Exploring Tooth Growth

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Overview

Here I will explore the tooth growth dataset that Rstudio provides. ## Load the data and perform some basic exploratory data analyses.

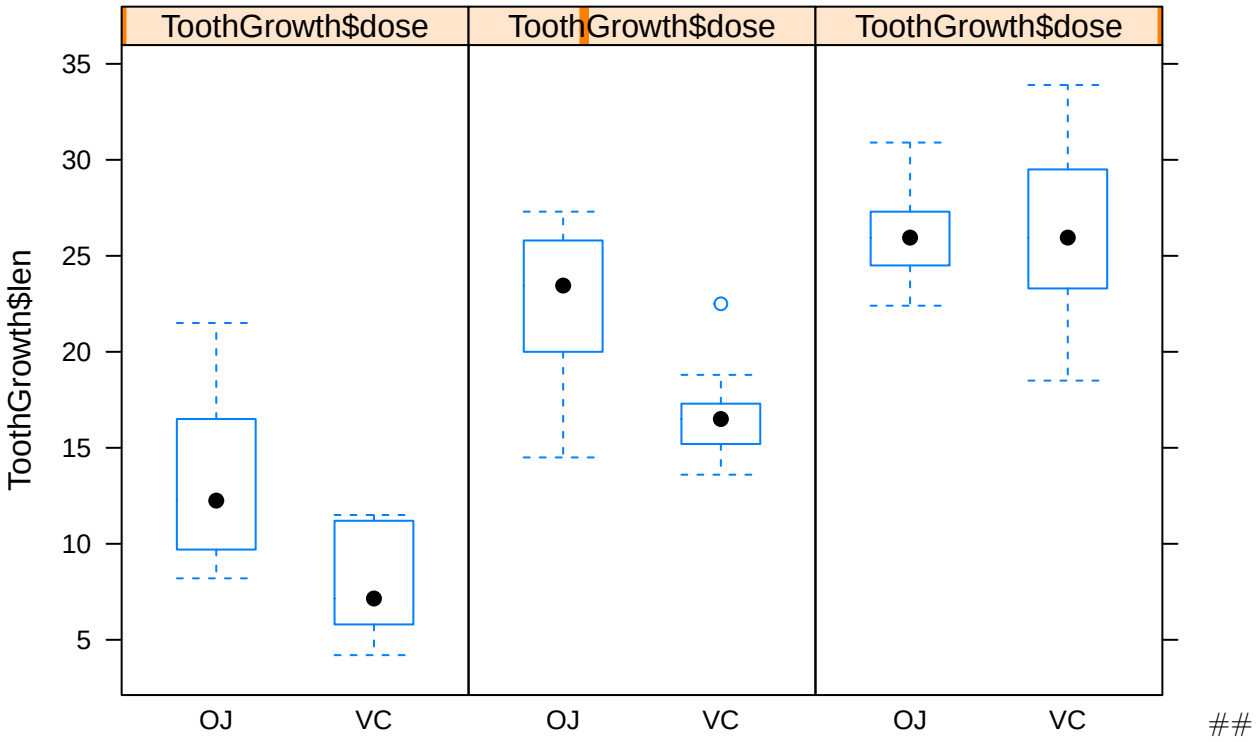
```
library(lattice)
data(ToothGrowth)
str(ToothGrowth)
```

```
## '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 ...
```

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

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

```
bwplot(ToothGrowth$len ~ToothGrowth$supp | ToothGrowth$dose)
```



##

Provide a basic summary of the data

```
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
```

```
aggregate(ToothGrowth$len,list(ToothGrowth$dose,ToothGrowth$supp)
          ,FUN=function(x) c(x_mean = mean(x), x_sd = sd(x)))
```

```
##   Group.1 Group.2  x.x_mean    x.x_sd
## 1     0.5      OJ 13.230000  4.459709
## 2     1.0      OJ 22.700000  3.910953
## 3     2.0      OJ 26.060000  2.655058
## 4     0.5      VC  7.980000  2.746634
## 5     1.0      VC 16.770000  2.515309
## 6     2.0      VC 26.140000  4.797731
```

Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose.

I test the hypothesis that the two different supplements, orange juice and vitamin C, have no affect on tooth length.

```
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
```

The interval contains zero, but the p-value is above 5% so it is not conclusive.

By comparing all doses with each other I can test the hypothesis that the does does not affect on the tooth length.

```
d5 <- ToothGrowth[which(ToothGrowth$dose==.5),1]
d10 <- ToothGrowth[which(ToothGrowth$dose==1),1]
d20 <- ToothGrowth[which(ToothGrowth$dose==2),1]
```

```
d510_t1 <- t.test(d5, d10, paired=FALSE, var.equal=TRUE)
d510_t2 <- t.test(d5, d10, paired=FALSE, var.equal=FALSE)
d510 <- data.frame("p-value"=c(d510_t1$p.value, d510_t2$p.value),
                           "Conf-Low"=c(d510_t1$conf[1],d510_t2$conf[1]),
                           "Conf-High"=c(d510_t1$conf[2],d510_t2$conf[2]),
                            row.names=c("t1","t2"), "Dose"="[0.5..1]")

d520_t1 <- t.test(d5, d20, paired=FALSE, var.equal=TRUE)
d520_t2 <- t.test(d5, d20, paired=FALSE, var.equal=FALSE)
d520 <- data.frame("p-value"=c(d520_t1$p.value, d520_t2$p.value),
                            "Conf-Low"=c(d520_t1$conf[1],d520_t2$conf[1]),
                            "Conf-High"=c(d520_t1$conf[2],d520_t2$conf[2]),
                            row.names=c("t1","t2"), "Dose"="[0.5..2]")

d1020_t1 <- t.test(d10, d20, paired=FALSE, var.equal=TRUE)
d1020_t2 <- t.test(d10, d20, paired=FALSE, var.equal=FALSE)
d1020 <- data.frame("p-value"=c(d1020_t1$p.value, d1020_t2$p.value),
                           "Conf-Low"=c(d1020_t1$conf[1],d1020_t2$conf[1]),
                           "Conf-High"=c(d1020_t1$conf[2],d1020_t2$conf[2]),
                           row.names=c("t1","t2"), "Dose"="[1..2]")
doseTot <- rbind(d510,d520,d1020)
doseTot
```

```
##          p.value   Conf.Low  Conf.High     Dose
## t1  1.266297e-07 -11.983748  -6.276252 [0.5..1]
## t2  1.268301e-07 -11.983781  -6.276219 [0.5..1]
## t11 2.837553e-14 -18.153519 -12.836481 [0.5..2]
## t21 4.397525e-14 -18.156167 -12.833833 [0.5..2]
## t12 1.810829e-05  -8.994387  -3.735613   [1..2]
## t22 1.906430e-05  -8.996481  -3.733519   [1..2]
```

The result of comparing all the doses is that their p-values are very low and the confidence intervals do not contain zero, so we can deny the hypothesis and conclude that the dose does affect the tooth length.

Conclusion

In conclusion I have analysed the tooth growth data and confirmed that an increase if the dose of the supplement increases the tooth growth. It is inconclusive whether the type of supplement, vitamin C or orange juice, affects the tooth The assumptions needed for these coclusions is that the guinea pigs were randonmly selected from a population of guinea pigs.