Stress Intervention Evaluation

Paired-samples t-test analysis in R

Executive Summary

This analysis evaluated whether a small intervention was associated with lower stress scores for the same five participants. Mean stress fell from 7.4 before the intervention to 4.2 afterward, a reduction of 3.2 points. Every participant recorded a lower post-intervention score.

A paired-samples t-test found that the reduction was statistically significant, t(4) = 4.00, p = .020, with a 95% confidence interval from 0.81 to 5.59 points. A one-tailed test aligned with the directional hypothesis also produced p = .010. The result is clear within this sample, but the sample size of five and absence of a control group limit generalisation and causal claims.

5	7.4	4.2	3.2
Participants	Mean before	Mean after	Mean reduction

Research Question

Did participants report lower stress after the intervention than before it?

Data Structure and Method

Measure	Before	After
Mean	7.4	4.2
Standard deviation	1.14	0.84
Minimum	6	3
Maximum	9	5
Median	7	4
IQR	1	1

The data were stored in both wide and long formats. Wide format supported paired testing, while long format supported grouped summaries and ggplot visualisations. Because the same participants were measured twice, a paired-samples t-test was the correct inferential method.

Analytical Workflow

- Imported Excel data with readxl and standardised variable names with janitor.
- Produced descriptive statistics in both wide and long data formats.
- Inspected histograms, boxplots and mean plots with standard-error bars.
- Compared the pre-intervention mean with a benchmark value of 5 using a one-sample t-test.

- Tested the before-after change using a paired-samples t-test and checked the directional alternative separately.
- Interpreted confidence intervals, p-values and the limitations created by a very small sample.

Distribution Before and After the Intervention

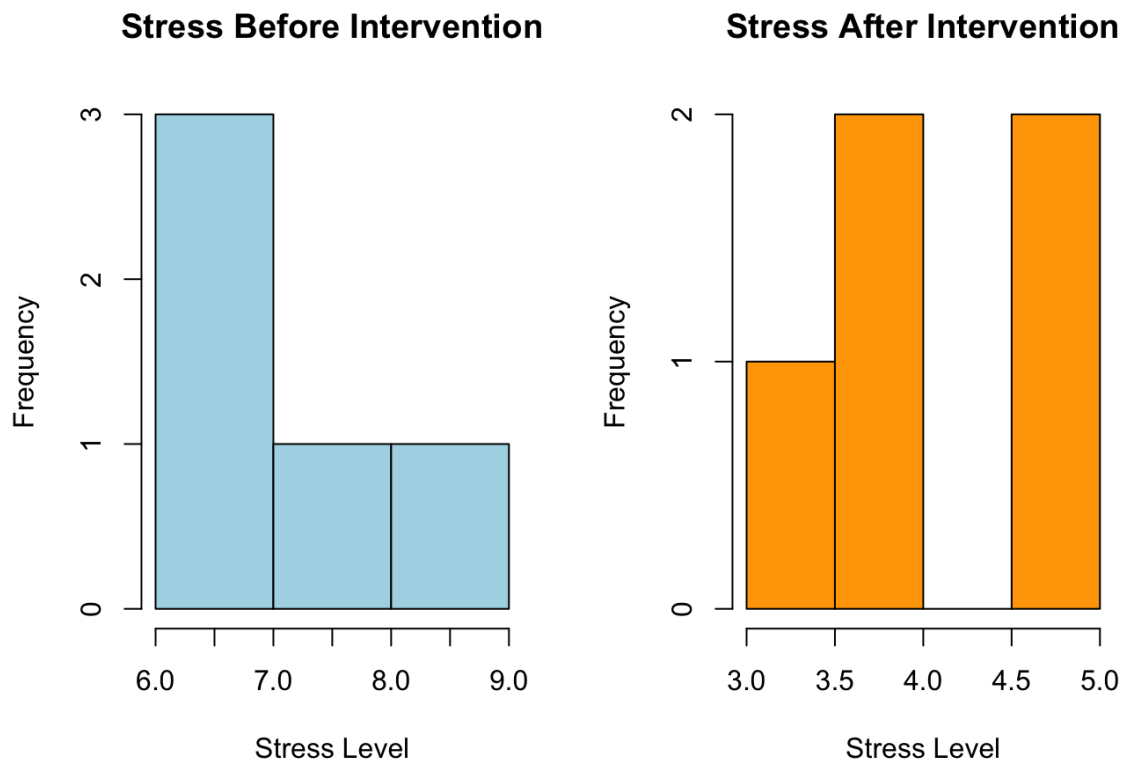

Figure 1. Histograms of stress levels before and after the intervention.

Visual interpretation

Pre-intervention scores range from 6 to 9 and cluster around 7, whereas post-intervention scores range from 3 to 5 and cluster around 4. The distributions are completely separated in this small sample: the highest post-intervention score (5) remains below the lowest pre-intervention score (6). This is a strong descriptive signal, although five observations are too few to establish population-level stability.

Boxplot Comparison

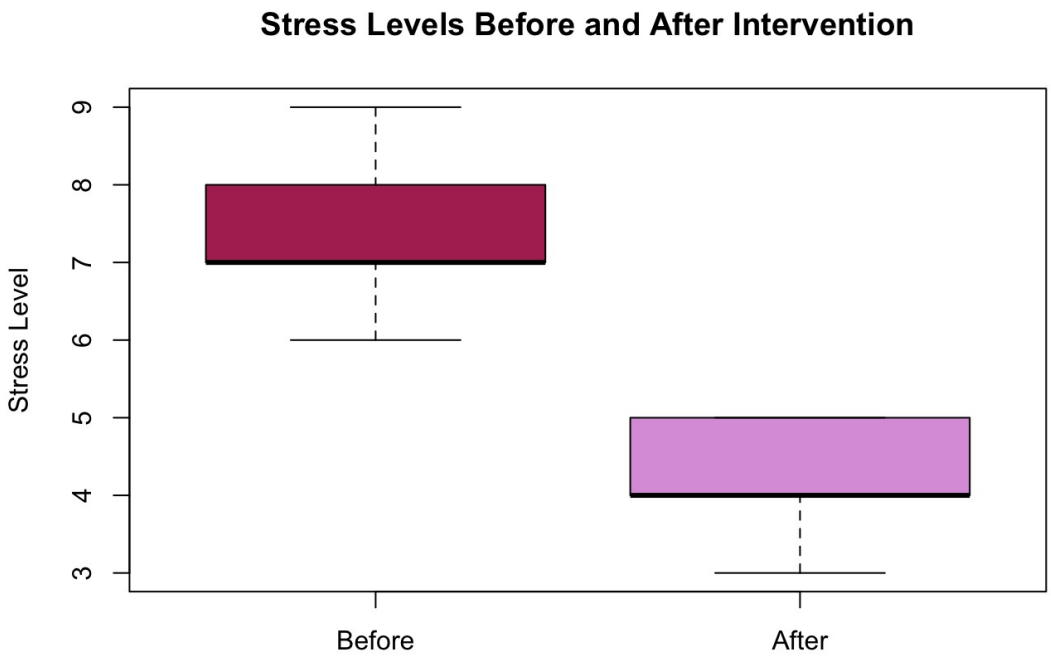

Figure 2. Stress levels before and after the intervention.

Visual interpretation

The before-intervention box is centred around 7-8, while the after-intervention box is centred around 4-5. The boxes and whiskers do not overlap, showing that the change is not driven by a single unusual participant. The slightly narrower spread after the intervention also corresponds with the lower standard deviation (0.84 after versus 1.14 before).

Inferential Results

Test	Statistic	p-value	95% confidence interval	Interpretation
Pre-intervention vs benchmark 5	t(4) = 5.00	.009	5.98 to 8.82 (mean)	Baseline stress exceeded the benchmark
Paired before vs after	t(4) = 4.00	.020	0.81 to 5.59 (difference)	Significant mean reduction
Directional paired test	t(4) = 4.00	.010	1.37 to infinity	Before scores were higher

The paired test estimates a mean reduction of 3.2 points. The confidence interval excludes zero, so the observed change is inconsistent with a no-change explanation at the 5% significance level.

Participant-Level Change

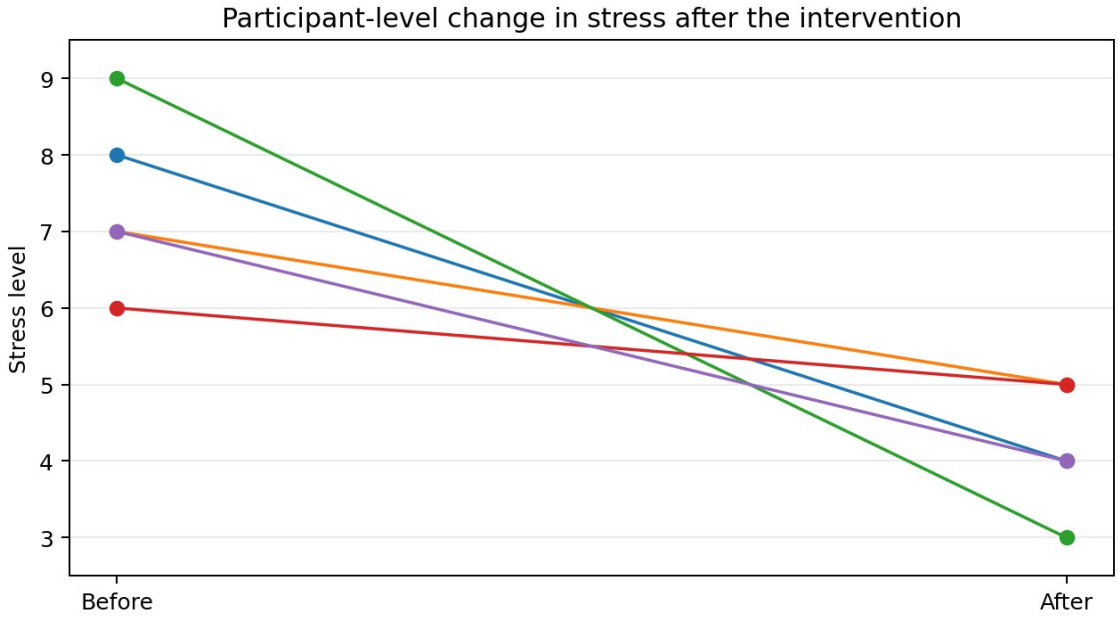

Figure 3. Paired change for each participant.

Visual interpretation

All five lines slope downward. This consistency matters because the paired t-test evaluates within-person change, not merely a difference between two unrelated averages. The largest reduction is 6 points and the smallest is 1 point; no participant moved in the opposite direction.

Mean Difference with Uncertainty

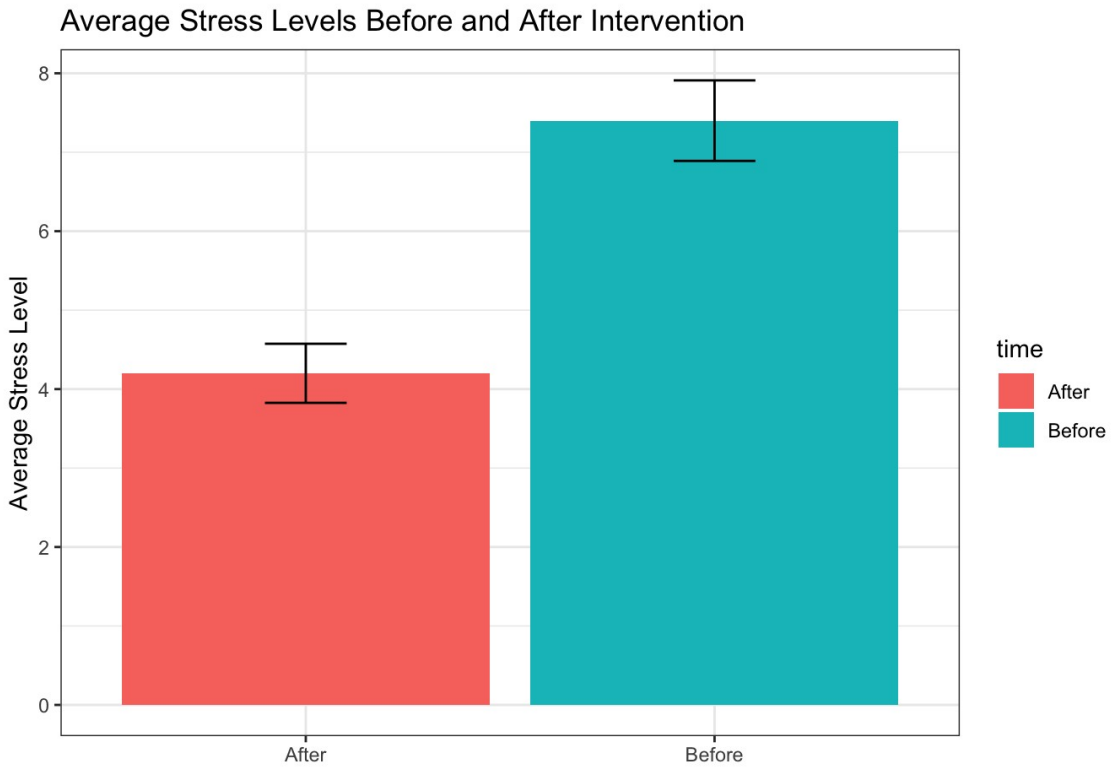

Figure 4. Mean stress before and after the intervention with error bars.

> **Visual interpretation**
> The mean bars reproduce the 7.4 versus 4.2 difference. Error bars are useful for showing uncertainty, but they do not replace the paired analysis because the two measurements come from the same participants. The paired test uses that within-person structure directly and is therefore the stronger inferential evidence.

Conclusion

Stress scores were substantially lower after the intervention within the observed sample. The result is statistically significant and descriptively consistent across all participants. It should nevertheless be presented as evidence from a small educational dataset, not as proof that the intervention would work broadly or that it alone caused the change.

Limitations and Next Steps

- Only five participants were observed, producing imprecise population estimates despite the significant result.
- There was no control group, so time effects, expectancy effects or other events cannot be ruled out.
- A larger evaluation should predefine the primary hypothesis, include a comparison group and report an effect size for the paired change.
- Longer follow-up would show whether lower stress was sustained rather than temporary.