Tooth Growth Data Analysis
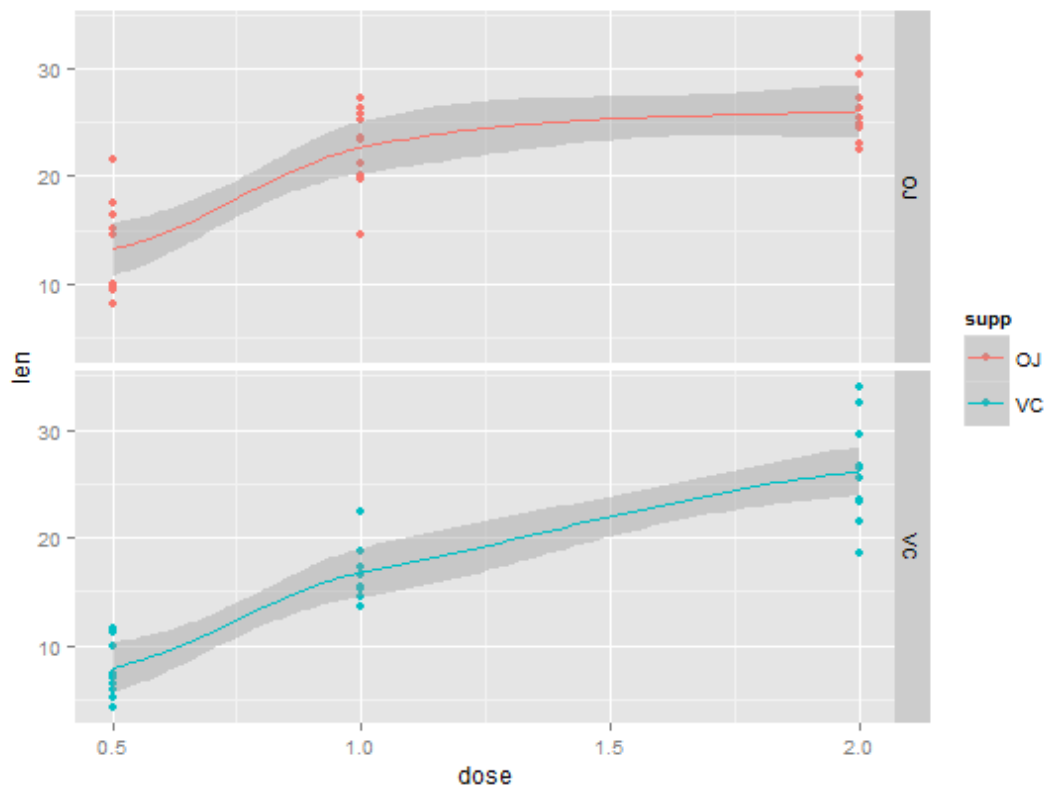
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This report presents the analysis performed on Tooth growth dataset. This data set shows the effect of Vitamin C on Tooth Growth in Guinea Pigs.

Analysis

1. Load data and perform a basic exploratory data analyses

```r
question1 <- function(){
    library(datasets)
    d<- ToothGrowth
    library(ggplot2)
    g <- qplot(dose,len,data=d, facets=supp~.,

        geom = c("point","smooth"),color=supp)
    g
}
```

Comment: On the basis of this graphic we can assert that the mean of teeth length increases with the Vitamine C dose. The graphics shows that each supplement (supp) has 3 groups by dose (0.5, 1 and 2):

2. A basic summary of data:

```
> 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
```

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

a) T-tests for mean (of the length) difference by supplement type :

```
> t.test(len~supp, data=ToothGrowth, paired=FALSE)
        Welch Two Sample t-test

data:  len by supp
t = 1.9153, df = 55.309, p-value = 0.06063
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.1710156  7.5710156
sample estimates:
mean in group OJ mean in group VC
        20.66333         16.96333
```

Comment: According to the T-test above, **p-value=0.06** is **greater** than **α =0.05** (α for confidence interval of 95%) that means that we **fail to reject the null hypothesis**. The confidence interval **[-0.17, 7.60]** contains the 0, there is no effect on changing the supplement type.

b) T-tests for mean (of the length) difference by dose

On the basis of data exploratory performed on the first question, we have 3 subsets per dose. We are going to compare, for each dose :

✓ Split dataset by dose :

```
> s <- split(ToothGrowth,ToothGrowth$dose)
> summary(s)
    Length Class      Mode
0.5 3      data.frame list
1   3      data.frame list
2   3      data.frame list
```

✓ Compare OJ and VC for the first subset : dose = 0.5

```
> d0.5 <- s$`0.5`
> t.test(len~supp, data=d0.5, paired=FALSE)
        Welch Two Sample t-test

data:  len by supp
t = 3.1697, df = 14.969, p-value = 0.006359
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 1.719057 8.780943
sample estimates:
mean in group OJ mean in group VC
          13.23            7.98
```

Comment: The p-value=0.006 **is less** than α=0.05 then we **reject the null hypothesis** for the Dose = 0.5.

✓ Compare OJ and VC for dose = 1

```
> d1 <- s$`1`
> t.test(len~supp, data=d1, paired=FALSE)
        Welch Two Sample t-test

data:  len by supp
t = 4.0328, df = 15.358, p-value = 0.001038
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 2.802148 9.057852
sample estimates:
mean in group OJ mean in group VC
          22.70           16.77
```

Comment: The p-value=0.001 **is less** than α=0.05 then we **reject the null hypothesis** for the Dose = 1.

✓ Compare OJ and VC for dose = 2

```
> d2 <- s$`2`
> t.test(len~supp, data=d2, paired=FALSE)
        Welch Two Sample t-test

data:  len by supp
t = -0.046136, df = 14.04, p-value = 0.9639
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -3.79807  3.63807
sample estimates:
mean in group OJ mean in group VC
          26.06           26.14
```

Comment: The p-value=0.96 **is greater** than α=0.05 then we **fail to reject the null hypothesis** for the Dose = 2.

4. General conclusion

Based on different T-tests above, we can say that:

1. There is a limit effect on teeth length when changing the supplement in the whole sample of Guinea pigs.
2. The tests show that there are effects when the dose of vitamine C is 0.5 or 1. It's not necessary to increase the Vitamine C dose to reach 2 because there no effect.