

Report 2

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Statistical Inference on supplements in tooth growth

```
library(knitr)

## Warning: package 'knitr' was built under R version 3.1.3

library(ggplot2)

## Warning: package 'ggplot2' was built under R version 3.1.3

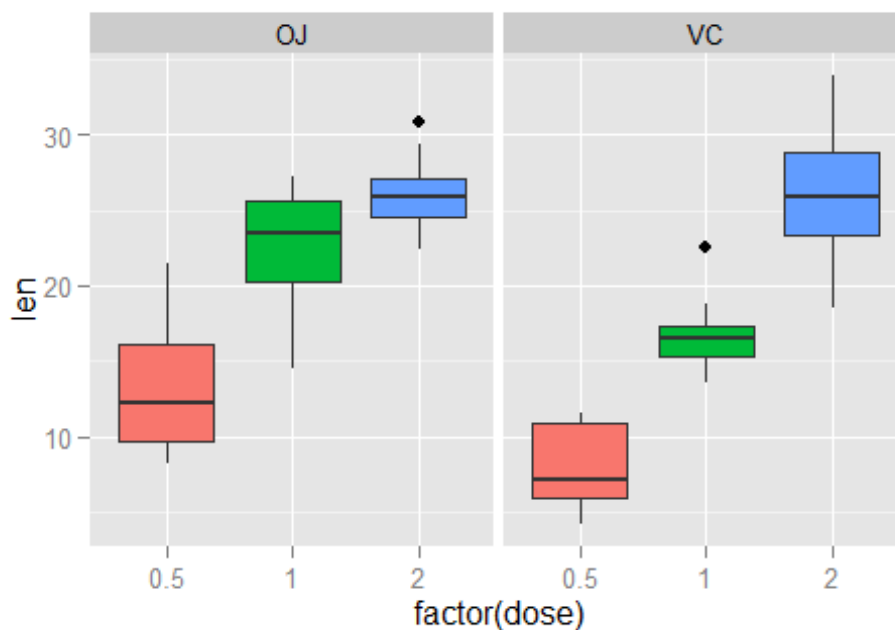
opts_chunk$set(eval = TRUE)
opts_chunk$set(echo = TRUE)
opts_chunk$set(fig.height = 3.5)
```

Introduction

This report is to study the response of the length of teeth in each of 10 guinea pigs at each of three dose levels of Vitamin C (0.5, 1, and 2 mg) with two different delivery methods (by orange juice or ascorbic acid).

Data snippets

```
par(mfrow = c(1,2))
p1 <- ggplot(ToothGrowth, aes(x = factor(dose), y = len, fill =
factor(dose)))
p1 + geom_boxplot() + guides(fill=FALSE) + facet_grid(. ~ supp)
```



By plotting the data as boxplots a number of correlations were observed. The finding is the length of the tooth increases as the dosage increases. The orange juice delivery method yields a greater length than the VC (approximately 10mm) for smaller dosages but the difference is negligible by a 2mg dosage.

Statistical inference

The tooth growth was compared by supplement for each dosage under the null hypothesis that each supplement has the same effect at a certain dosage on the tooth.

$$H_0: \mu_{OJ|0.5} = \mu_{VC|0.5} \quad H_0: \mu_{OJ|1.0} = \mu_{VC|1.0} \quad H_0: \mu_{OJ|2.0} = \mu_{VC|2.0}$$

```
# split the data up by dosages provided
```

```
d0.5 <- subset(ToothGrowth, dose == 0.5)
```

```
d1.0 <- subset(ToothGrowth, dose == 1.0)
```

```
d2.0 <- subset(ToothGrowth, dose == 2.0)
```

```
# conduct a t-test between supplements
```

```
test0.5 <- t.test(len ~ supp, paired = FALSE, var.equal = FALSE, data = d0.5)
```

```
test0.5$p.value; test0.5$conf[1]
```

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

```
## [1] 1.719057
```

```
test1.0 <- t.test(len ~ supp, paired = FALSE, var.equal = FALSE, data = d1.0)
```

```
test1.0$p.value; test1.0$conf[1]
```

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

```
## [1] 2.802148
```

Dosages 1.0 and 1.5 have significant p-values of 0.006359 and 0.001038 respectively indicating that the difference in mean values between the supplements is significant. It is also noted that Dosage 1.0 has a confidence interval of 1.719-8.781 Dosage 2.0 has a confidence interval of 2.802-9.058.

```
test2.0 <- t.test(len ~ supp, paired = FALSE, var.equal = FALSE, data = d2.0)
test2.0$p.value; test2.0$conf[1]

## [1] 0.9638516
## [1] -3.79807
```

Dosage 3.0 has a very high p-value of 0.9639 and a confidence interval below zero -3.798-3.638. This indicates that there is no significance between the supplements at this dosage. This is also shown from the earlier boxplot.

Conclusions

The conclusions made was the supplements orange juice and ascorbic acid have different effects on tooth length for lower dosages especially on dosage 0.5mg and 1.0mg where the orange juice resulted a longer tooth. The results for 3.0mg shows there is not much difference in tooth length.

The Postulation

Guinea pigs are essentially identical - size, diet, breed, and etc. Samples are unpaired, with unequal variances.