Tooth Growth and vitamin C in Guinea Pigs

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Synopsis

This report shows that tooth growth in guinea pigs is associated with both vitamin C dose and delivery method (orange juice vs. ascorbic acid).

ToothGrowth Analysis

Loading the dataset and checking its structure

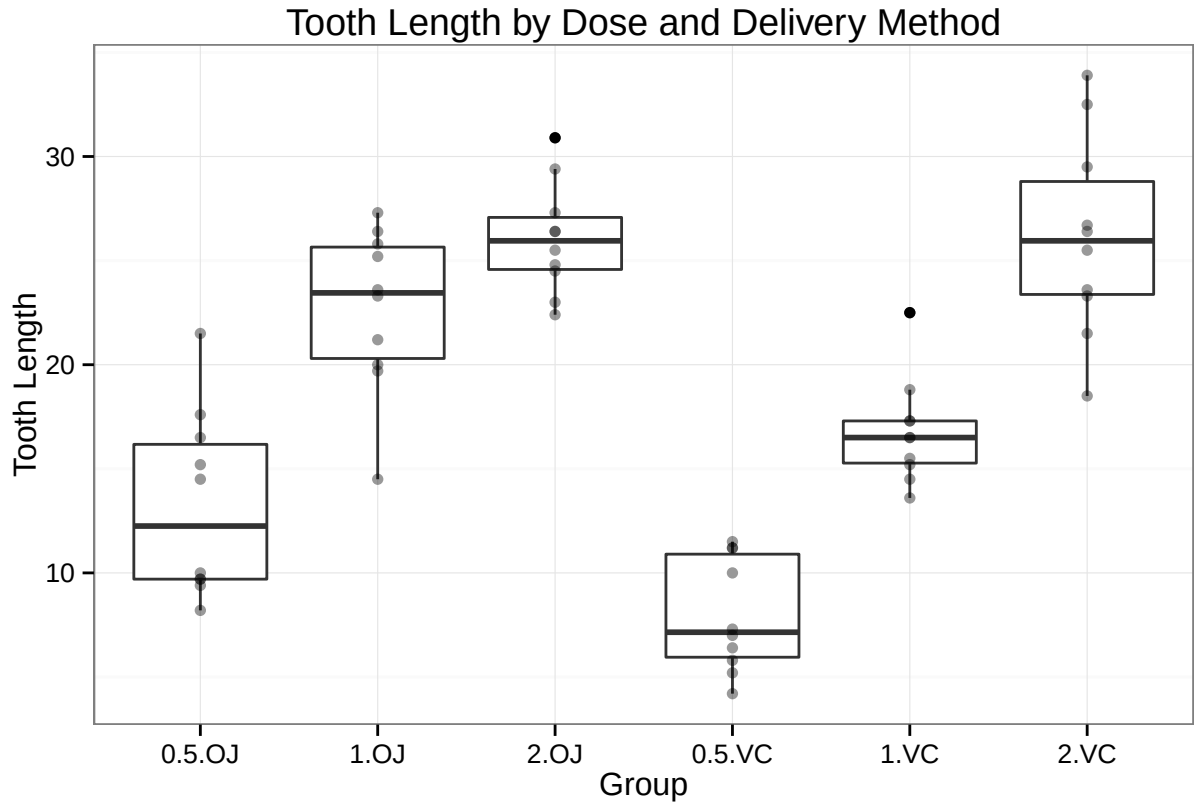
```
## 'data.frame':    60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

```
##       len        supp         dose
##  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
```

Summary of data

60 observations of 3 variables, no missing data

Design: 10 guinea pigs, 3 different doses (`dose`) of vitamin C
Delivery method: `supp` = orange juice or ascorbic acid
Response: `len` = length of teeth



Visually, tooth length appears to be associated with vitamin C dose and perhaps delivery method. Those hypotheses are tested below. I assume in both cases that the variances are unequal and that a paired test is appropriate because the same 10 guinea pigs are being tested.

```
## mean of the differences
##                     3.7
```

```
## [1] 1.408659 5.991341
## attr(,"conf.level")
## [1] 0.95
```

The above test shows that orange juice is associated with more tooth growth than ascorbic acid.

```
## mean of the differences
##                 -15.495
```

```
## [1] -18.3672 -12.6228
## attr(,"conf.level")
## [1] 0.95
```

I excluded the middle dose (1) to make the t-test work, but lower dose is associated with less tooth growth when the `0.5` and `2` groups are compared. Linear regression would be a better way to do this.

Appendix

R code - run above, not run here

Set random number seed and load packages

```
set.seed(1234)
library(ggplot2)
library(dplyr)
```

Load the toothgrowth data and generate some simple dataset summaries Loading the dataset and checking its structure

```
library(datasets)
data(ToothGrowth)
str(ToothGrowth)
summary(ToothGrowth)
```

Generate the necessary analysis variables and the exploratory tooth growth box plot

```
data <- ToothGrowth %>%
    mutate(Group = interaction(as.factor(dose), supp))
p <- ggplot(data, aes(Group, len)) + theme_bw()
p + geom_boxplot() + geom_point(alpha=0.4) + labs(title = "Tooth Length by Dose and Delivery Method", y
```

Perform the t-tests on the tooth growth data

```
t.test(len ~ supp, data = data, paired=TRUE, var.equal=FALSE)$estimate
t.test(len ~ supp, data = data, paired=TRUE, var.equal=FALSE)$conf
```

```
datasm1 <- data %>%
    filter(dose!=1)
t.test(len ~ dose, data = datasm1, paired=TRUE, var.equal=FALSE)$estimate
t.test(len ~ dose, data = datasm1, paired=TRUE, var.equal=FALSE)$conf
```