The Effect of Vitamin C on Tooth Growth in Guinea Pigs

Lau Heng Kar

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Overview

Now in the second portion of the class, we're going to 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. (Only use the techniques from class, even if there's other approaches worth considering) 4. State your conclusions and the assumptions needed for your conclusions.

Loading and Exploring Data

```
require(datasets)
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 ...
```

```
head(ToothGrowth, 3)
```

```
##    len supp dose
## 1  4.2   VC  0.5
## 2 11.5   VC  0.5
## 3  7.3   VC  0.5
```

```
tail(ToothGrowth, 3)
```

```
##     len supp dose
## 58 27.3   OJ    2
## 59 29.4   OJ    2
## 60 23.0   OJ    2
```

Basic summary of the data

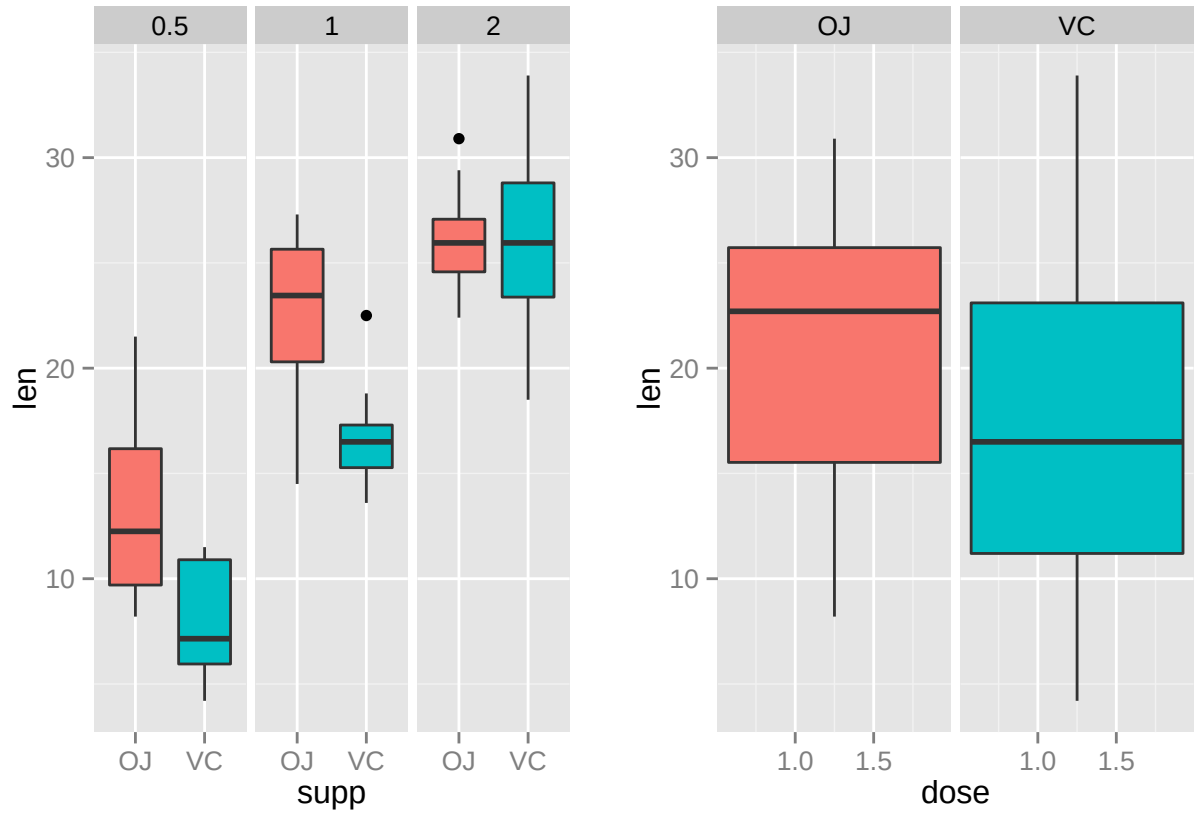
The response is the length of odontoblasts (teeth) in each of 10 guinea pigs at each of three dose levels of Vitamin C (0.5, 1, and 2 mg) with each of two delivery methods (orange juice or ascorbic acid).

```
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
```

```
table(ToothGrowth$dose, ToothGrowth$dose)
```

```
##
##       0.5  1  2
##   0.5  20  0  0
##   1     0 20  0
##   2     0  0 20
```



Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose

```
# data frame for both VC and OJ
groupVc <- ToothGrowth[ToothGrowth$supp=='VC',]
groupOJ <- ToothGrowth[ToothGrowth$supp=='OJ',]
```

Supp : VC, OJ

```
# t.test for both group
difference <- groupVc$len - groupOJ$len
t1 <- t.test(groupVc$len, groupOJ$len, paired = TRUE)
```

Conclusion: We obtained p-value (**0.0025498**) and 95% confident internal (**-5.9913414, -1.4086586**). p-value is smaller than 0.05, then we can conclude that the averages of two groups are not significantly similar. This confirms that we can **reject** the null hypothesis H0 of equality of the means.

Dose : 0.5 mg

```
# t.test for both group for dose == 0.5
difference <- groupVc[groupVc$dose == "0.5", ]$len - groupOJ[groupOJ$dose == "0.5", ]$len
t2 <- t.test(groupVc[groupVc$dose == "0.5", ]$len, groupOJ[groupOJ$dose == "0.5", ]$len, paired = TRUE)
```

Conclusion: We obtained p-value (**0.015472**) and 95% confident internal (**-9.2365417, -1.2634583**). p-value is smaller than 0.05, then we can conclude that the averages of two groups are not significantly similar. This confirms that we can **reject** the null hypothesis H0 of equality of the means.

Dose : 1.0 mg

```
# t.test for both group for dose == 1
difference <- groupVc[groupVc$dose == "1", ]$len - groupOJ[groupOJ$dose == "1", ]$len
t3 <- t.test(groupVc[groupVc$dose == "1", ]$len, groupOJ[groupOJ$dose == "1", ]$len, paired = TRUE)
```

Conclusion: We obtained p-value (**0.0082292**) and 95% confident internal (**-9.9080891, -1.9519109**). p-value is smaller than 0.05, then we can conclude that the averages of two groups are not significantly similar. This confirms that we can **reject** the null hypothesis H0 of equality of the means.

Dose : 2.0 mg

```
# t.test for both group for dose == 2
difference <- groupVc[groupVc$dose == "2", ]$len - groupOJ[groupOJ$dose == "2", ]$len
t4 <- t.test(groupVc[groupVc$dose == "2", ]$len, groupOJ[groupOJ$dose == "2", ]$len, paired = TRUE)
```

Conclusion: We obtained p-value (**0.9669567**) and 95% confident internal (**-4.1689765, 4.3289765**). p-value is greater than 0.05, then we can conclude that the averages of two groups are significantly similar. This confirms that we can **accept** the null hypothesis H0 of equality of the means.

Conclusions

With the values obtained it can be assumed that there is a significantly similar in the growth of the tooth while the dose is 2.0 mg.