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**Taste During Sleep - Arousal Responses to Gustatory and
Trigeminal Stimulation**

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The processing of nociceptive, visual, vibrotactile, thermal and acoustic stimuli during sleep has been extensively investigated. Recently, a series of trials has assessed the impact of olfactory stimulation on sleep. The goal of this study was to determine whether gustatory stimulation is able to cause arousal reactions during sleep.

A prospective controlled trial was performed at the sleep research facility of the Department of Otolaryngology of the Mannheim University Hospital, involving 21 young, healthy, normosmic, normogeusic volunteers. Arousal reactions due to chemosensory stimulation were assessed by overnight polysomnography during 40 nights of testing.

A specially adjusted intra-oral device, with tubes connected to a gustometer, was used to introduce taste solutions into the oral cavity during sleep. The aqueous solutions used for stimulation were NaCl (7.5%), sucrose (20%), citrate (5%), and quinine (0.02%). Capsaicin (0.1% in peanut oil) was employed as a positive control. Applying it causes pain which has been shown to be a reliable way of causing arousals. An artificial saliva solution (KCl 1.86%, NaHCO₃ 0.21%) was administered as a negative control, as it has been shown that pure water activates certain areas of the taste cortex. The artificial saliva was also used to rinse after each application of the bitter stimulus.

Gustatory stimulation led to a significant increase in arousal frequencies compared to the negative control (artificial saliva) in sleep stage N2. There was no difference in N1, where the overall arousal rate was very high, probably due to the mechanical stimulation caused by the application process. There was no significant difference either in sleep stages N3 or REM. In both N3 and REM the overall arousal rate was very low. Capsaicin woke participants in the majority of cases, which is in agreement with previous studies that investigated the effect of pain on sleep.

In summary, this study was able to prove that gustatory stimulation during sleep can elicit arousals. Stimulus intensity, i.e. number of flavour molecules, and sleep stage influence the frequency of arousals after stimulation. Taste quality (sweet, salty, sour, bitter) does not matter. This is in contrast to olfactory stimulation, the other chemical sense. This is probably due to the central nervous pathways and connections.