Ascorbic Acid vs Orange Juice Supplements as a Tooth Growth Supplement.

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Introduction

In this project I will analyse dataset from the Reference "C. I. Bliss (1952) The Statistics of Bioassay. Academic Press."

In this dataset 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).

In this dataset collected 60 observables with 3 variables:

- Tooth length
- Supplement type (VC or OJ)
- Dose in milligrams.

Numerics

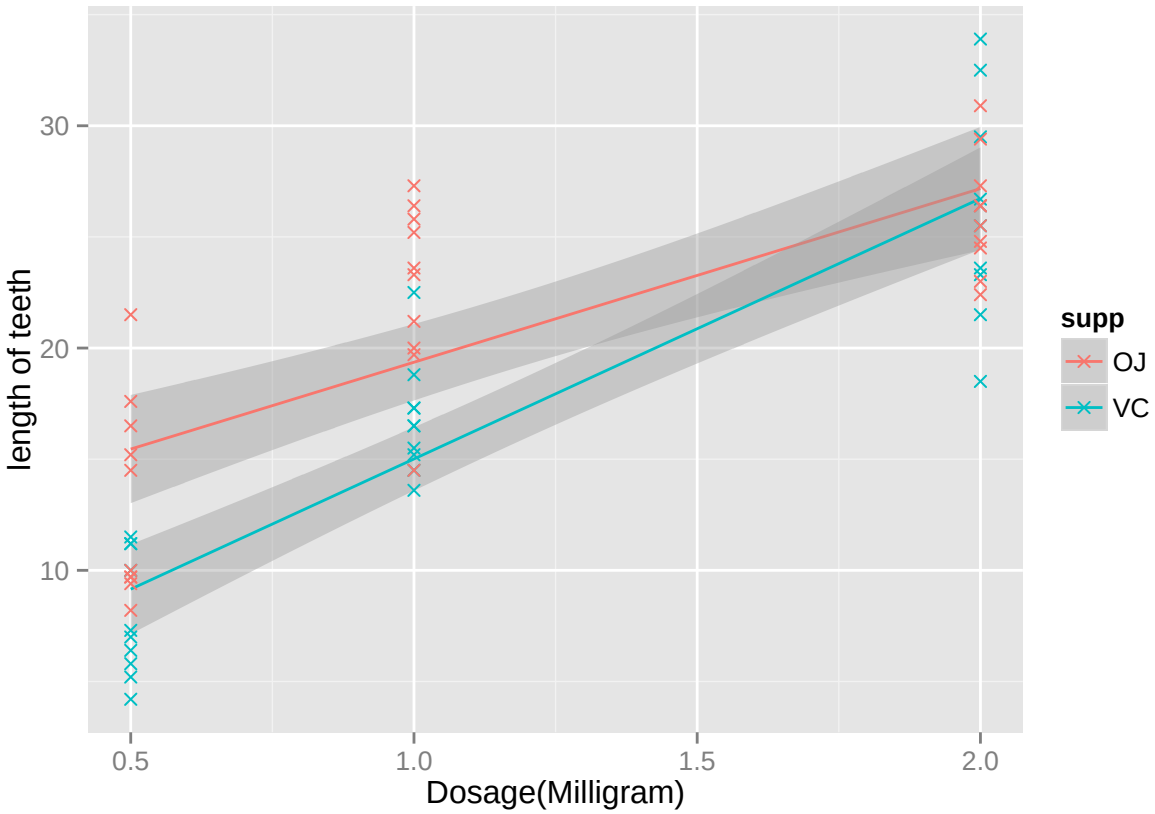
```
library(dplyr)
library(ggplot2)
```

```
data(ToothGrowth)

#Data for ascorbic acid supplement is separated from the data with orange juice supplement.
#New dataSets with corresponding names created: data.VC, data.OJ

data.VC <- select(filter(ToothGrowth, supp == "VC"), len, dose)
data.OJ <- select(filter(ToothGrowth, supp == "OJ"), len, dose)
```

Is dependence linear?

It looks natural to assume that more supplement pigs were consume, bigger length of the teeth. Dependence between these quantities can be assumed linear, that can be checked on the plot.

```
ggplot(ToothGrowth, aes(dose, len, color=supp)) + ylab("length of teeth") + xlab("Dosage(Milligram)") +
```



Plot shows that for both supplements we see linear dependence, and slope is pretty similar. Thus it we need to check if both hypothsis are statistically similar.

How similar effect of both tooth growth supplements?

First I will compare supplements in general.

```
"Mean for orange juice supplement:"
```

```
## [1] "Mean for orange juice supplement:"
```

```
mean(data.OJ$len)
```

```
## [1] 20.66333
```

```
"mean for ascorbic acid supplement:"
```

```
## [1] "mean for ascorbic acid supplement:"
```

```
mean(data.VC$len)
```

```
## [1] 16.96333
```

We can see that mean of the OJ tooth length is bigger than mean of the VC tooth length. Thus we need t-test to check how significant is this difference.

```r
t.test(data.OJ$len, data.VC$len, alternative="greater")
```

```
##
##  Welch Two Sample t-test
##
## data:  data.OJ$len and data.VC$len
## t = 1.9153, df = 55.309, p-value = 0.03032
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
##  0.4682687       Inf
## sample estimates:
## mean of x mean of y
##  20.66333  16.96333
```

Now I will compare how effective different supplements at different dosages.

```r
#dose = 0.5
t.test(data.OJ[data.OJ$dose == 0.5, ]$len, data.VC[data.VC$dose == 0.5, ]$len, alternative="greater")
```

```
##
##  Welch Two Sample t-test
##
## data:  data.OJ[data.OJ$dose == 0.5, ]$len and data.VC[data.VC$dose == 0.5, ]$len
## t = 3.1697, df = 14.969, p-value = 0.003179
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
##  2.34604     Inf
## sample estimates:
## mean of x mean of y
##     13.23      7.98
```

```r
#dose = 1
t.test(data.OJ[data.OJ$dose == 1, ]$len, data.VC[data.VC$dose == 1, ]$len, alternative="greater")
```

```
##
##  Welch Two Sample t-test
##
## data:  data.OJ[data.OJ$dose == 1, ]$len and data.VC[data.VC$dose == 1, ]$len
## t = 4.0328, df = 15.358, p-value = 0.0005192
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
##  3.356158      Inf
## sample estimates:
## mean of x mean of y
##     22.70     16.77
```

```r
#dose = 2
t.test(data.OJ[data.OJ$dose == 2, ]$len, data.VC[data.VC$dose == 2, ]$len, alternative="greater")
```

```
##
##  Welch Two Sample t-test
```

```
##
## data:  data.OJ[data.OJ$dose == 2, ]$len and data.VC[data.VC$dose == 2, ]$len
## t = -0.0461, df = 14.04, p-value = 0.5181
## alternative hypothesis: true difference in means is greater than 0
## 95 percent confidence interval:
##  -3.1335     Inf
## sample estimates:
## mean of x mean of y
##     26.06     26.14
```

Conclusion and assumptions.

- In general, P-value 0.03032 with 95% confidence tells us that overall orange juice is more efficient.
- For dosage 0.5, P-value 0.003179 with 95% confidence tells us that with dosage 0.5 milligram orange juice is more efficient.
- For dosage 1, P-value 0.0005192 with 95% confidence tells us that with dosage 1 milligram orange juice is more efficient.
- For dosage 2, P-value 0.5181 tells us that there is no statistical difference between supplements.