

Living at higher altitudes in India linked to increased risk of childhood stunting

Children living at 2000+ m above sea level 40% more at risk than those living 1000m below

Children in rural areas seem to be the most vulnerable

Living at higher altitudes in India is linked to an increased risk of stunted growth, with children living in homes 2000 metres or more above sea level 40% more at risk than those living 1000 metres below, finds research published in the open access journal **BMJ Nutrition Prevention & Health**.

Children living in rural areas seem to be the most vulnerable, prompting the researchers to advocate prioritising nutritional programmes in hilly and mountainous regions of the country.

Despite various initiatives, childhood stunting, caused by chronic malnutrition, remains a major public health challenge in India, affecting over a third of 5-year olds, note the researchers.

While research from other countries indicates a link between residential altitude and stunting, it's not clear if this might also be applicable in India, where a substantial number of people live more than 2500 metres above sea level.

To explore this further, the researchers drew on data from the 2015–16 National Family Health Survey (NFHS-4), a nationally representative household survey of India. Some 167,555 children under the age of 5 from across the country were included in the analysis.

GPS data were used to categorise altitude level while the World Health Organization (WHO) standard was used to define stunting.

Most (98%;164,874) of the children lived less than 1000 m above sea level; 1.4% (2346) lived between 1000 and 1999m above sea level; and 0.2% (335) lived at or above 2000m. Seven out of 10 lived in rural areas.

The overall prevalence of stunting among these children was 36%, with a higher prevalence among children aged 18–59 months (41%) than among those under 18 months of age (27%).

Stunting was more common among children of third or higher birth order (44%) than it was among firstborns (30%). And stunting rates were even higher among those children who had been small or very small (45%) at birth.

Mother's education emerged as an influential factor: stunting prevalence fell as maternal educational attainment rose. The proportion of children whose mothers had had no schooling was more than double that of children whose mothers had had a higher education: 48% vs 21%.

Other protective factors included elements of antenatal care, such as clinic visits, tetanus vaccination, and iron and folic acid supplements; proximity to health facilities; and not belonging to a particular caste or indigenous tribe.

This is an observational study that captured a snapshot of the population at a specific point in time, making it difficult to confirm altitude as a cause of stunting, acknowledge the researchers.

But there are plausible explanations for their findings, they suggest. For example, chronic exposure to high altitude can reduce appetite, restrict oxygen delivery to tissues, and limit nutrient absorption.

Food insecurity also tends to be greater at higher elevations where crop yields are lower and the climate is harsher. Similarly, healthcare provision, including implementing nutritional programmes, and healthcare access are also more challenging, they suggest.

“In summary, concerted efforts are needed across health and nutrition sectors to address stunting, tailored to focus on higher-risk children in vulnerable areas,” they conclude.

“A multipronged approach should combine reproductive health initiatives, women’s nutrition programmes, infant and young child feeding interventions, and food security measures. Continued research, monitoring, and evaluation will be key to guide evidence-based policies and targeted action to ensure every Indian child has the opportunity for healthy growth and development.”

Professor Sumantra Ray, Executive Director of the NNEdPro Global Institute for Food, Nutrition and Health, which co-owns BMJ Nutrition Prevention & Health with BMJ, adds:

“In recent decades public health interventions in India have effectively tackled previously prevalent nutritional problems, such as Iodine deficiency, which are associated with living at higher altitudes.

“But this study highlights the complexities of malnutrition in hilly regions where wider determinants of malnutrition among the under 5s require further study to elucidate the relative contributions of heredity, environment, lifestyle, and socioeconomic factors.”