Why We Smell Better With Our Noses Than Our Mouths

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Summary: A new study probes the difference between picking up odors by breathing and chewing.

Source: Springer.

Researchers probe the difference between odors picked up when breathing or chewing.

The marked difference in how much better you recognize odors you breathe in than those that are released when you chew something can be explained by the workings of the epithelium cells that line the nasal cavity. This was established when researchers had ten study participants stick probes into their noses, and then made electro-physical recordings of how the epithelium cells reacted to different odors presented to them. The study was led by Thomas Hummel of the Technische Universität Dresden in Germany, and is published in Springer's journal *Chemosensory Perception*.

Olfaction refers to the action or capacity of smelling. People are able to smell thanks to their noses (an ability referred to as their orthonasal sense of smell) and through their mouths (their retronasal smelling sense) when odorous molecules are released into the nasal cavity during the process of chewing and swallowing.

According to Hummel, retronasal olfaction, although not as sensitive, represents a peculiar aspect of the olfactory system in that it allows for smells to be evaluated within the interior of the body rather than from the external world. Retronasal olfaction adds to people's experience of eating or drinking, as it evokes different sensations compared to orthonasal smelling. It also helps to keep people out of harm's way when they put

potentially harmful substances into their mouths.

Hummel's team used electro-olfactogram (EOG) recordings to evaluate how the epithelium lining in the nasal cavity reacts to stimuli that are either breathed in or are released thanks to the workings of the mouth. This electrographic technique is similar to electrocardiograms that provide neuronal information about the changing bioelectrical potential of the heart.

The experiment was performed on six men and four women, who had to insert a tubular electrode about seven centimeters deep into their nasal cavity. The reaction of the participants' epithelial lining to three odorants (phenylethyl alcohol, hydrogen sulfide and carbon dioxide) were then recorded.

The epithelial lining responded more to orthonasal stimuli than to retronasal ones. This indicates that orthonasal stimuli are perceived with a higher intensity than retronasal ones.

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The findings are in line with the thought that the odors of food and liquids, most often experienced through chewing and swallowing, are typically encountered at higher concentrations than orthonasal perceived ones, to allow them to be picked up adequately.

“Compared to the smell of a given food, such as cheese, odor release from that same food is higher intraorally due to salivation, warming, and chewing,” explains Hummel. “Because of these conditions, retronasal perception of odors, compared with orthonasal olfaction, may be adjusted to a higher range of odor concentrations.”

“This indicates that differences between ortho- and retronasal olfaction may start as early as on the mucosal level,” adds Hummel, who says the current findings lend support to previous research showing that the intensity of physically identical stimuli is slightly lower after retronasal stimulation.

About this neuroscience research article

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Abstract

The Trace Amine-Associated Receptor 1 Agonist RO5256390 Blocks Compulsive, Binge-Like Eating in Rats

Ortho- and retronasal olfaction represent two aspects of a shared sensory system yet evoke different sensations. The differences between ortho- and retronasal olfaction have triggered a number of studies during the past years, which pointed towards a decreased sensitivity to odors presented through the retronasal olfactory pathway. Especially intensity was reported to be lower after retronasal olfactory stimulation. The aim of this study was to investigate how this compares to activation at the level of the olfactory epithelium in humans.

Methods

Trigeminal (CO_2) and olfactory (H_2S, phenylethyl alcohol) stimuli were presented ortho- and retronasally. Electro-olfactograms (EOG) in response to chemosensory stimulation were recorded in 10 participants (6 women, 4 men, mean age 23.4 years).

Results

Typical EOGs were demonstrable after either orthonasal or retronasal stimulation across the stimulus qualities. Overall, EOG amplitudes to retronasal stimulation were smaller when compared to those to orthonasal stimulation, but a significant difference was obtained only in phenylethyl alcohol ($p = 0.048$).

Conclusions

The present data indicate that the perceptual differences between ortho- and retronasal olfaction may start at the level of the olfactory epithelium. The data support the idea that the intensity of physically identical stimuli is lower after retronasal stimulation compared to orthonasal stimulus presentation for both olfactory and trigeminal stimuli.

Implications

The current electrophysiological results are in line with reported differences in psychophysical properties of retro- and orthonasal stimulations meaning that different sensations are elicit through these two channels although the same molecule is presented.

“Electro-Olfactograms in Humans in Response to Ortho- and Retronasal Chemosensory Stimulation” byThomas Hummel, Han-Seok Seo, Roberto Pellegrino, and Stefan Heilmann in *Chemosensory Perception*. Published online September 30 2016 doi:10.1007/s12078-016-9217-z

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