

Statistical Inference Analysis of ToothGrowth

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Overview

Report basic inference analysis for ToothGrowth dataset.

Load data

```
library(datasets)
library(dplyr)
library(ggplot2)
library(reshape2)

data("ToothGrowth")
```

```
str(ToothGrowth)
```

```
## 'data.frame':    60 obs. of  3 variables:
## $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
## $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
## $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

Basic analysis

The dataset contains observations of the effect of Vitamin C on tooth growth in Guinea Pigs. It contains 60 observations on 3 variables:

- len - numeric tooth length
- supp - a factor column for Supplement type (VC or OJ)
- dose - numeric dose in milligrams

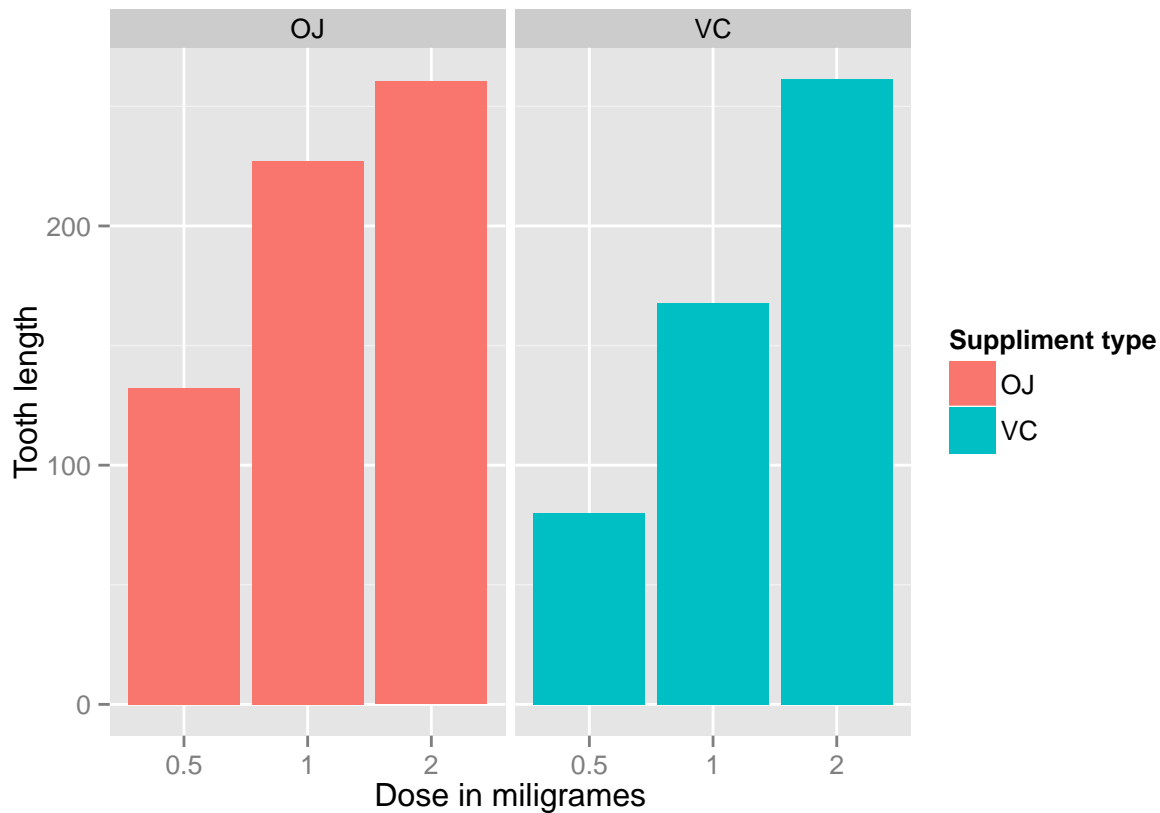
The response is the length of odontoblasts (teeth) in each of 10 guinea pigs at each of three dose levels of Vitamin C (0.5, 1, and 2 mg) with each of two delivery methods (orange juice or ascorbic acid).

```
table(ToothGrowth$dose, ToothGrowth$supp)
```

```
##
##      OJ VC
## 0.5 10 10
## 1   10 10
## 2   10 10
```

As we can see there are 10 tests for each pair

```
ggplot(data = ToothGrowth, aes(x = as.factor(dose), y = len, fill = supp)) +  
  geom_bar(stat = "identity") +  
  facet_grid(. ~ supp) +  
  xlab("Dose in miligrames") +  
  ylab("Tooth length") +  
  guides(fill = guide_legend(title = "Suppliment type"))
```



From the graph we can conclude that there is a correlation between tooth growth size and dose levels of Vitamin C, for both delivery methods.

Inference Analysis

Comparison of tooth growth by supp and dose

```
r <- ToothGrowth %>% mutate(id = rep(1:10, times = 6))  
r <- dcast(r, id ~ dose + supp, value.var = "len")  
  
rbind(t.test(r$`0.5_OJ`, r$`1_OJ`)$conf.int,  
      t.test(r$`1_OJ`, r$`2_OJ`)$conf.int,  
      t.test(r$`0.5_VC`, r$`2_VC`)$conf.int  
)
```

```
##           [,1]      [,2]
## [1,] -13.415634 -5.5243656
## [2,]  -6.531443 -0.1885575
## [3,] -16.335241 -9.3247594
```

For Orange Juice none of intervals contains zero which means that any increase in dosege of orange juice will lead to efficient toothgrowth

```
rbind(t.test(r$`0.5_VC`, r$`1_VC`)$conf.int,
      t.test(r$`1_VC`, r$`2_VC`)$conf.int,
      t.test(r$`0.5_VC`, r$`2_VC`)$conf.int
)
```

```
##           [,1]      [,2]
## [1,] -11.26571  -6.314288
## [2,] -13.05427  -5.685733
## [3,] -21.90151 -14.418488
```

Again for VC none of interval contains zero. Since both suppliments show effective growth in tooth, we can conclude increasing Vitamin C in the diet will lead to longer teeth.

```
rbind(t.test(r$`0.5_OJ`, r$`0.5_VC`)$conf.int,
      t.test(r$`1_OJ`, r$`1_VC`)$conf.int,
      t.test(r$`2_OJ`, r$`2_VC`)$conf.int
)
```

```
##           [,1]      [,2]
## [1,]  1.719057  8.780943
## [2,]  2.802148  9.057852
## [3,] -3.798070  3.638070
```

Results shows that for lower dosage (0.5 and 1) the Ascorbic accid is more efficient than Orange Juice. As for 2 mg the confident interval contains zero we can conclude that both suppliments have approximately same efficacy for tooth growth.

Conclusion

Overall we can say that both suppliments are effective at tooth growth, however when comparing suppliments we see ascorbic acid is more effective than orange juice on lower dosage. For 2 mg it's moke no difference.