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Evaluation of Salts and Salt Substitutes Using Evaluation Methods for Salty Taste with Palatability

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Summary

Salt is essential for enhancing the palatability of food. However, excessive salt intake has been regarded as a remote cause of lifestyle-related conditions such as high blood pressure, and therefore, salt intake should be controlled. Research on the development of a salt substitute has been performed, but a substitute with palatability equivalent to that of salt has not yet been developed. Salty taste is divided into at least 2 types: one type affects palatability and the other does not. In our previous year's project, we developed methods for evaluating saltiness from the viewpoint of palatability by using ethology- and molecular physiology-based techniques, and evaluated the saltiness of the salty taste enhancer using these techniques. In this year's project, we evaluated the saltiness of various sodium salts in order to elucidate the role that anions of sodium salts play in enhancing salty taste.

Initially, we evaluated saltiness in connection with palatability for various salts by using an ethological technique. We counted the number of times that the mouse licked the solution as an indicator of the favorability of the solutions. The addition of 5 mM $NaHCO_3$ to 15–45 mM NaCl increased the number of licks. This effect was equal to that obtained on addition of 10 mM NaCl to the 15–45 mM NaCl solution. In contrast, addition of 5 mM K_2CO_3 did not increase the number of licks. Therefore, we did not concluded that HCO_3^- enhanced salty taste. Moreover, addition of 10 mM $NaHCO_3$ did not increase the number of licks and addition of 30 mM $NaHCO_3$ decreased it, suggesting that high $NaHCO_3$ concentrations inhibit salty taste perception.

In parallel, we evaluated various sodium salts by using cultured cells transiently expressing ENaC. We observed that the response to 30 mM $NaHCO_3$ was nearly equal to that obtained for 30 mM NaCl. In contrast, the responses to 30 mM sodium citrate and 30 mM MSG were weaker than that to 30 mM NaCl. These results suggested that the ENaC responses did not correspond to the intensities of salty tastes for these sodium salts.

These results indicate that the type of anion and the ratio of sodium ions to anions might be important for enhancing salty taste. Further studies are required to obtain more information on the role of anions in the occurrence of salty taste in order to determine the optimal ratio of sodium ions to anions for enhancing salty taste.