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Measurement and modulation of human taste detection thresholds

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Disturbances of taste are often reported by people suffering from mood disorders and depression but the exact nature of these disturbances is not known and has not been systematically investigated. Serotonin and noradrenaline have been identified in taste receptor cells and at various points throughout the taste projection pathway, but their role in taste transmission has not been clearly elucidated. We hypothesised that altered taste and appetite in depression may result from altered serotonergic and/or noradrenergic transmission in the taste pathway.

Here we demonstrate a rapid taste test that can be applied to an individual in 60 minutes and that can detect serotonergic or noradrenergic sensitivity by measurement of taste threshold. Solutions of decreasing concentrations (1/4 log concentration steps) of sucrose (sweet), NaCl (salt), quinine (bitter) and HCl (sour) will be applied to the tongue in a pseudorandom order. The full range of detectable concentrations will be applied at least 5 times for each taste modality. A curve of log solute concentration against number of positive trials will be constructed and the concentration at which 50% of the trials are positively identified determined (50% detection threshold). This gives highly reproducible detection thresholds in an individual between trials (e.g. sour taste - trial 1 50% detection threshold: 15.6μM, trial 2: 15.6μM, trial 3 16.5μM).

We have used this taste test protocol to investigate the effect of manipulation of the serotonergic and noradrenergic transmitter systems on taste detection threshold. We have previously shown that in a cohort of volunteers, administration of an SNRI (serotonin/noradrenaline reuptake inhibitor) resulted in a lowered detection threshold for sweet but not salt taste (Melichar et al, 2004). We have extended these studies to investigate the effect of manipulation of either serotonin, with an SSRI (serotonin specific reuptake inhibitor) or NARI (noradrenaline reuptake inhibitor). Herein we demonstrate the method used to compare taste detection thresholds before and after SSRI, NARI or active placebo administration. Taste tests are conducted before and after drug administration and 50% detection thresholds are compared. In preliminary studies these manipulations result in substantial shifts in taste-modality specific detection thresholds in single individuals when compared to active placebo.

This simple taste test could reveal differences in serotonin and noradrenaline signalling in different individuals. This could be applied to the study of taste disturbance in depression and other mood disorders, and may be used to determine relative sensitivities of individuals with mood disorders to specific therapeutic agents.

Melichar J.K., T. Heath, L.N. Jackson, H. Watson, D.J. Nutt and L.F. Donaldson Serotonin and the 5HTlAreceptor in the signalling of taste: A novel human surrogate marker? Eur Neuropsychopharmacol. 14 (Suppl 3), 2004, S225-S226

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Where applicable, the experiments described here conform with Physiological Society ethical requirements.