

The Effect of Vitamin C on Tooth Growth in Guinea Pigs

Overview

The purpose of this data analysis is to analyze the ToothGrowth data set by comparing the guinea

tooth growth by supplement and dose. First, I will do exploratory data analysis on the data set. Then I will

do the comparison with confidence intervals in order to make conclusions about the tooth growth.

Load the ToothGrowth data and perform exploratory data

analyses

```
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 box plots seem to show, increasing the dosage increases the tooth growth. 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.

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

Hypothesis #1

Orange juice & ascorbic acid deliver the same tooth growth across the data set.

```
hypothesis<-t.test(len ~ supp, data = t)
hypothesis$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 the p-value is below the 0.05 threshold. The null hypothesis can be rejected. The alternative hypothesis that 0.5 mg/day dosage of orange juice delivers

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 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 same 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 the 0.05 threshold. The null

hypothesis cannot be rejected.

Conclusions & assumptions

Orange juice delivers more tooth growth than ascorbic acid for dosages 0.5 & 1.0. 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 the tooth lengths

No other unmeasured factors are affecting tooth length