Tooth Dataset Analysis

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Tooth Data Analysis to find relation between Supplement,Dosage and Tooth length.

Overview:

- An initial analysis on the Tooth growth Dataset.
- Our goal is to find is there exists a relation with Supplements (VC, OJ), their dosage prescribed and Tooth Length.

A summary of the Dataset:

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.0.2
```

```
teeth <- datasets::ToothGrowth
str(teeth)
```

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

```
summary(teeth)
```

```
##       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
```

```
table(teeth$dose)
```

```
##
## 0.5   1   2
##  20  20  20
```

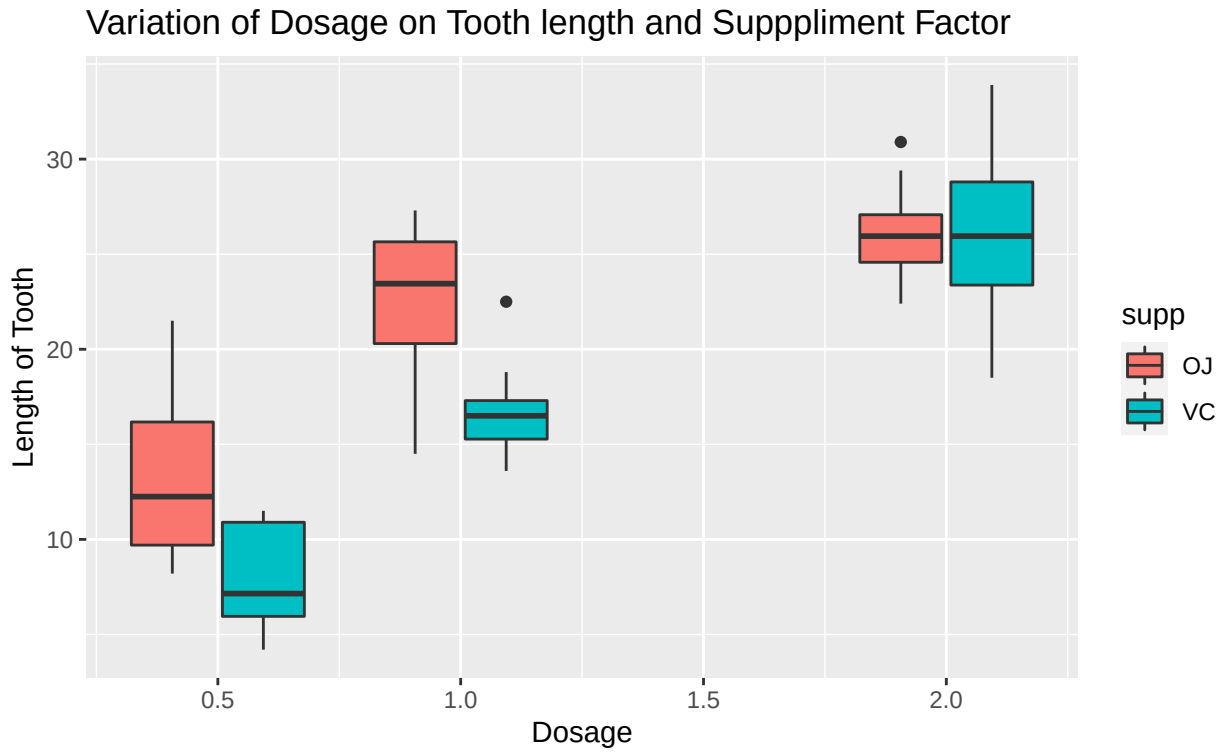
```
table(teeth$supp)
```

```
##
## OJ VC
## 30 30
```

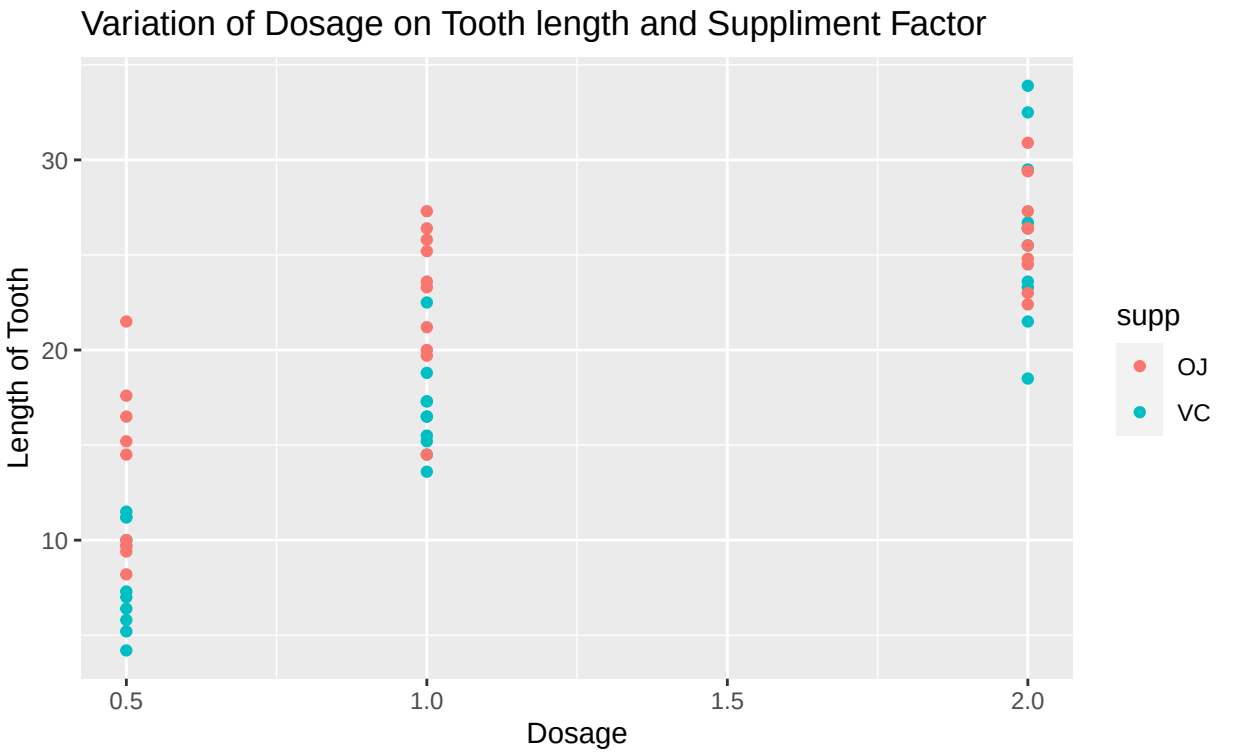
Initial Observations:

- Length of Tooth:
  - The Average Tooth Length is 18.81
  - The smallest Tooth Length is 4.20
  - The Largest Tooth Length is 33.90
- Suppliment Consists of 2 types:
  - VC
  - OJ
- Dosage in milligrams/day:
  - The average dosage is 1.167.
  - The minimum dosage is 0.500.
  - The maximum dosage is 2.000.

```
ggplot(data = teeth) + geom_boxplot(aes(dose,len,group = interaction(dose,supp),fill=supp)) +labs(x= "D
```



```
ggplot(data = teeth) + geom_point(aes(dose,len,group = dose,color=supp)) + labs(x= "Dosage", y= "Length
```



From the above we can make the assumptions: * As Tooth Length increases, the Dosage also increases. * The Tooth Length is greated on suppliment type OJ than on VC.

Tring to find a correlation between Dosage,Length and Support:

Let us consider different hypotheses:

Hypotheses at 3 different dosage levels to see if we can find a relationship between Supplements and Length of Tooth: * 0.5mg/day * 1mg/day * 2mg/day

Null Hypothesis that there is no difference between suppliments OJ and VC at 0.5mg/day dosage:

```
## [1] "OJ 1mg/day dosage 95% confidence interval: 10.0397167182875 16.4202832817125"
```

```
## [1] "VC 1mg/day dosage 95% confidence interval: 6.01517618244589 9.94482381755411"
```

```
## mean in group OJ mean in group VC
##            13.23             7.98
```

```
## [1] "Hypothesis of 1mg/day Dosage P Value: 0.0063586067640968"
```

```
## [1] "The Power of differentiating OJ and VC in 0.5mg/day dosage is: 0.948960051792108"
```

- Upon looking at the 95% confidence intervals and Means of OJ and VC we can say that the Length of teeth for OJ and VC are very different.
- Upon looking at the P value and Power we can be confident that the two supplements OJ and VC are very different.
- Hence we can reject the Null Hypothesis and conclude that in fact the suppliments OJ and VC are different at 0.5mg/day dosage.

Null Hypothesis that there is no difference between suppliments OJ and VC at 1mg/day dosage:

```
## [1] "OJ 1mg/day dosage 95% confidence interval: 19.9022725624783 25.4977274375217"
```

```
## [1] "VC 1mg/day dosage 95% confidence interval: 14.9706565619722 18.5693434380278"
```

```
## mean in group OJ mean in group VC
##            22.70            16.77
```

```
## [1] "Hypothesis of 1mg/day Dosage P Value: 0.00103837587229988"
```

```
## [1] "The Power of differentiating OJ and VC in 1mg/day dosage is: 0.985277992036494"
```

- Upon looking at the 95% confidence intervals and Means of OJ and VC we can say that the Length of teeth for OJ and VC are very different.
- Upon looking at the P value and Power we can be confident that the two supplements OJ and VC are very different.
- Hence we can reject the Null Hypothesis and conclude that in fact the supplements OJ and VC are different at 1mg/day dosage.

Null Hypothesis that there is no difference between suppliments OJ and VC at 2mg/day dosage:

```
## [1] "OJ 1mg/day dosage 95% confidence interval: 19.9022725624783 25.4977274375217"
```

```
## [1] "VC 1mg/day dosage 95% confidence interval: 14.9706565619722 18.5693434380278"
```

```
## mean in group OJ mean in group VC
##            26.06            26.14
```

```
## [1] "Hypothesis of 1mg/day Dosage P Value: 0.963851588723373"
```

```
## [1] "The Power of differentiating OJ and VC in 2mg/day dosage is: 0.0290725157200443"
```

- Upon looking at the 95% confidence intervals and Means of OJ and VC we can say that the Length of teeth for OJ and VC are very similar.
- Upon looking at the P value and Power we cannot be confident that the two supplements OJ and VC are very different.
- Hence we cannot reject the Null Hypothesis and conclude that the supplements OJ and VC are similar at 2mg/day dosage.

Conclusion:

- We can conclude that there exists a direct relation between Tooth Length and Dosage level, the greater the dosage the greater the Tooth Length/Growth.
- We also observe that although in 0.5 and 1 mg/day dosage levels VC and OJ supplements perform very different, they perform very similar at 2 mg/day dosage level and hence we cannot conclude that there is a direct relation between Supplement type and Tooth Length/Growth. It needs to be looked further into.