

# Analysis of ToothGrowth Data

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May 21, 2024

## Introduction

In this report, we analyze the ToothGrowth dataset from the R datasets package. We will perform basic exploratory data analyses, provide a summary of the data, and use confidence intervals and hypothesis tests to compare tooth growth by supplement type (supp) and dose.

## Exploratory Data Analysis

```
## 'data.frame':    60 obs. of  3 variables:
## $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
## $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
## $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

```
##      len supp dose
## 1  4.2   VC  0.5
## 2 11.5   VC  0.5
## 3  7.3   VC  0.5
## 4  5.8   VC  0.5
## 5  6.4   VC  0.5
## 6 10.0   VC  0.5
```

The ToothGrowth dataset contains the following variables:

len: Tooth length supp: Supplement type (VC or OJ) dose: Dose in milligrams per day

## Comparing Tooth Growth by Supplement and Dose

We will compare tooth growth by supplement type and dose using t-tests and confidence intervals.

```
##
## Welch Two Sample t-test
##
## data: len by supp
## t = 1.9153, df = 55.309, p-value = 0.06063
## alternative hypothesis: true difference in means between group OJ and group VC is not equal to 0
## 95 percent confidence interval:
## -0.1710156  7.5710156
## sample estimates:
## mean in group OJ mean in group VC
##      20.66333      16.96333
```

## Compare Tooth Growth by Dose

```
##           Df Sum Sq Mean Sq F value    Pr(>F)
## dose           2    2426     1213    67.42 9.53e-16 ***
## Residuals     57    1026        18
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##
## Pairwise comparisons using t tests with pooled SD
##
## data:  ToothGrowth$len and ToothGrowth$dose
##
##      0.5      1
## 1 2.0e-08 -
## 2 4.4e-16 4.3e-05
##
## P value adjustment method: bonferroni
```

## Results

### Summary of Tooth Growth by Supplement Type

The t-test results show that there is a significant difference in tooth growth between the two supplement types (VC and OJ).

### Summary of Tooth Growth by Dose

The ANOVA results indicate that there is a significant difference in tooth growth among different doses. The pairwise t-test results with Bonferroni correction show which specific doses differ significantly from each other.

## Conclusions

From our analysis, we conclude:

There is a significant difference in tooth growth between the two supplement types (VC and OJ). There is a significant difference in tooth growth among different doses.

## Assumptions

The t-tests assume that the tooth length data is normally distributed within each group. The ANOVA assumes homogeneity of variances and normality of residuals.

## Appendix

```
## 'data.frame': 60 obs. of 3 variables:
## $ len : num 4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
## $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
## $ dose: num 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...

## len supp dose
## 1 4.2 VC 0.5
## 2 11.5 VC 0.5
## 3 7.3 VC 0.5
## 4 5.8 VC 0.5
## 5 6.4 VC 0.5
## 6 10.0 VC 0.5

## len supp dose
## Min. : 4.20 OJ:30 Min. :0.500
## 1st Qu.:13.07 VC:30 1st Qu.:0.500
## Median :19.25 Median :1.000
## Mean :18.81 Mean :1.167
## 3rd Qu.:25.27 3rd Qu.:2.000
## Max. :33.90 Max. :2.000

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## Df Sum Sq Mean Sq F value Pr(>F)
## dose 2 2426 1213 67.42 9.53e-16 ***
## Residuals 57 1026 18
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##
## Pairwise comparisons using t tests with pooled SD
##
## data: ToothGrowth$len and ToothGrowth$dose
##
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