Effects of Non-normality and Heterogeneity on Tests for One-Way Independent Groups Design: Type I Error and Power Comparisons

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Researchers mainly investigate the treatment effect on a dependent variable. While comparing more than two groups of treatment effect, normality and homogeneity of variances have important roles affecting the performance of tests. In this study, one-way ANOVA, Welch's ANOVA, Kruskal Wallis test, Alexander-Govern test, James-Second order test, Brown-Forsythe test, Welch's heteroscedastic F test with trimmed means and Winsorized variances, Mood's Median test are included to illustrate the effect of non-normality and/or heterogeneity on these tests. For this purpose, two simulation studies are implemented to illustrate the performance of these tests for the scenarios which assumptions of normality and/or variance homogeneity are not held or both assumptions are satisfied. The first simulation study is organized under the equality of means to investigate the change of type I rates among tests. The second simulation study is conducted under the inequality of means to explore the impact of non-normality and heterogeneity on power of the tests. Wide inferences are drawn on the type I error and power behaviors of considered tests, and some general suggestions are given on which tests should be used or avoided under violations of assumptions. An R package is proposed for public use.

Keywords : ANOVA, Welch's ANOVA, Independent Groups Design.