Effect of Vitamin C on Tooth Growth in Guinea Pigs

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March 17, 2019

Overview

- We use 'ToothGrowth' dataset and perform exploratory analysis on it.
- Then we use confidence intervals and hypothesis tests to compare tooth growth.

Exploratory Analysis:

```
library(datasets)
library(ggplot2)
head(ToothGrowth)
```

```
##    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
```

```
tail(ToothGrowth)
```

```
##     len supp dose
## 55 24.8   OJ    2
## 56 30.9   OJ    2
## 57 26.4   OJ    2
## 58 27.3   OJ    2
## 59 29.4   OJ    2
## 60 23.0   OJ    2
```

```
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
```

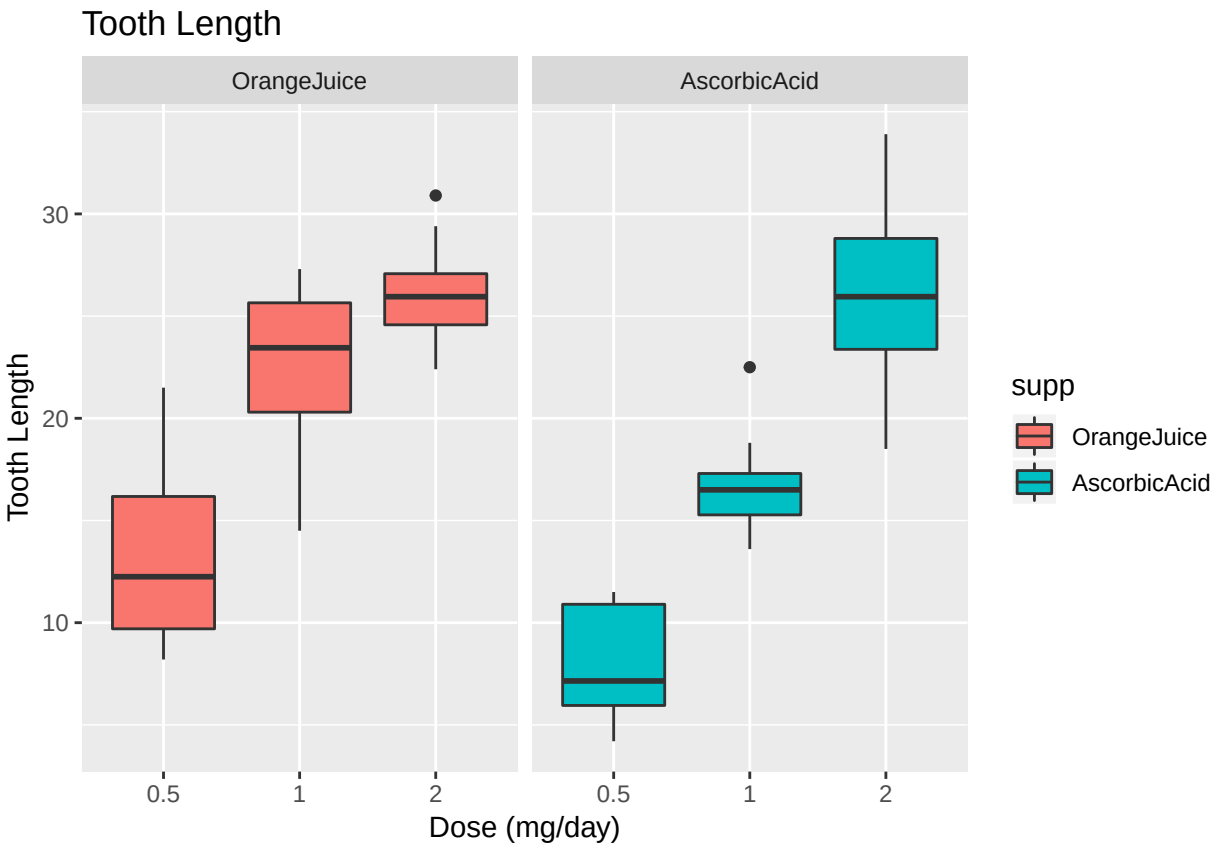
```
str(ToothGrowth)
```

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

Plotting boxplot of toothlength per dosages & supplement:

```
data <- ToothGrowth
levels(data$supp) <- c("OrangeJuice", "AscorbicAcid")
g <- ggplot(data, aes(x = factor(dose), y = len))
```

```
g <- g + facet_grid(.~supp)
g <- g + geom_boxplot(aes(fill = supp))
g <- g + labs(title = "Tooth Length")
g <- g + labs(x = "Dose (mg/day)", y = "Tooth Length")
print(g)
```



We observe Orange juice shows better results for 0.5 and 1 mg/day dosages however 2 mg/day results are quite similar

Assumptions

We assume from here, ToothGrowth data follows normal distribution.

Hypothesis Tests

- Testing three different hypothesis

1) For x = 0.5 mg/day

```
h0.5 <- t.test(len ~ supp, data = subset(data, dose == 0.5))
h0.5$conf.int
```

```
## [1] 1.719057 8.780943
## attr(,"conf.level")
## [1] 0.95
```

```
h0.5$p.value
```

```
## [1] 0.006358607
```

We reject null hypothesis as the p-value is smaller than significant level of 0.05. Therefore orange juice results in more tooth growth than absorbic acid.

2) For x = 1 mg/day

```
h1 <- t.test(len ~ supp, data = subset(data, dose == 1))
h1$conf.int
```

```
## [1] 2.802148 9.057852
## attr(,"conf.level")
## [1] 0.95
```

```
h1$p.value
```

```
## [1] 0.001038376
```

We again reject null hypothesis as the p-value is smaller than significant level of 0.05. Therefore orange juice results in more tooth growth than absorbic acid.

3) For x = 2 mg/day

```
h2 <- t.test(len ~ supp, data = subset(data, dose == 2))
h2$conf.int
```

```
## [1] -3.79807  3.63807
## attr(,"conf.level")
## [1] 0.95
```

```
h2$p.value
```

```
## [1] 0.9638516
```

Now, p-value is larger than the significance level of 0.05. therefore we cannot reject null hypothesis. Therefor orange juice and absorbic acid have same effect now.

Conclusions

We conducted three hypothesis tests. We inferred that Orange juice is better for tooth growth in guinea pigs in doses of 0.5 and 1 mg/day. however no difference between orange juice and absorbic acid for 2 mg/day dosage.