

The Mechanism Underlying Additive Salty Taste and Alteration of Preference Induced by Neutralizing a Basic Amino Acid, Arginine

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Summary

A basic amino acid, arginine (Arg) shows complex taste qualities including sweet, bitter and umami. Furthermore, the additive salty taste is induced by neutralization of arginine (nArg). We examined responses of taste bud cells to Arg and nArg using Ca²⁺-imaging method applied to slice preparation of mouse circumvallate papillae. Taste bud cells examined were categorized into 3 types: Only Arg-responsive type (Arg type), Only nArg-responsive type (nArg type) and both Arg and nArg-responsive type (Dual type). Only nArg responses were suppressed by verapamil, a nonspecific voltage-dependent Ca²⁺ channel (VCaC) blocker existing in only Type III cells, suppressed only response to nArg of Dual type cells, indicating that Type I or Type II cell detects salty taste responses of nArg.

The sensory rating experiments revealed the sex difference in human sensitivity to salty taste of nArg : Female subjects showed gradual increasing sensitivity to salty taste quality induced by nArg in the dose-dependent manner, whereas male showed lower sensitivities to all concentration range tested and decrement of sensitivities to higher concentration of nArg. The measurement of change of oxy-hemoglobin (oxy-Hb) using a near-infrared spectroscopy also represented the sex difference in the prefrontal brain region activated by the salty taste quality induced by nArg. Taken together with the results obtained by Ca²⁺-imaging method with mouse taste buds, it is suggested that not only the peripheral processing mechanism of salty taste induced by nArg may be different from that by NaCl, but also there may be differential pathways between female and male in central processing mechanism of salty taste induced by nArg.