Effect of Vitamin C on Guinea Pig Tooth Growth

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Overview

The ToothGrowth data set will be analyzed to determine if supplemental doses of vitamin c influences tooth growth in guinea pigs.

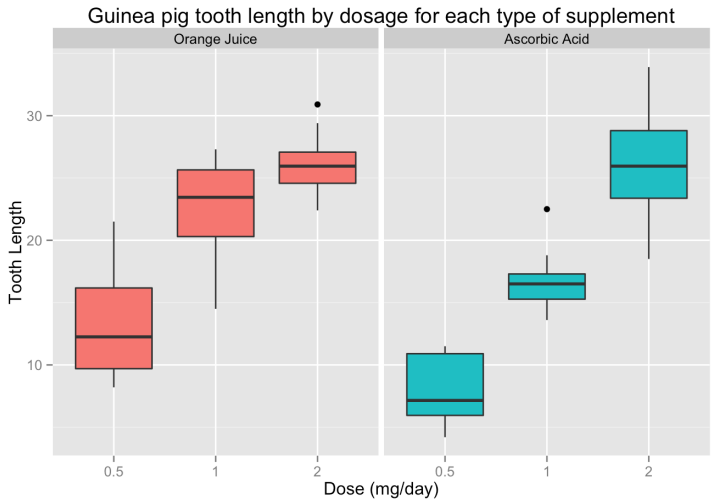
Load the ToothGrowth data and Explore Data

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

library(ggplot2)t = ToothGrowthlevels(t$supp) <-
c("Orange Juice", "Ascorbic Acid") ggplot(t,
aes(x=factor(dose), y=len)) +

facet_grid(.~supp) +geom_boxplot(aes(fill = supp),
show_guide = FALSE) +labs(title="Guinea pig tooth
length by dosage for each type of supplement",

x="Dose (mg/day)", y="Tooth Length")
```



Basic summary of the data

The box plots seem to show that for both supplements, as dose increase so does tooth length. Orange juice appears to be more effective than ascorbic acid for tooth growth when the dosage is .5 to 1.0 milligrams per day but the two supplements are fairly equal at 2 milligrams per day suggesting a potential ceiling effect.

Confidence Intervals and Hypothesis Testing

H_o1:

There is no difference between the amount of tooth growth caused by vitamin c and ascorbic acid.

H_a1:

There is a difference between the amount of tooth growth caused by vitamin c and ascorbic acid.

```
hypoth1<-t.test(len ~ supp, data = t)
hypoth1$conf.int

##[1]-0.1710156 7.5710156 ## attr(,"conf.level")##
[1] 0.95
```

```
hypoth1$p.value ## [1] 0.06063451
```

Since the confidence interval includes 0 and p > .05, we fail to reject the null hypothesis.

H_o2:

There is no difference between the amount of tooth growth caused by vitamin c and ascorbic acid at .5mg/day.

H_a2:

There is a difference between the amount of tooth growth caused by vitamin c and ascorbic acid at .5mg/day.

```
hypoth2<-t.test(len ~ supp, data = subset(t, dose
== 0.5)) hypoth2$conf.int

## [1] 1.719057 8.780943 ## attr(,"conf.level") ##
[1] 0.95

hypoth2$p.value ## [1] 0.006358607
```

Since the confidence interval excludes 0 and p = .006, we reject the null and in turn accept the alternative.

H_o3:

There is no difference between the amount of tooth growth caused by vitamin c and ascorbic acid at 1mg/day.

H_a3:

There is a difference between the amount of tooth growth caused by vitamin c and ascorbic acid at 1mg/day.

```
hypoth3<-t.test(len ~ supp, data = subset(t, dose
== 1)) hypoth3$conf.int

## [1] 2.802148 9.057852 ## attr(,"conf.level") ##
[1] 0.95
```

```
hypoth3$p.value ## [1] 0.001038376
```

Since the confidence interval excludes 0 and p = .001, we reject the null and in turn accept the alternative.

H_o4:

There is no difference between the amount of tooth growth caused by vitamin c and ascorbic acid at 2mg/day.

H_a4:

There is a difference between the amount of tooth growth caused by vitamin c and ascorbic acid at 2mg/day.

```
hypoth4<-t.test(len ~ supp, data = subset(t, dose
== 2)) hypoth4$conf.int

##[1]-3.79807 3.63807 ## attr(,"conf.level") ##
[1] 0.95

hypoth4$p.value ## [1] 0.9638516
```

Since the confidence interval includes 0 and p > .05, we fail to reject the null hypothesis.

Conclusions

Vitamin c supplement appears to have a larger impact on tooth growth than ascorbic acid when the dosage of both supplements are below 2mg/day. When a dose of 2mg/day is reached there seems to be a ceiling effect of the supplements on their influence of tooth growth. In order to determine is this hypothesis is true more dosages would need to be analyzed.

Assumptions are met:

Normal distribution of tooth lengths.

No other unmeasured factors are affecting tooth length.