Study of Effects of Vitamin C Delivery Methods on Tooth Growth in Guinea Pigs

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Overview

The purpose of this report is to analyze the ToothGrowth data from the R datasets package and state any conclusions which can be drawn.

In this case, an analysis was done specifically to determine the better delivery option for vitamin C to stimulate growth of teeth in guinea pigs: orange juice or ascorbic acid.

Data Summary

```
library(ggplot2)
head(ToothGrowth)
```

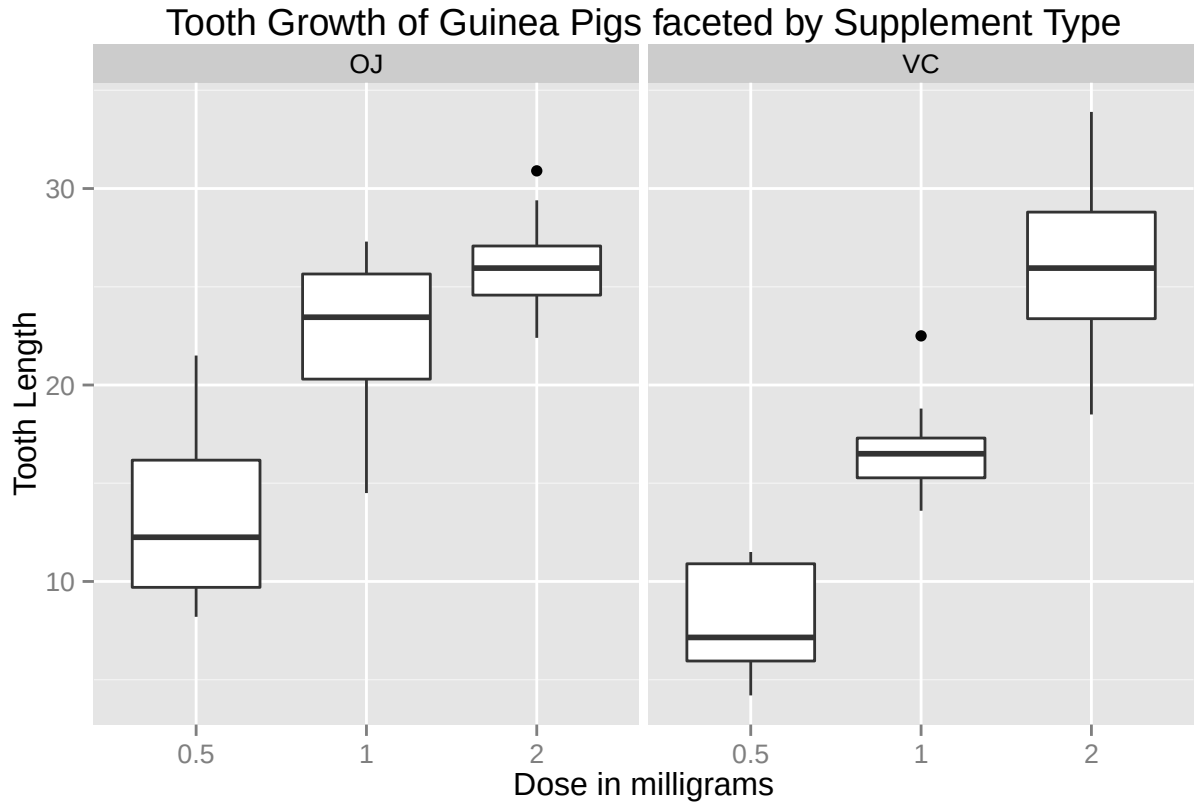
```
##    len supp dose
## 1  4.2   VC  0.5
## 2 11.5   VC  0.5
## 3  7.3   VC  0.5
## 4  5.8   VC  0.5
## 5  6.4   VC  0.5
## 6 10.0   VC  0.5
```

```
summary(ToothGrowth)
```

```
##       len        supp         dose
##  Min.   : 4.20   OJ:30   Min.   :0.500
##  1st Qu.:13.07   VC:30   1st Qu.:0.500
##  Median :19.25           Median :1.000
##  Mean   :18.81           Mean   :1.167
##  3rd Qu.:25.27           3rd Qu.:2.000
##  Max.   :33.90           Max.   :2.000
```

Comparison of tooth growth

```
data_plot <- ggplot(ToothGrowth, aes(factor(dose),len))
data_plot <- data_plot + geom_boxplot() + facet_grid(. ~ supp) + labs(title="Tooth Growth of Guinea Pigs
data_plot
```




```
t.test(len ~ supp, data=ToothGrowth)
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = 1.9153, df = 55.309, p-value = 0.06063
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.1710156  7.5710156
## sample estimates:
## mean in group OJ mean in group VC
##         20.66333         16.96333
```

```
t.test(len ~ supp, data=ToothGrowth[ToothGrowth$dose == 0.5, 1:2])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = 3.1697, df = 14.969, p-value = 0.006359
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  1.719057 8.780943
```

```
## sample estimates:
## mean in group OJ mean in group VC
##            13.23             7.98
```

```
t.test(len ~ supp, data=ToothGrowth[ToothGrowth$dose == 1, 1:2])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = 4.0328, df = 15.358, p-value = 0.001038
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  2.802148 9.057852
## sample estimates:
## mean in group OJ mean in group VC
##            22.70            16.77
```

```
t.test(len ~ supp, data=ToothGrowth[ToothGrowth$dose == 2, 1:2])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = -0.0461, df = 14.04, p-value = 0.9639
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -3.79807  3.63807
## sample estimates:
## mean in group OJ mean in group VC
##            26.06            26.14
```

T-testing is done, first on the overall data set and then on each dosage level. From the low p-values in dosages 0.5 and 1, it can be concluded that OJ is a much better delivery agent of Vitamin C than Ascorbic Acid.

Conclusions

As shown above, the tooth growth for 0.5 and 1 mg dosages of OJ is much higher than the comparable amount for Ascorbic Acid. For a 2 mg dosage, there is no appreciable difference between the delivery methods.

Assumptions for conclusion

It is assumed that the data points collected are independent random observations and that the changes in tooth growth are connected solely to the delivery mechanism of Vitamin C and the dosage amount rather than to an additional, unmeasured factor.