A scoring method for screening field odor assessors using multivariate analysis of mixed data

ABSTRACT

A previously developed test for screening field odor assessors was reexamined to objectively evaluate its numerical and categorical variables. The first part of the test is objective (discrimination between different odors and varying intensity levels), reflecting sensory capability through “correct” or “incorrect” responses; whereas the other components (rating odor intensity, hedonic tone, and odor characterization) are influenced by odor perception. Between 2006-2024, a total of 1428 individuals participated in this test, out of which 841 fully answered all questions and were selected for the current study. Scoring was enabled by using a Principal Component Analysis (PCA), Multiple Correspondence Analysis (MCA), and PCA for Mixed Data (PCAmix) of numerical and categorical variables, following by Mahalanobis distance calculations. This method overcomes the limitations of the previous study, in which certain arbitrary decisions were incorporated into the grading process. The new scoring method proved useful for objectively identifying individuals who may be screened out according to their deviation from the mean population. Moreover, individuals showed marked variability across different olfactory abilities; a total of 77.6% of individuals who scored outside 1σ (one standard deviation) from the mean of “odor character” were within 1σ of the mean for “odor discrimination". Likewise, 76.9% of individuals who scored outside 1σ from the mean of “hedonic tone” were still within 1σ of the mean for “odor intensity". These results suggest that odor assessors should be carefully selected, possibly according to specific tasks. The proposed scoring calculation can be automated and adopted by regulatory agencies and the community.