

ANOVA Results and Post Hoc Tests

An ANOVA result answers one narrow question about three or more groups at once. This page explains exactly what that answer is, and what to do after you get it.



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What this answers

This page answers "my ANOVA came back significant, now what?" A one-way ANOVA tests whether at least one group mean differs from the others somewhere among three or more groups. It does not tell you which specific groups differ, which requires a separate follow-up step.

What the omnibus test tells you

The F-statistic compares variation between group means to variation within groups. A significant result means the data provide evidence that not all group means are equal somewhere among the groups compared; it is silent on which pair or pairs of groups actually differ. A nonsignificant result means the data did not provide sufficient evidence of any difference among the groups at the chosen sample size, not that all groups are truly identical.

Effect size and post hoc tests

Eta squared or omega squared describes how much of the total variation in the outcome is associated with group membership, giving a magnitude alongside the omnibus p-value. To find which specific pairs of groups differ, use a post hoc test built for multiple comparisons, such as Tukey's HSD for roughly equal variances or Games-Howell when variances differ across groups, rather than running a series of unadjusted t-tests, which inflates the chance of a false positive across the full set of comparisons.

Worked example

A one-way ANOVA comparing four store locations' average sales returns $F = 4.2$, $p = .01$, an eta squared of 0.18. The omnibus result says at least one location differs from the others. Running Tukey's HSD afterward shows Location A differs significantly from Location D, but no other pair does, giving the specific comparison the omnibus test alone could not provide.

Assumption audit

Calculated from your data: the F-statistic, p-value, and effect size, automatically, from the linked ANOVA calculator, along with group sizes and variances.

Evidence to review: whether group variances look similar, since Welch ANOVA and Games-Howell are more appropriate than the standard versions when they clearly do not.

You must verify: that comparing these specific groups answers your actual research question, and that any interaction effects in a multi-factor design are checked separately with a two-way ANOVA.

Source

This guidance follows the ANOVA and multiple-comparisons treatment in the NIST/SEMATECH e-Handbook of Statistical Methods and the shared statistical reasoning contract every StatReason engine is built against.

Limitations

This page covers the standard one-way ANOVA and its common post hoc tests; repeated measures, two-way, and ANCOVA designs each have additional assumptions covered on their own engine pages.

Next action: run the [One-Way ANOVA Calculator](#) or [Welch ANOVA Calculator](#), then follow up with [Tukey HSD](#) or [Games-Howell Test](#).