Analysis of ToothGrowth data

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Overview

This report provides a summary of ToothGrowth data to highlight basic features of the data. Moreover, this report shows assumptions, solutions, and conclusions of confidence intervals and hypothesis tests to compare tooth growth of 60 guinea pigs by supplement and dosage.

Exploratory Data Analysis

```
# Load the ToothGrowth data
data(ToothGrowth)
data <- data.frame(ToothGrowth)

# Display the overview structure of the ToothGrowth data
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 ...
```

the ToothGrowth data was collected from 60 guinea pigs. The researchers measured 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 two delivery methods coded VC, OJ.

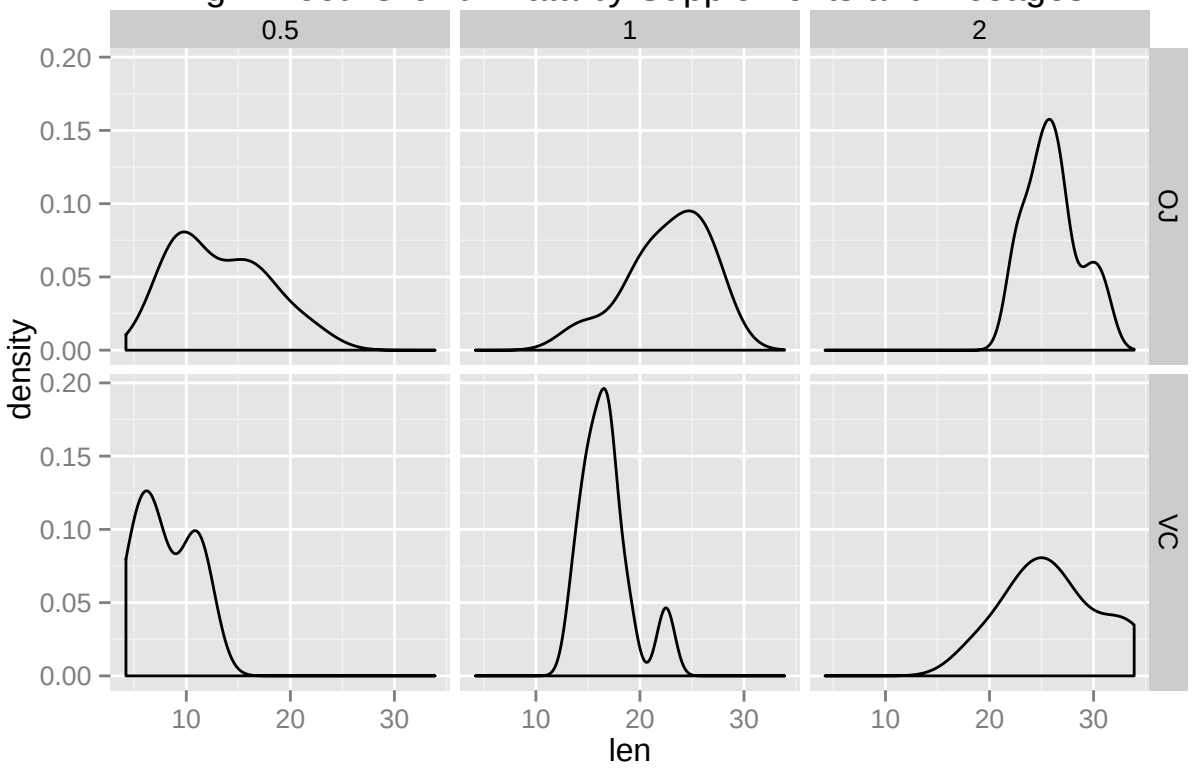
```
# Calculate means of the data of each of 10 guinea pigs by supplements and dosages.
means <- aggregate(data$len, list(data$supp, data$dose), mean)
colnames(means) <- c ("supp", "dose", "mean_len")
means
```

```
##   supp dose mean_len
## 1   OJ  0.5    13.23
## 2   VC  0.5     7.98
## 3   OJ  1.0    22.70
## 4   VC  1.0    16.77
## 5   OJ  2.0    26.06
## 6   VC  2.0    26.14
```

Following figure show the data of each of 10 guinea pigs by supplements and dosages.

```
library(ggplot2)
base <- qplot(x = len, data = data, facets = supp ~ dose, geom=c("density"))
base <- base + labs(title = "Fig 1. ToothGrowth Data by Supplements and Dosages")
print(base)
```

Fig 1. ToothGrowth Data by Supplements and Dosages



Confidence Intervals and Hypothesis Tests

```
t.test(len ~ supp, paired=FALSE, data=data)
```

```
##
##  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
```

```
t.test(len ~ supp, paired=FALSE, data=data[data$dose == 0.5,])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = 3.1697, df = 14.969, p-value = 0.006359
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
```

```
##  1.719057 8.780943
## sample estimates:
## mean in group OJ mean in group VC
##            13.23             7.98
```

```
t.test(len ~ supp, paired=FALSE, data=data[data$dose == 1,])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = 4.0328, df = 15.358, p-value = 0.001038
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  2.802148 9.057852
## sample estimates:
## mean in group OJ mean in group VC
##            22.70            16.77
```

```
t.test(len ~ supp, paired=FALSE, data=data[data$dose == 2,])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = -0.046136, df = 14.04, p-value = 0.9639
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -3.79807  3.63807
## sample estimates:
## mean in group OJ mean in group VC
##            26.06            26.14
```

```
# Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose. (Only use
# State your conclusions and the assumptions needed for your conclusions.
# Did the student perform some relevant confidence intervals and/or tests?
# Did the student describe the assumptions needed for their conclusions?
```