

# Colder Temperatures May Worsen Asthma Symptoms in Pediatric Patients

*However, more research is needed to effectively integrate this biomarker into individualized asthma management strategies for pediatric patients.*

Recent research published in *Pediatric Research* finds a connection between cold temperatures, oxidative stress, and asthma flare-ups in children with asthma. The authors note that these findings can be a significant step in the process of further enhancing and understanding treatments for pediatric asthma.<sup>1</sup>

Previously, colder temperature was known to be a trigger for pediatric asthma exacerbation, and that oxidative stress is a pathophysiologic pathway for exacerbation; however, the role of oxidative stress in linking colder temperature exposure and worsened pediatric asthma symptoms is not well understood.<sup>2</sup>

For this panel study, 43 children with asthma aged 5 to 13 years were enrolled. Over the course of 4 visits that were 2 weeks apart, nasal fluid, urine, and saliva samples were collected from each patient to measure for any biomarkers of oxidative stress. According to the investigators, oxidative stress occurs when there is an imbalance present between free radicals and antioxidants inside of the body, which can lead to the damage of cells, proteins, and DNA.<sup>1,2</sup>

The samples collected from the enrolled children were analyzed for levels of urinary, nasal, and salivary malondialdehyde (MDA)—a byproduct of the process in which free radicals attack lipids within cell membranes—which is a known biomarker of oxidative stress. Elevated levels of salivary, urinary, and nasal MDA are considered an indicator of increased oxidative stress in the oral cavity, circulatory system, and nasal cavity, respectively. Additionally, the Childhood Asthma-Control Test (CACT)—which relies on reports from both children and their caregivers—was used to assess the participants' asthma symptoms, with lower scores indicating worse symptoms or control.<sup>1,2</sup>

According to the findings, when the ambient daily-average temperature ranged from 7 to 18 °C (mid-40s to mid-60s °F), a 2°C (3.6°F) decrease in personal temperature exposures were significantly associated with both higher nasal MDA and urinary MDA concentrations by approximately 47% to 77% and 6% to 14%, respectively.<sup>1,2</sup> Additionally, the investigators estimated that with the decrease in CACT scores associated with colder temperature exposure, approximately 14% to 57% were mediated by nasal MDA.<sup>2</sup> This suggests that higher oxidative stress in the nasal cavity may trigger mucosal irritation in the lower airway and lead to respiratory problems.<sup>1</sup>

“Our results suggest that colder temperature exposure may increase oxidative stress in the nasal cavity, which in turn worsens asthma symptoms in children,” said study author Linchen He, PhD, MA, MEM, professor, Department of Community and Population Health, Lehigh University, in a news release. “By establishing an understanding of this pathway and an associated biomarker, these results pave the way for future research on how to effectively devise personalized pediatric asthma management strategies.”<sup>1</sup>

The investigators also note that these findings show similar results to another study, which found that colder temperature exposure was able to damage the interior lining of the nose, resulting in an increase in inflammation and reduction in immunity to infectious bacteria and viruses that exist in the nasal cavity.

The elevated inflammatory response, according to the authors, could generate free radicals which can damage lipids and proteins and lead to higher oxidative stress in the nasal cavity.<sup>1</sup>

The nasal cavity is the primary entryway for air pollutants to enter the body, and the authors note that their previous research reports higher air pollutant exposures were also associated with higher nasal MDA levels. Further, both the previous and current findings suggest nasal MDA is a sensitive biomarker to these asthma triggers.<sup>1,2</sup>

The investigators also note that study limitations may include the enrolled sample size, unmeasured environmental exposures, such as aeroallergens, and limited variation in temperature exposure during the study's duration. More effort is necessary to better understand how to effectively incorporate this biomarker into asthma management strategies that are personalized for the individual patient.<sup>1</sup>

“Further research is recommended to confirm these findings and explore potential mechanisms underlying the association between temperature exposure, oxidative stress and asthma exacerbation,” said He in the news release.<sup>1</sup>

## References

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2. He, L., Norris, C., Palaguachi-Lopez, K. *et al.* Nasal oxidative stress mediating the effects of colder temperature exposure on pediatric asthma symptoms. *Pediatr Res* (2024) doi:10.1038/s41390-024-03196-2

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