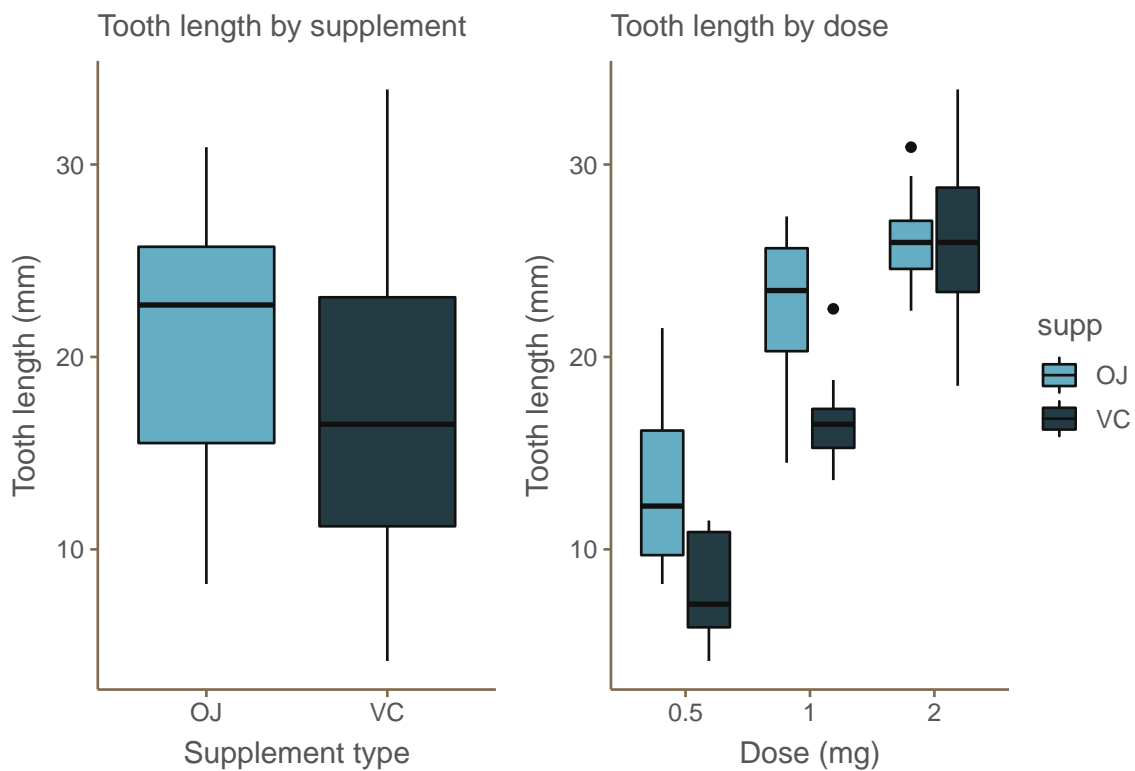


Inferential Data Analysis

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Basic inferential data analysis

The goal of the following analysis of the 'ToothGrowth' data by Galton, is to quantifiably compare the effects of Vitamin C in tooth growth of Guinea Pigs between the groups defined by two factors. The 'ToothGrowth' data consists of 60 independent observations for the length of tooth in Guinea Pigs over two factors, the supply method and the dose of Vitamin C. The supply method refers to how Vitamin C was supplied either as *Orange Juice* (OJ) or as *Ascorbic Acid* (VC).



As a preliminary hypothesis, we can form the first research question around the supplement type. In general, is expected tooth length larger, when Vitamin C is supplied as orange juice instead of ascorbic acid?

```
##  
## 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
```

As can be seen, considering 95% confidence the null hypothesis cannot be rejected, since the p -value is greater than 0.05. So we have no evidence that there is a significant difference between the two supplements.

Now, let's see if there is a significant difference between the supplements at different dosages.

```
##
## 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
```

From this result, we see that the data do provide substantial evidence ($p < 0.006$) to reject the null hypothesis H_0 , according to which the expected tooth length is the same when dose of 0.5 mg/day of Vitamin C is supplied as orange juice.

```
##
## 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
```

From this result, we see that the data do provide substantial evidence ($p < 0.001$) to reject the null hypothesis H_0 , according to which the expected tooth length is the same when dose of 1 mg/day of Vitamin C is supplied as orange juice.

```
##
## 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
```

From this result, we see that the data do *not* provide substantial evidence ($p > 0.9638$) to reject the null hypothesis H_0 , according to which the expected tooth length is the same when dose of 2 mg/day of Vitamin C is supplied either as orange juice or as ascorbic acid.

Conclusions

The data does not provide ample evidence to support the hypothesis that there is a significant difference between Vitamin C and Asorbic acid supplements on the expected tooth length of Guinea pigs, However, when analyzing the dosage level, there is a significant difference for 0.5 and 1 mg. At both the 0.5 mg ($p < 0.006$) and 1 mg ($p < 0.001$) dosage levels, the data provides evidence to reject null hypothesis in favor the alternative that expected tooth length is larger when Vitamin C is provided as the supplement. It is not possible to say that for 2 mg dose the supplements differ in effects on expected tooth length. The data do *not* provide substantial evidence ($p > 0.9638$) to reject the null hypothesis H_0 , in which the expected tooth length is the same when dose of 2 mg/day of Vitamin C is supplied as orange juice.