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.

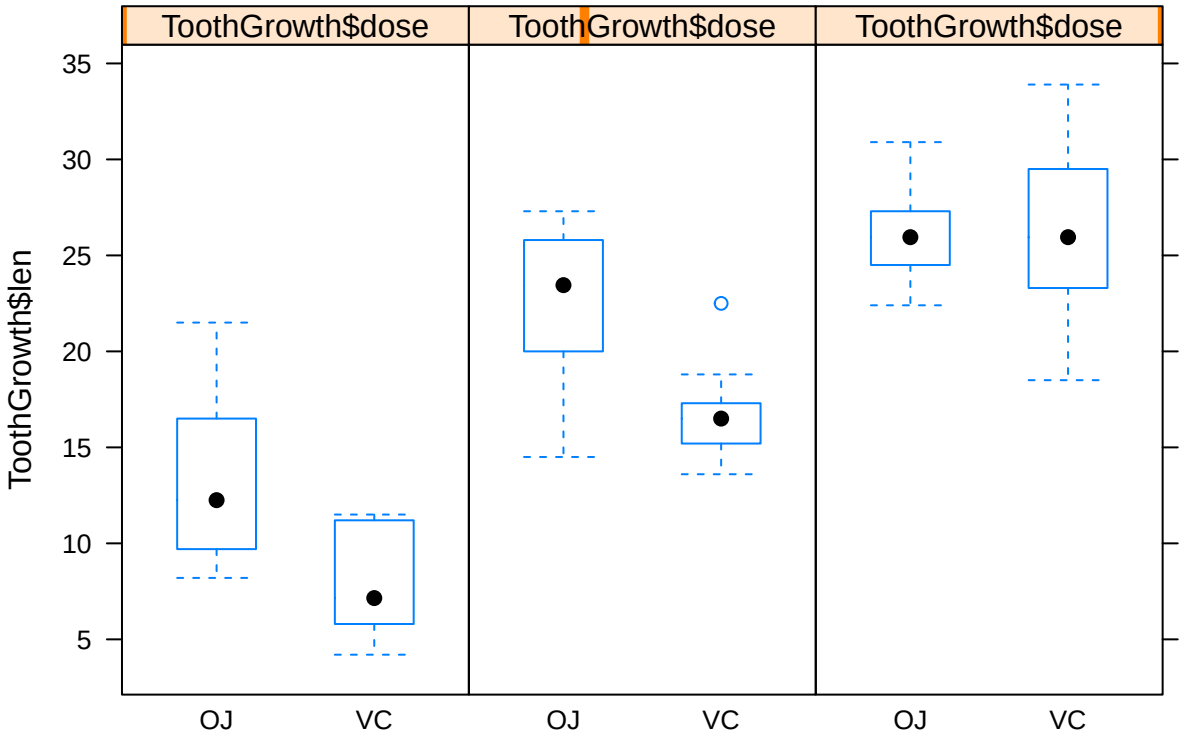
```
library(lattice)
data(ToothGrowth)
str(ToothGrowth)
```

```
## '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.