genetic aspects predominate in regulating childhood height.

This was expounded in a study carried out by the Hyderabad-based Centre for Cellular and Molecular Biology (CSIR-CCMB) along with several other national and international institutions. The study was recently published in the journal *Nature Communications*.

While human height is strongly influenced by fixed genetic and variable environmental factors, the authors of the study noted that the contribution of modifiable epigenetic factors is under-explored. Epigenetic factors are external influences, including lifestyle, nutrition and environment that affect the way genes work. Epigenetic changes affect gene regulation and alter gene expression but not the DNA sequence.

Many environmental factors, including socio-economic status, nutrition and infection load are believed to influence childhood growth which plays a critical role in determining one’s height. Quoting the World Health Organization, 2021 estimates which indicated that a large proportion of stunted children reside in LMIC, particularly in South Asia and sub-Saharan Africa where undernutrition and associated co-morbidities are more prevalent compared to high income countries (HICs), the study observed “this offers a potential explanation for the disparity in height variation attributed to non-genetic factors between LMIC and high-income countries”.

Although the impact of environmental exposure during early childhood is believed to be quite significant with long-term consequences, there are no genome-wide epigenetic investigations on height in childhood especially in low and middle income countries. Epigenetic processes such as DNA methylation and histone modifications can influence gene expression. Methylation basically is a chemical modification of DNA molecules used by cells to regulate gene expression. It can be influenced by environmental factors such as diet, drugs, stress and exposure to chemicals and toxins.

In this study, the scientists did an epigenome-wide association analysis and genome-wide association study to independently investigate links between DNA methylation and genetic variants with childhood height in five cohorts—three from India, one from Gambia and another one from the U.K. (high income country —HIC). The scientists found a novel, robust association between methylation in the SOCS3 gene and height in children from low- and middle-income countries which was replicated in the HIC cohort but with a lower effect size. “Overall, our study provides strong evidence of genome-wide DNA methylation associations with height in children from LMIC”, the study observed. Interestingly, the established 12,000 genetic variants were also associated with height in Indians but their effect was significantly lower compared to the European and American counterparts.

According to Dr. Giriraj Chandak, Sir J C Bose Fellow at CCMB, the genetic risk variations are largely similar for Europeans and Indians, although the magnitude differs between the two ancestries. However, the genetic risk appears to have been modified due to environmental factors in children in LMIC. Apparently, the environmental cues that trigger the epigenetic processes in children in low and middle income countries are different in Indians and thus not influencing the epigenetic regulation of height in Europeans, he added.

(*Y. Mallikarjun is a freelancer writing on science and health*)

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