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Molecular hydrogen suppresses FcepsilonRI-mediated signal transduction and prevents degranulation of mast cells

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Abstract

Molecular hydrogen ameliorates oxidative stress-associated diseases in animal models. We found that oral intake of hydrogen-rich water abolishes an immediate-type allergic reaction in mice. Using rat RBL-2H3 mast cells, we demonstrated that hydrogen attenuates phosphorylation of the FcepsilonRI-associated Lyn and its downstream signal transduction, which subsequently inhibits the NADPH oxidase activity and reduces the generation of hydrogen peroxide. We also found that inhibition of NADPH oxidase attenuates phosphorylation of Lyn in mast cells, indicating the presence of a feed-forward loop that potentiates the allergic responses. Hydrogen accordingly inhibits all tested signaling molecule(s) in the loop. Hydrogen effects have been solely ascribed to exclusive removal of hydroxyl radical. In the immediate-type allergic reaction, hydrogen exerts its beneficial effect not by its radical scavenging activity but by modulating a specific signaling pathway. Effects of hydrogen in other diseases are possibly mediated by modulation of yet unidentified signaling pathways. Our studies also suggest that hydrogen is a gaseous signaling molecule like nitric oxide.

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