

The Effect of Vitamin C on Tooth Growth in Guinea Pigs

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Overview

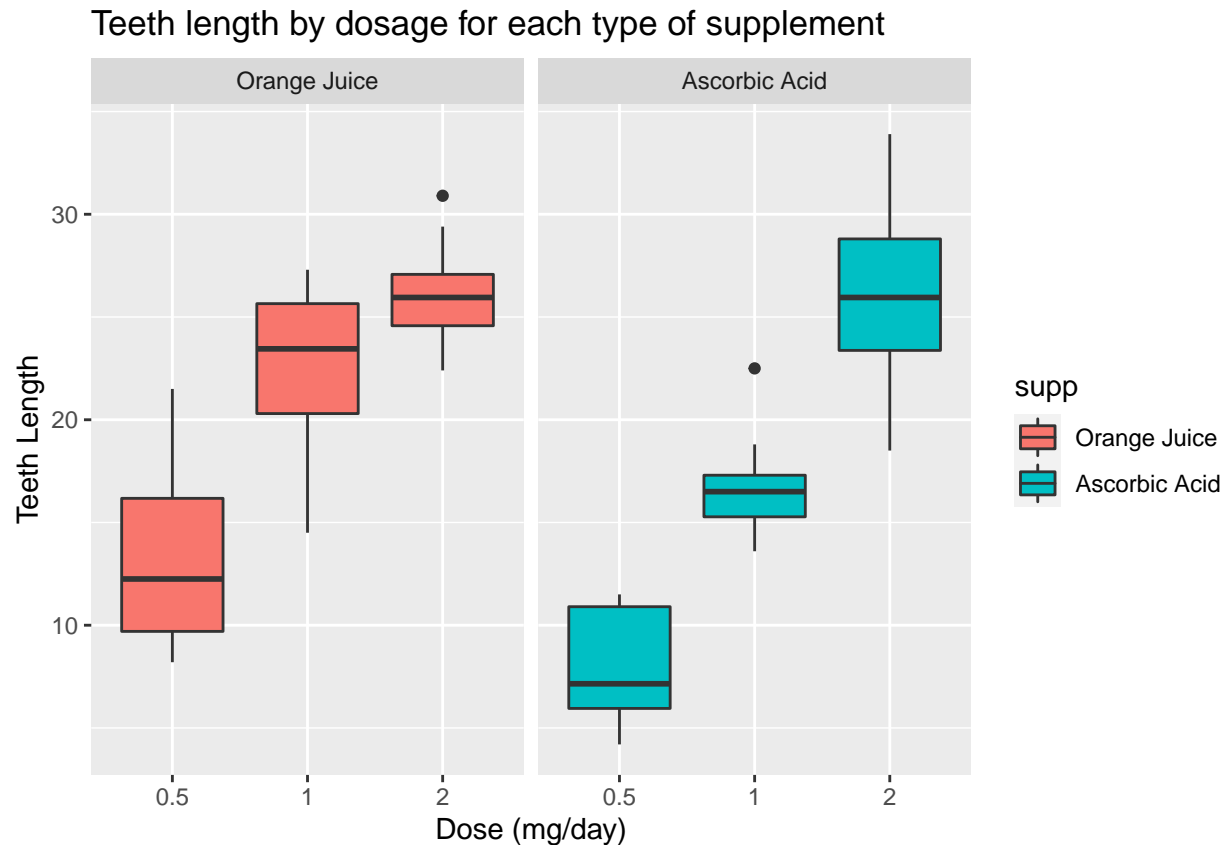
The purpose of the this data analysis is to analyze the ToothGrowth data set by comparing the guinea tooth growth by supplement and dose. First,exploratory data analysis is performed on the data set & then comparison with confidence intervals in order to make conclusions about the tooth growth.

Load the ToothGrowth dataset

```
library(datasets)
data("ToothGrowth")
```

Exploratory Analysis

```
library(ggplot2)
tg = ToothGrowth
levels(tg$supp) <- c("Orange Juice","Ascorbic Acid")
ggplot(tg,aes(x=factor(dose),y=len)) + facet_grid(.~supp)+geom_boxplot(aes(fill=supp)) + labs(title="Te
  x="Dose (mg/day)",
  y="Teeth Length")
```



Basic summary

It can be observed from the plot that increasing the dosage leads to increase in tooth growth. When the dosage is between 0.5 mg to 1 mg per day, Orange juice seems to be more effective than Ascorbic Acid. However, when the dosage is 2mg per day, both supplements are equally effective.

Hypothesis Tests

Hypothesis #1 Both supplement types deliver same results across the data set.

```
hyp1 <- t.test(len~supp, data=tg)
hyp1$conf.int
```

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

```
hyp1$p.value
```

```
## [1] 0.06063451
```

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

Hypothesis #2 Both supplement types deliver same results when the dosage is 0.5 mg/day

```
hyp2 <- t.test(len~supp, data = subset(tg, dose==0.5))
hyp2$conf.int
```

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

```
hyp2$p.value
```

```
## [1] 0.006358607
```

The confidence interval does not 0 and the p-value is less than the threshold of 0.05. Therefore, the null hypothesis can be rejected. The alternative hypothesis that 0.5 mg/day dosage of orange juice delivers more growth than ascorbic acid is accepted.

Hypothesis #3 Both supplement types deliver same results when the dosage is 1 mg/day

```
hyp3 <- t.test(len~supp, data = subset(tg, dose==1))
hyp3$conf.int
```

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

```
hyp3$p.value
```

```
## [1] 0.001038376
```

The confidence interval does not 0 and the p-value is less than the threshold of 0.05. Therefore, the null hypothesis can be rejected. The alternative hypothesis that 1 mg/day dosage of orange juice delivers more growth than ascorbic acid is accepted.

Hypothesis #4 Both supplement types deliver same results when the dosage is 2mg/day

```
hyp4 <- t.test(len~supp, data = subset(tg, dose==2))
hyp4$conf.int
```

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

```
hyp4$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 and assumptions For dosage of 2mg/day, both orange juice and ascorbic acid deliver the same amount of tooth growth. However, orange juice delivers better results when the dosage is 0.5 mg/day or 1 mg/day.

Assumptions: * Normality : observations come from a normal/nearly normal distribution. * No other factors are affecting tooth length. * Independence : sampling/assignment is random.