Tooth Growth Analysis

Justin Pizzino

7/7/2019

1. Summary

Using the r Tooth Growth data I will make a judgement as to which delivery method and dose resulted in the most growth. This was done through plotting the results, and reviewing the t.test for the different methods and dosages.

2. Load the data and provide a summary

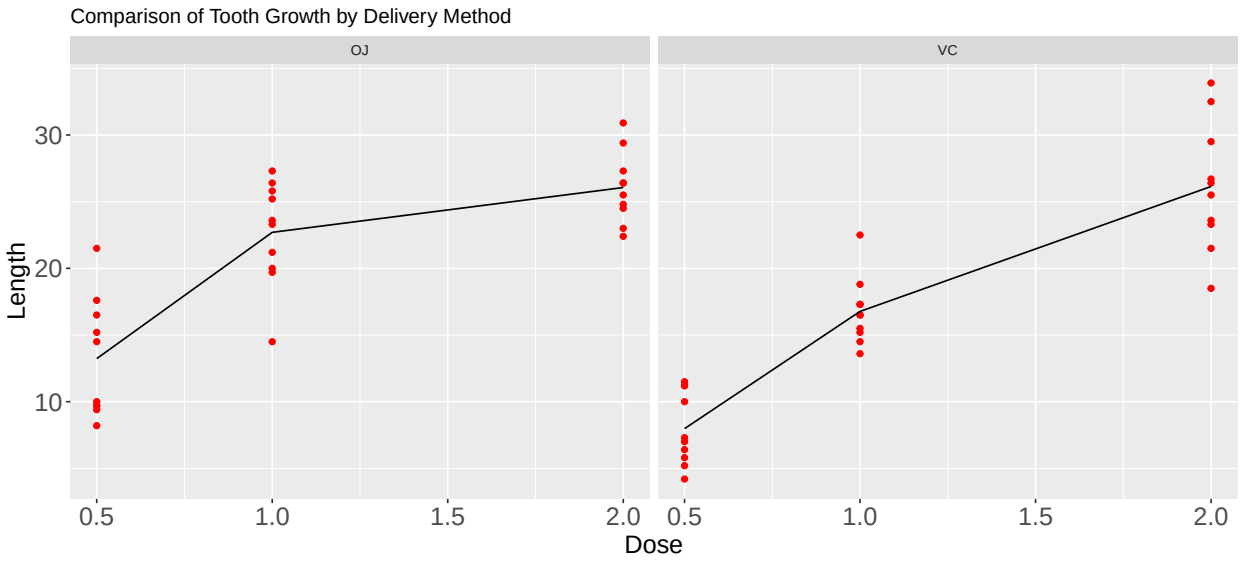
```
data(ToothGrowth)
summary(ToothGrowth)
```

```
##       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
```

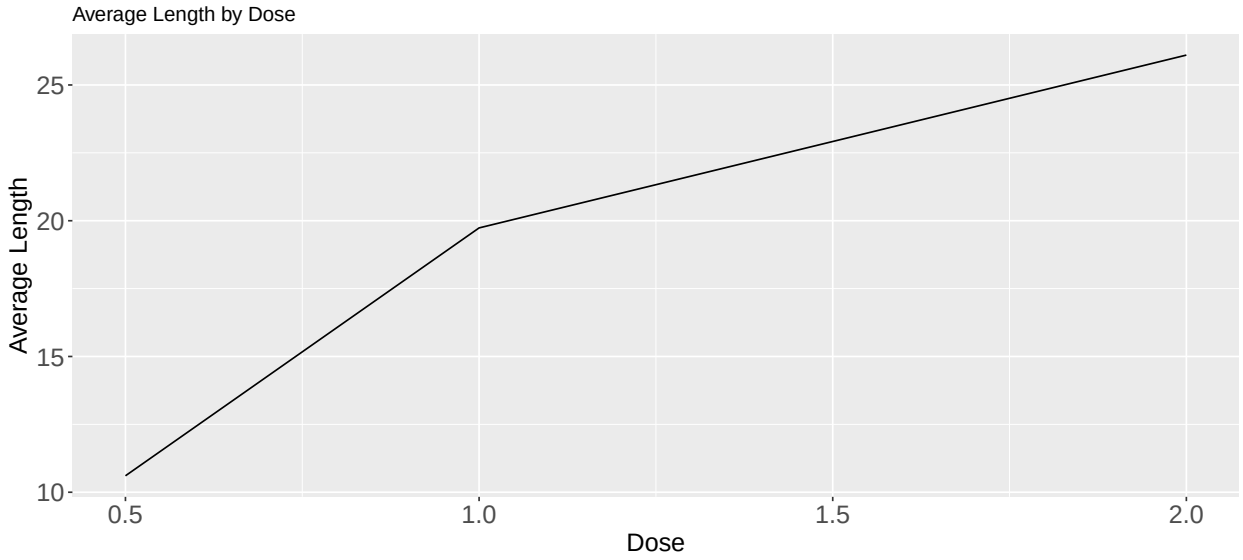
Let's review the two delivery methods, VC and OJ

Mean of Tooth Growth by VC: 16.9633333 and by OJ 20.6633333

By plotting the data we can see that tooth growth increases consistently using VC, but tapers off a bit after 1.0 dose with OJ.



Let's review the different dose types, 0.5, 1.0, 1.5, and 2.0



We can see here that a higher dosage seem to improve length, but starts to taper off at 1.0.

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

Using a 95% confidence level let's run some tests on the data.

Below we see that the mean of OJ is higher but the p-value is 0.06 which is higher than 0.05 resulting in not enough evidence to reject the null hypothesis.

```
t.test(subset(ToothGrowth,supp=="VC")[,"len"],
       subset(ToothGrowth,supp=="OJ")[,"len"],
       paried=FALSE, var.equal=FALSE)
```

```
##
##  Welch Two Sample t-test
##
## data:  subset(ToothGrowth, supp == "VC")[, "len"] and subset(ToothGrowth, supp == "OJ")[, "len"]
## 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:
##  -7.5710156  0.1710156
## sample estimates:
## mean of x mean of y
##  16.96333  20.66333
```

Now let's compare the different doses, starting with 0.5 to 1.0. Here you can see the mean is higher for 1.0 dose, and p-value is much lower, and the confidence interval doesn't include 0. Thus we can reject the null hypothesis

```
t.test(subset(ToothGrowth,dose==0.5)[,"len"],
       subset(ToothGrowth,dose==1.0)[,"len"],
       paried=FALSE, var.equal=FALSE)
```

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

```
##
## data:  subset(ToothGrowth, dose == 0.5)[, "len"] and subset(ToothGrowth, dose == 1)[, "len"]
## t = -6.4766, df = 37.986, p-value = 0.0000001268
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.983781  -6.276219
## sample estimates:
## mean of x mean of y
##    10.605    19.735
```

Compare 1.0 to 2.0

```
t.test(subset(ToothGrowth,dose==1.0)[,"len"],
       subset(ToothGrowth,dose==2.0)[,"len"],
       paried=FALSE, var.equal=FALSE)
```

```
##
##  Welch Two Sample t-test
##
## data:  subset(ToothGrowth, dose == 1)[, "len"] and subset(ToothGrowth, dose == 2)[, "len"]
## t = -4.9005, df = 37.101, p-value = 0.00001906
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -8.996481 -3.733519
## sample estimates:
## mean of x mean of y
##    19.735    26.100
```

Here we can see the mean for 2.0 is higher then 1.0, but the change is less so then from 0.5 to 1.0. Also the p value is lower, but still, we cannot reject the null hypothesis as the confidence interval does not contain 0, and we have a very low p-value.

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

Do delivery method and/or dosage affect tooth growth in guinea pigs? Using the data provided and assuming there are no other factors in the different methods of supplement deliver and dosage I conclude that:

1) OJ delivery method may provide better results at 0.5 and 1.0 dosage, but there is not enough data to support that holistically, further more at a dosage of 2.0 the difference is no longer there.
2) Tooth growth increases at a dosage of 1.0 over 0.5. Tooth growth continues to increase at a dosage of 2.0, but tappers off.

5. Appendix

Code for plot 1

```
g<-ggplot(ToothGrowth, aes(dose, len))
g<-g+facet_grid(.~ supp)+geom_point(color="pink")
g<-g+stat_summary(fun.y=mean, geom="line")
g<-g+labs(title="Comparison of Tooth Growth by Delivery Method", x="Dose", y="Length")
g
```

Code for plot 2

```
tgSum<-summarise(group_by(ToothGrowth,dose), Avg_Len=mean(len))
g2<-ggplot(tgSum, aes(x=dose, y=Avg_Len))+geom_line()
g2<-g2+labs(title="Average Length by Dose", x="Dose", y="Average Length")
g2
```