

P2.140 A bootstrap-based approach for sample size calculation when traditional estimations are not possible

Leonardo Menghi^{1,2,3}, Pietro Franceschi³, Davide Giacalone², Flavia Gasperi^{1,3}

¹University of Trento Center Agriculture Food Environment, Trento, Italy. ²University of Southern Denmark, Department of Technology and Innovation, Odense, Denmark. ³Edmund Mach Foundation Research and Innovation Centre, San Michele All Adige, Italy

Abstract

In sensory science, formal sample size estimations are seldom used, especially when the magnitude of the underlying phenomena are hard to estimate. This may lead to underpowered studies and lower the reproducibility of sensory studies. In the impossibility of using traditional techniques, a simulation-based approach based on sampling from existing data may be a viable solution.

We demonstrate this approach with a case study focusing on the possible relation between oral and gut microbiota and sensory perception. Here, we employed a bootstrap with replacement approach to estimate the minimum sample size needed to replicate the intra-sample gut microbial diversity (Shannon α -diversity) and sensory responsiveness (PROP status) from two reference cohorts, previously assessed for gut microbial composition (American Gut project; AG; N=474) and inter-individual variability on sensory perception (Italian Taste project; IT; N=605).

Firstly, we randomly sampled an increasingly higher number of participants (from N=5 to N=AG; 10k times each) to observe the minimum sample size showing the same median (Mann-Whitney test; $p>0.05$) and a maximum reduction $<20\%$ in the IQR of the AG cohort α -diversity ($p<0.05$). Then, we estimated the proportion of Non-, Medium-, and Super-Tasters from the IT dataset and repeated the analysis to obtain the minimum sample size reproducing the same PROP status distribution (chi-square statistic; $p>0.05$) of the IT cohort. We found that N=106 was the minimum sample size needed to replicate the overall microbial diversity and the PROP status distribution of both cohorts. Reference data were then compared to actual data, which confirmed the similarity of cohorts.

Overall, a bootstrap-based approach appears to be a suitable method to correctly calculate sample size when traditional estimations are not possible. In the attempt to further encourage formal sample size calculations in sensory studies, our approach is useful especially in exploratory studies based on newly hypothesized inferences.

Keywords

Sample size calculations
Bootstrapping