ToothGrowth Statistical Inference P2

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Overview

This project analyzes the ToothGrowth data set by comparing the guinea tooth growth by supplement and dose. Contains 1. Data analysis; and 2. Comparison with confidence intervals to make conclusions about the tooth growth.

Load the ToothGrowth data and perform exploratory data analyses

```r
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")

## Warning: `show_guide` has been deprecated. Please use `show.legend`
## instead.
```

Guinea pig tooth length by dosage for each type of sup
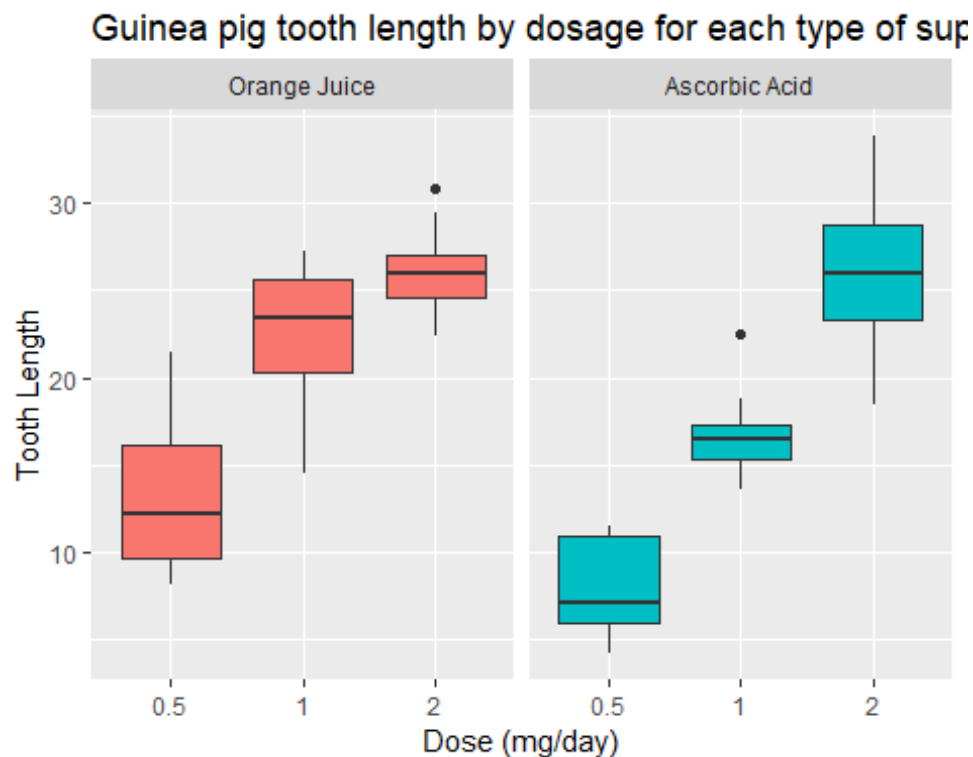
Basic summary of the data

The box plot shows that dosage and tooth length are directly proportional. Orange juice is more effective than ascorbic acid for tooth growth when the dosage is .5 to 1.0 milligrams per day. Both types of supplements are equally as effective when the dosage is 2.0 milligrams per day.

Confidence Intervals & Hypothesis Tests

Hypothesis #1

Orange juice & ascorbic acid deliver the same 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. Accept the null hypothesis.

Hypothesis #2

For the dosage of 0.5 mg/day, the two supplements deliver the similar 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 the p-value is below the 0.05 threshold. Reject Null hypothesis.

Hypothesis #3

For the dosage of 1 mg/day, the two supplements deliver the similar 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 interval does not include 0 and the p-value is smaller than the 0.05 threshold. The null hypothesis can be rejected. The alternative hypothesis that 1 mg/day dosage of orange juice delivers more tooth growth than ascorbic acid is accepted.

Hypothesis #4

For the dosage of 2 mg/day, the two supplements deliver the similar 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 the 0.05 threshold. The null hypothesis cannot be rejected.

Conclusions & Discussion

Orange juice delivers more tooth growth than ascorbic acid for lower dosages. Orange juice and ascorbic acid deliver the ssimilar growth for higher dose. We cannot conclude orange juice is more effective that ascorbic acid. Recommending to perform other statistical methods for verifications

Assumptions

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