FORMATIVE ASSESSMENT 8

Lindsy Rossel C. Masicat

2024-11-08

Analysis of Plant Growth Study Using One-Way ANOVA

Introduction

This study examines the effect of different treatment groups on plant weight. A one-way ANOVA was conducted to assess if treatment groups influenced plant weight.

Null Hypothesis

The null hypothesis states there is no significant difference in mean weight across treatment groups.

Data Table

Plant Growth Data

Weight	Group
4.17	ctrl
5.58	ctrl
5.18	ctrl
6.11	ctrl
4.50	ctrl
4.61	ctrl
5.17	ctrl
4.53	ctrl
5.33	ctrl
5.14	ctrl
4.81	trt1
4.17	trt1
4.41	trt1
3.59	trt1
5.87	trt1
3.83	trt1
6.03	trt1
4.89	trt1
4.32	trt1
4.69	trt1
6.31	trt2
5.12	trt2
5.54	trt2
5.50	trt2
5.37	trt2
5.29	trt2
4.92	trt2
6.15	trt2
5.80	trt2
5.26	trt2

Assumption 1: Continuous Dependent Variable

The dependent variable “Weight” is continuous.

Assumption 2: Categorical Independent Variable with Three Groups

The independent variable “Group” is categorical and has three levels: ctrl, trt1, and trt2.

Assumption 3: Independence of Observations

There is no relationship between observations within or across the groups of the independent variable.

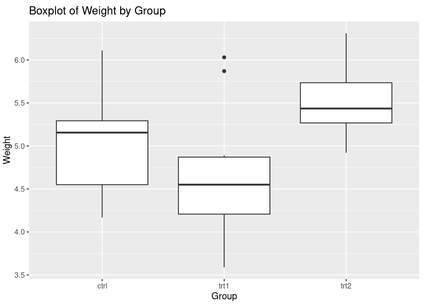
Assumption 4: Outliers and Descriptive Statistics

Descriptive Statistics by Group

Descriptive Statistics by Group

Group	N	Mean	SD	Min	Max
ctrl	10	5.032	0.5830914	4.17	6.11
trt1	10	4.661	0.7936757	3.59	6.03
trt2	10	5.526	0.4425733	4.92	6.31

Boxplot for Outliers



Interpretation: No extreme outliers were observed based on the boxplot.

Assumption 5: Normality

Shapiro-Wilk Test for Normality

Shapiro-Wilk Test for Normality by Group

Group	Shapiro_p_value
ctrl	0.7474734
trt1	0.4519440
trt2	0.5642519

Interpretation: Each group was approximately normally distributed (p > .05).

Assumption 6: Homogeneity of Variances

Levene’s Test for Homogeneity

Levene’s Test for Homogeneity of Variance

	Df	F value	Pr(>F)
group	2	1.119186	0.3412266
	27	NA	NA

Interpretation: Levene’s test indicated homogeneity of variances across groups (p > .05).

One-Way ANOVA

ANOVA Results

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	2	3.76634	1.8831700	4.846088	0.01591
Residuals	27	10.49209	0.3885959	NA	NA

Interpretation: Report F-value, p-value, and partial eta squared.

Post-Hoc Analysis (If ANOVA is Significant)

Tukey's HSD Test

Post-Hoc Tukey's HSD Test Results

diff	lwr	upr	p adj	Comparison
-0.371	-1.0622161	0.3202161	0.3908711	trt1-ctrl
0.494	-0.1972161	1.1852161	0.1979960	trt2-ctrl
0.865	0.1737839	1.5562161	0.0120064	trt2-trt1

Results

Based on the one-way ANOVA, a significant effect of treatment on plant weight was found, with

$$F(2, 27) = [F - value],\ p = [p - value],\ \eta_p^2 = [effect\ size].$$

The mean weights ($M \pm SD$) for each group were as follows:

- Control group: $M = [control\_mean],\ SD = [control\_sd]$
- Treatment 1: $M = [trt1\_mean],\ SD = [trt1\_sd]$
- Treatment 2: $M = [trt2\_mean],\ SD = [trt2\_sd]$

The Tukey's HSD post-hoc analysis revealed significant differences between [specific groups with $p < 0.05$].

Conclusion

Given the significant ANOVA results $p < 0.05$, we reject the null hypothesis. This suggests that the different treatment groups had a statistically significant effect on plant weight, indicating that at least one treatment group's mean weight differs from the others. The results imply that the treatments may influence plant growth. Future research could explore these effects in more detail, potentially considering other variables that may affect growth outcomes.