Effect of Vitamin C on Tooth Growth

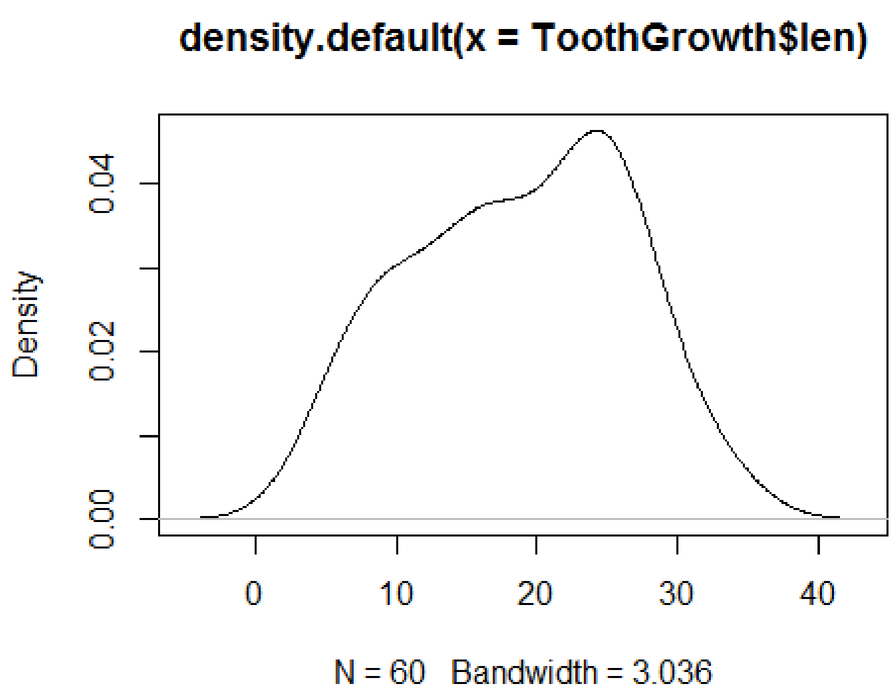
```
 In this part of the project, we will investigate that the effect of vitamin
C on tooth growth in Guinea Pigs. For this purpose, we are provided a data
set called ToothGrowth. The data is consisting of three variables named len
(Length of tooth), supp (type of supplement type) and third one is dose (dose
of supplement having three types).
```

So we will start with some explanatory analysis

```r
data(ToothGrowth) # To load data in R
summary(ToothGrowth$len) # Provide some basic explanatory detail about length

##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    4.20   13.08   19.25   18.81   25.28   33.90

plot(density(ToothGrowth$len))
```



Summary statistics tell us that the average value of tooth length is 18.81, its median and range are 19.25 and 29.7 respectively. Moreover, the density plot indicates that its follws normal distribution,

```r
cbind(table(ToothGrowth$supp))
```

```
##    [,1]
## OJ   30
## VC   30
```

```
cbind(table(ToothGrowth$dose))
```

```
##     [,1]
## 0.5   20
## 1     20
## 2     20
```

Now frequency distribution of both variables supp and dose show that there are two types odf supplements used each having 30 observations and three types of doses are used having 20 each observations.

Firslty, we will check that are both types of supplement have any effect on tooth growth . To do this, we will test the equality of these two supplements.

```
g1<-subset(ToothGrowth, supp == "VC", len)[,1] # To select tooth length first
type of Supplement
g2<-subset(ToothGrowth, supp == "OJ", len)[,1] # To select tooth length
second type of Supplement
t.test(g1, g2, paired = TRUE, var.equal=TRUE)
```

```
##
##  Paired t-test
##
## data:  g1 and g2
## t = -3.3026, df = 29, p-value = 0.00255
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -5.991341 -1.408659
## sample estimates:
## mean of the differences
##                    -3.7
```

The results show that we will reject our null hypothesis that the supplements have same effect on tooth length. Further more, confidence interval cannot include the zero which also supported the above argument. Now we will check the effect of dose on tooth growth

```
g1<-subset(ToothGrowth, dose == 0.5, len)[,1] # To select tooth length of
first type of dose
g2<-subset(ToothGrowth, dose == 1, len)[,1] # To select tooth length second
type of dose
g3<-subset(ToothGrowth, dose == 2, len)[,1] # To select tooth length second
type of dose

t.test(g1, g2, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
```

```
## data:  g1 and g2
## t = -6.4766, df = 38, p-value = 1.266e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.983748  -6.276252
## sample estimates:
## mean of x mean of y
##    10.605    19.735
```

```
t.test(g1, g3, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  g1 and g3
## t = -11.799, df = 38, p-value = 2.838e-14
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -18.15352 -12.83648
## sample estimates:
## mean of x mean of y
##    10.605    26.100
```

```
t.test(g2, g3, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  g2 and g3
## t = -4.9005, df = 38, p-value = 1.811e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -8.994387 -3.735613
## sample estimates:
## mean of x mean of y
##    19.735    26.100
```

Now the doses are independently given to objects. Now after testing the null hypothesis it is concluded that the effect of all three doses are not equal on tooth growth.Because 95% Confidence interval does not include the zero value.