Basic Inferential Data Analysis

Statistical Inference Course Project: Part 2

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Overview

Analyze the *ToothGrowth* data in the R datasets package.

1. Load the *ToothGrowth* data and perform some basic exploratory data analyses
2. Provide a basic summary of the data
3. Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose
4. State conclusions and assumptions needed for the conclusions

Analysis

ToothGrowth data

```
# Load the ToothGrowth data
data("ToothGrowth")
str(ToothGrowth)
```

```
## '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 ...
```

Description The response is the length of odontoblasts (cells responsible for tooth growth) in 60 guinea pigs. Each animal received one of three dose levels of vitamin C (0.5, 1, and 2 mg/day) by one of two delivery methods, orange juice or ascorbic acid (a form of vitamin C and coded as VC).

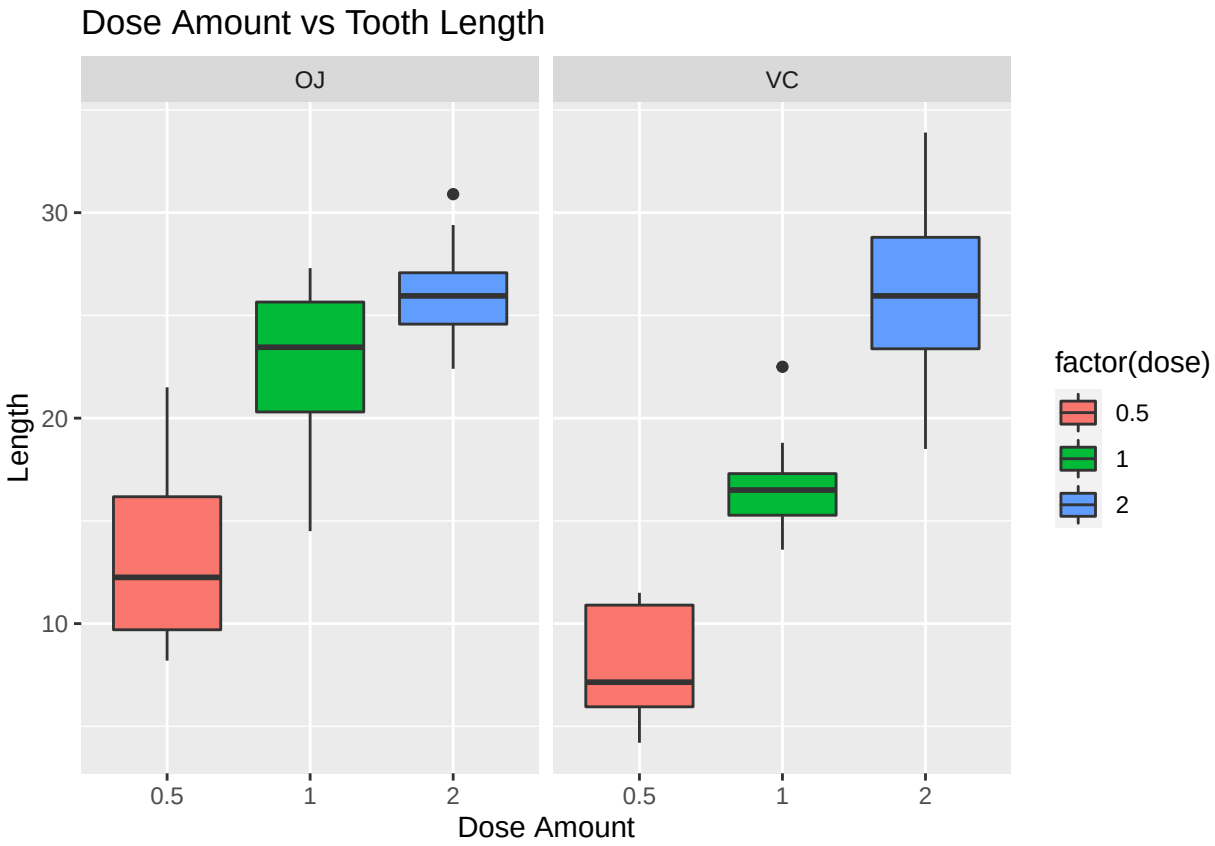
Basic Summary

```
summary(ToothGrowth)
```

```
##       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
```

```
g <- ggplot(ToothGrowth, aes(x = factor(dose), y = len))
g <- g + geom_boxplot(aes(fill = factor(dose)))
g <- g + facet_grid(. ~ supp)
g <- g + ggtitle("Dose Amount vs Tooth Length")
```

```
g <- g + xlab("Dose Amount") + ylab("Length")
g
```



Hypothesis Test

Now tooth growth by supplement using a t-test will be compared.

```
t.test(len ~ supp, ToothGrowth)
```

```
##
##  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 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
```

The p-value of this test was 0.06063.

Since the p-value is greater than 0.05 and the confidence interval of the test contains zero, it can be concluded that supplement types seem to have no impact on tooth growth based on this test.

Now a comparison of tooth growth by dose will be done, looking at the different pairs of dose values.

```r
t.test(len ~ dose, ToothGrowth[ToothGrowth$dose %in% c(0.5, 1), ])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -6.4766, df = 37.986, p-value = 1.268e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.983781  -6.276219
## sample estimates:
## mean in group 0.5   mean in group 1
##            10.605            19.735
```

```r
t.test(len ~ dose, ToothGrowth[ToothGrowth$dose %in% c(1, 2), ])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -4.9005, df = 37.101, p-value = 1.906e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -8.996481 -3.733519
## sample estimates:
## mean in group 1 mean in group 2
##          19.735          26.100
```

The p-value of each test was essentially zero and the confidence interval of each test does not cross over zero.

Based on this result, it can be assumed that the average tooth length increases with an increasing dose, and therefore the null hypothesis can be rejected.

Conclusions and Assumptions

Based on the t-test analysis, it can be concluded that supplement type has no effect on tooth growth, and increasing the dose level leads to increased tooth growth.