Living at higher altitudes associated with higher levels of child stunting

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Residing at higher altitude is associated with greater rates of stunting, even for children living in "ideal-home environments" according to a new study from researchers at the International Food Policy Research

Institute (IFPRI) and Addis Ababa University. The study provides new insight in the relationship between altitude and undernutrition and the additional efforts needed to ensure policy interventions are appropriately tailored to high altitude contexts.

"More than 800 million people live at 1,500 meters above sea level or higher, with two-thirds of them in Sub-Saharan Africa, and Asia. These two regions host most of the world's stunted children so it is important to understand the role that altitude plays in growth" said IFPRI Senior Research Fellow and co-author of the study, Kalle Hirvonen.

"If children living at altitude are, on average, more stunted than their peers at sea level, then a more significant effort to address high altitude stunting is needed."

The study, "Evaluation of Linear Growth at Higher Altitudes," co-authored by Hirvonen and Addis Ababa University Associate Professor Kaleab Baye, was published in the *JAMA Pediatrics.* The study analyzed height-for-age data of more than 950,000 children from 59 countries. The data were compiled through the Advancing Research on Nutrition and Agriculture (AReNA) project funded by the Bill & Melinda Gates Foundation.

Children were classified as having lived in an ideal-home environment if they were born to highly educated mothers, had good health-service coverage and high living conditions. Global tracking of growth rates relies on the assumption that children living in such environments have the same growth potential, irrespective of genetic makeup or geographic location.

"The data clearly indicated that those residing in ideal-home environments grew at the same rate as the median child in the growth standard developed by the World Health Organization (WHO), but only

until about 500 meters above sea level (masl). After 500 masl, average child height-for-age significantly deviated from the growth curve of the median child in the reference population", said Hirvonen. The research further shows that these estimated growth deficits are unlikely to be due to common risk factors such as poor diet and disease.

The study suggests that the effects of altitude were most pronounced during the perinatal period i.e., the time leading up to, and immediately after, the birth. "Pregnancies at high-altitudes are characterized by chronic hypoxia, or an inadequate supply of oxygen, which is consistently associated with a higher risk of fetal growth restriction. Restricted growth in the womb is in turn a leading risk factor for linear growth faltering" said Hirvonen.

There is some evidence to suggest that residing at high altitude over multiple generations may lead to some genetic adaption, but these findings did not hold for women with only a few generations of high-altitude ancestry. "Women of high-altitude ancestry were able to partially cope with the hypoxic conditions through increased uterine artery blood flow during pregnancy, but it may take more than a century before such adaptions are developed", said Baye.

Hirvonen and Baye conclude that the WHO growth standards for children should not be adjusted because growth faltering at high altitudes is unlikely to be the result of physiological adaptations. Instead, they call for greater attention and health-care guidance for managing pregnancies in high-altitude settings.

"A first step is to unravel the complex relationship linking altitude, hypoxia and fetal growth to identify effective interventions. Failing to address altitude-mediated growth deficits urgently can fail a significant proportion of the world population from meeting the Sustainable Development Goals and World Health Assembly nutrition targets" said

Baye.

More information: Kaleab Baye et al, Evaluation of Linear Growth at Higher Altitudes, *JAMA Pediatrics* (2020). DOI: 10.1001/jamapediatrics.2020.2386

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