

Paired T-Test

A paired t-test is a statistical test used to compare the **means of two related groups** where the data comes from the **same subjects or units** measured under different conditions. is used to compare the means of two samples when each observation in one sample can be paired with an observation in the other sample.

Focuses on Differences:

The test analyzes the **differences** between the paired measurements within each subject/unit. This approach helps eliminate or reduce the influence of individual variations that might be unrelated to the conditions being compared.

Steps involved in a paired t-test:

1. Formulate the hypothesis:

- **Null hypothesis (H0):** There's no significant difference between the means of the reaction times before and after the energy drink ($\mu_{diff} = 0$).
- **Alternative hypothesis (HA):** The energy drink improves reaction time ($\mu_{diff} < 0$). We expect a negative difference (improvement) if the drink is effective.

2. Calculate the differences:

Subtract the reaction time at Time 1 from the reaction time at Time 2 for each participant. This gives you the individual difference scores (improvement/decline in reaction time).

3. Analyze the differences:

Perform a regular one-sample t-test on the calculated difference scores. This test assesses if the **mean difference** is significantly different from zero (no improvement).

4. Interpret the results:

- Choose a significance level (alpha, typically 0.05).
- If the p-value from the t-test is less than alpha (let's say p-value = 0.02), you reject the null hypothesis and conclude there's a significant difference in the mean difference scores. This suggests the energy drink likely improved reaction time on average for the participants.
- If the p-value is greater than alpha, you fail to reject the null hypothesis. There's not enough evidence to say the drink has a significant effect on reaction time at the chosen significance level.