The Effect of Vitamin C on Tooth Growth in Guinea Pigs

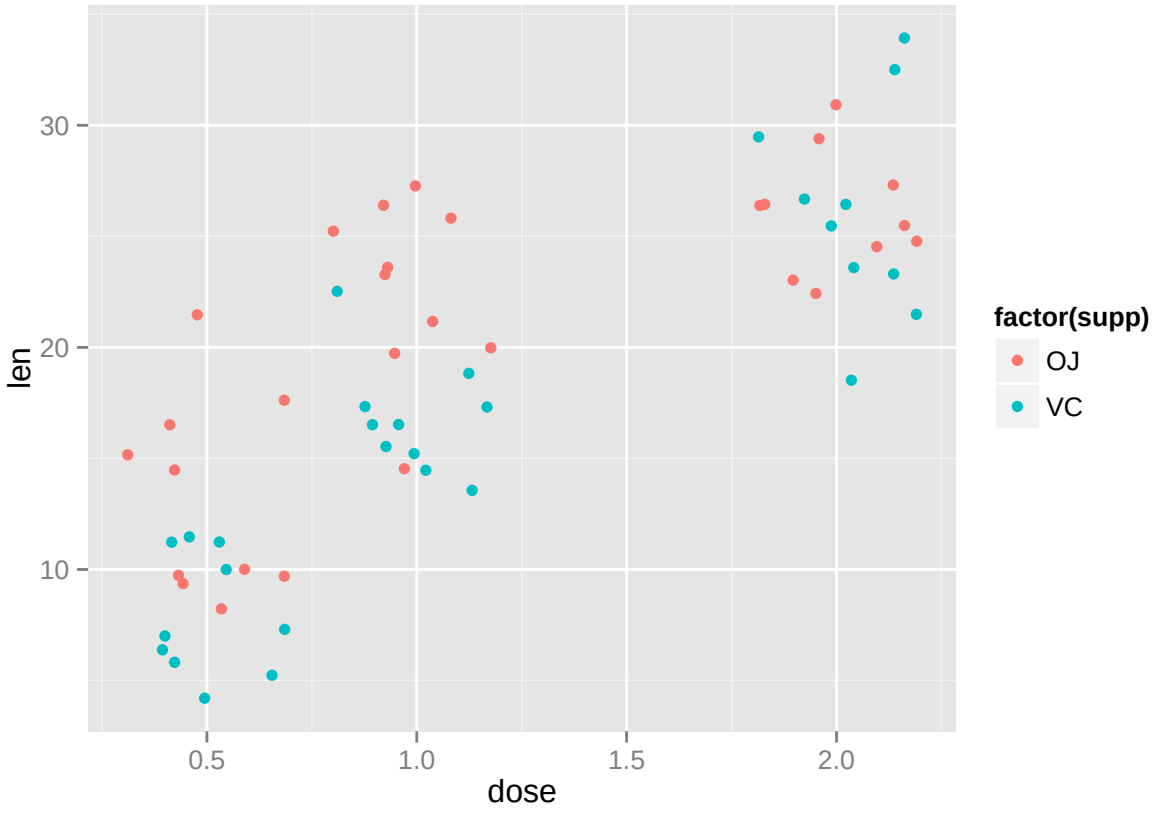
The response is the length of odontoblasts (teeth) in each of 10 guinea pigs at each of three dose levels of Vitamin C (0.5, 1, and 2 mg) with each of two delivery methods (orange juice or ascorbic acid).

A data frame with 60 observations on 3 variables.

[,1] len numeric Tooth length [,2] supp factor Supplement type (VC or OJ). [,3] dose numeric Dose in milligrams.

1. Load the ToothGrowth data and perform some basic exploratory data analyses

```
library(ggplot2)
data(ToothGrowth)
ggplot(ToothGrowth, aes(dose, len))+
geom_jitter(aes(colour = factor(supp)))
```



2. Provide a basic summary of the data.

```
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
```

```
summary(ToothGrowth)
```

```
##       len       supp         dose
##  Min.   : 4.2   OJ:30   Min.   :0.50
##  1st Qu.:13.1   VC:30   1st Qu.:0.50
##  Median :19.2           Median :1.00
##  Mean   :18.8           Mean   :1.17
##  3rd Qu.:25.3           3rd Qu.:2.00
##  Max.   :33.9           Max.   :2.00
```

```
summary(ToothGrowth$len)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     4.2    13.1    19.2    18.8    25.3    33.9
```

```
summary(ToothGrowth$dose)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    0.50    0.50    1.00    1.17    2.00    2.00
```

```
summary(ToothGrowth$supp)
```

```
## OJ VC
## 30 30
```

3. Use confidence intervals and hypothesis tests to compare tooth growth by supp and dose. (Use the techniques from class even if there's other approaches worth considering)

```
chisq.test(ToothGrowth$len,ToothGrowth$dose)
```

```
## Warning: Chi-squared approximation may be incorrect
```

```
##
##  Pearson's Chi-squared test
##
## data:  ToothGrowth$len and ToothGrowth$dose
## X-squared = 92.5, df = 84, p-value = 0.2464
```

The output includes an Chi-squared statistic (X-squared) , the relevant degrees of freedom and an associated p-value. Here we would accept the null hypothesis that there is no association between the tooth length and dose, as there is a p-value larger than 0.05.

```
chisq.test(ToothGrowth$len,ToothGrowth$supp)
```

```
## Warning: Chi-squared approximation may be incorrect
```

```
##
##  Pearson's Chi-squared test
##
## data:  ToothGrowth$len and ToothGrowth$supp
## X-squared = 39.67, df = 42, p-value = 0.5739
```

Here we would accept the null hypothesis that there is no association between the tooth length and supplement type, as there is a p-value much larger than 0.05.

4. State your conclusions and the assumptions needed for your conclusions.

P-value for association between the tooth length and supplement type is larger than between the tooth length and dose. My conclusion therefore is that dose affects tooth length more than supplement type. (For more accurate conclusion additional tests are required)