# The Effect of Vitamin C on Tooth Growth in Guinea Pigs

Aim

The purpose of this data analysis is to analyse the Tooth growth data set by comparing the guinea tooth growth by supplement and dose. First exploratory data analysis on the data set is done and then comparison with the confidence intervals were carried out.

Load the Tooth growth data and exploratory data analysis carried out

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

```
library(ggplot2)
t = ToothGrowth
levels(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")
```
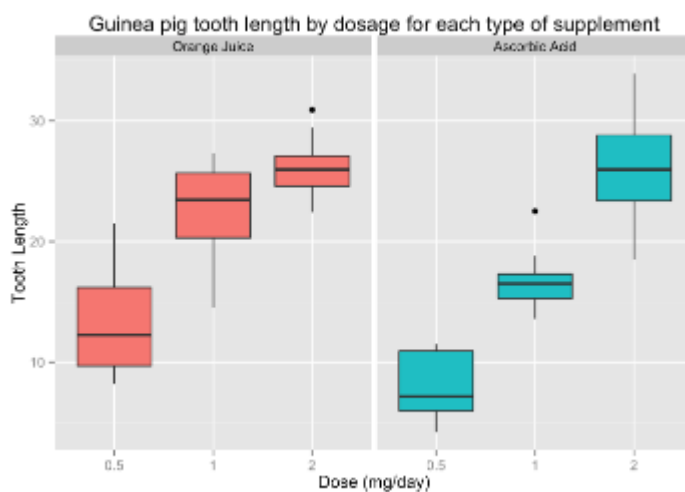
Basic summary of the data

The plot seems to show with the increase in the dosage the tooth growth increases.

Using confidence intervals and hypothesis tests to compare tooth growth by supplement and dose

Hypothesis #1

Orange juice and ascorbic acid are equally effective for the tooth growth

```
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
```

The confidence intervals includes 0 and the p-value is greater than the threshold of 0.05.The null hypothesis cannot be rejected.

Hypothesis #2

For the dosage of 0.5 mg/day the two supplements deliver the same tooth growth.

```
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
```

The confidence interval does not include 0 and p-value is below 0.05 threshold null hypothesis can be rejected. The alternative hypothesis that 0.5mg/day dosage of orange juice promotes more tooth growth than ascorbic acid is accepted.

Hypothesis #3

For the dosage of 1 mg/day, the two supplements deliver the same tooth growth

```
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
```

The confidence intervals do not include, and the p-value is smaller than threshold. The null hypothesis can be rejected. The alternative hypothesis that 1mg/day dosage of orange juice delivers more tooth growth than ascorbic acid is accepted

Hypothesis#4

For the dosage of 2mg/day two supplements have equal effect on tooth growth

```
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
```

The confidence interval does include 0 and the p-value is larger than threshold. The null hypothesis cannot be rejected.

Conclusions and assumptions

Orange juice delivers more tooth growth than ascorbic acid for dosages .Orange juice and ascorbic acid deliver the same amount of tooth growth for dose amount 2.0 mg/day. For the entire data set we cannot conclude orange juice is more effective than ascorbic acid

Assumptions

- Normal distribution of tooth lengths
- No other unmeasured factors are affecting tooth length