

The Effect of Acute Concurrent Exercise on Executive Function: An Event-Related Potential Study

Statistical Analyses Plan

The statistical analyses will be conducted using IBM SPSS Statistics (IBM Corp., Armonk, NY). A one-way ANOVA will be executed to compare the demographic data among the three groups (CE vs. AE vs. RC). A one-way ANCOVA will be performed to compare the effect of acute exercise on executive function. The pretest of the cognitive test will serve as the covariance, the independent variable will be the group, and the dependent variable will be the post-test of the cognitive test. Similarly, a one-way ANCOVA will be applied to mean P3 amplitudes.

To investigate the effects of acute exercise on heart rate (HR) and lactate levels, mixed-model ANOVAs will be employed. A 3 (Group) \times 4 (Timepoint: resting HR vs. pre-activity HR vs. treatment HR vs. post-activity HR) design will be used for HR, while a 3 (Group) \times 3 (Timepoint: Time 1 vs. Time 2 vs. Time 3) design will be used for lactate. In cases of significant interaction effects, multiple comparisons will be conducted, and Greenhouse–Geisser-adjusted F ratios will be employed when the assumption of sphericity is violated.

For mediation analyses, the PROCESS macro by Hayes (2022) will be utilized, employing a simple mediation model (Hayes & Preacher, 2014). Dummy variables will be created, with the RC group as the reference group. The incremental area under the lactate curve will serve as the mediator, calculated by subtracting lactate concentrations at Time 1 from those at Time 2 and Time 3. The post-test of the cognitive test will be the dependent variable, and the pretest of the cognitive test will serve as the covariate. Mediation effects will be assessed through a bootstrap method (5000 resamples) with a 95% confidence interval (CI). The examination will include total effects, direct effects, regressions of group to lactate, regressions of lactate to executive function, and indirect effects, with significance determined by the 95% CI.

Reference

- Hayes, A. F. (2022). Introduction to mediation, moderation, and conditional process analysis. In *A regression-based approach* (3rd ed.). Guilford Publications.
- Hayes, A. F., & Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical independent variable. *British Journal of Mathematical and Statistical Psychology*, 67(3), 451–470. <https://doi.org/10.1111/bmsp.12028>