

# ToothGrowth Dataset

Kushal Kharel

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Dataset contains tooth growth data, supplement types, and different dose levels. We can see below:

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

We have 60 observations for two supplement types OJ and VC with 3 variables.

Let's check the top 5 rows of our dataset.

```
## len supp dose
## 1 4.2 VC 0.5
## 2 11.5 VC 0.5
## 3 7.3 VC 0.5
## 4 5.8 VC 0.5
## 5 6.4 VC 0.5
## 6 10.0 VC 0.5
```

Now, Let's check the supplement types.

```
## [1] VC OJ
## Levels: OJ VC
```

Let's check our distinct doses.

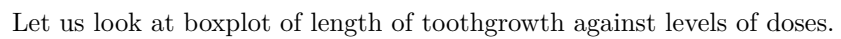
```
## [1] 0.5 1.0 2.0
```

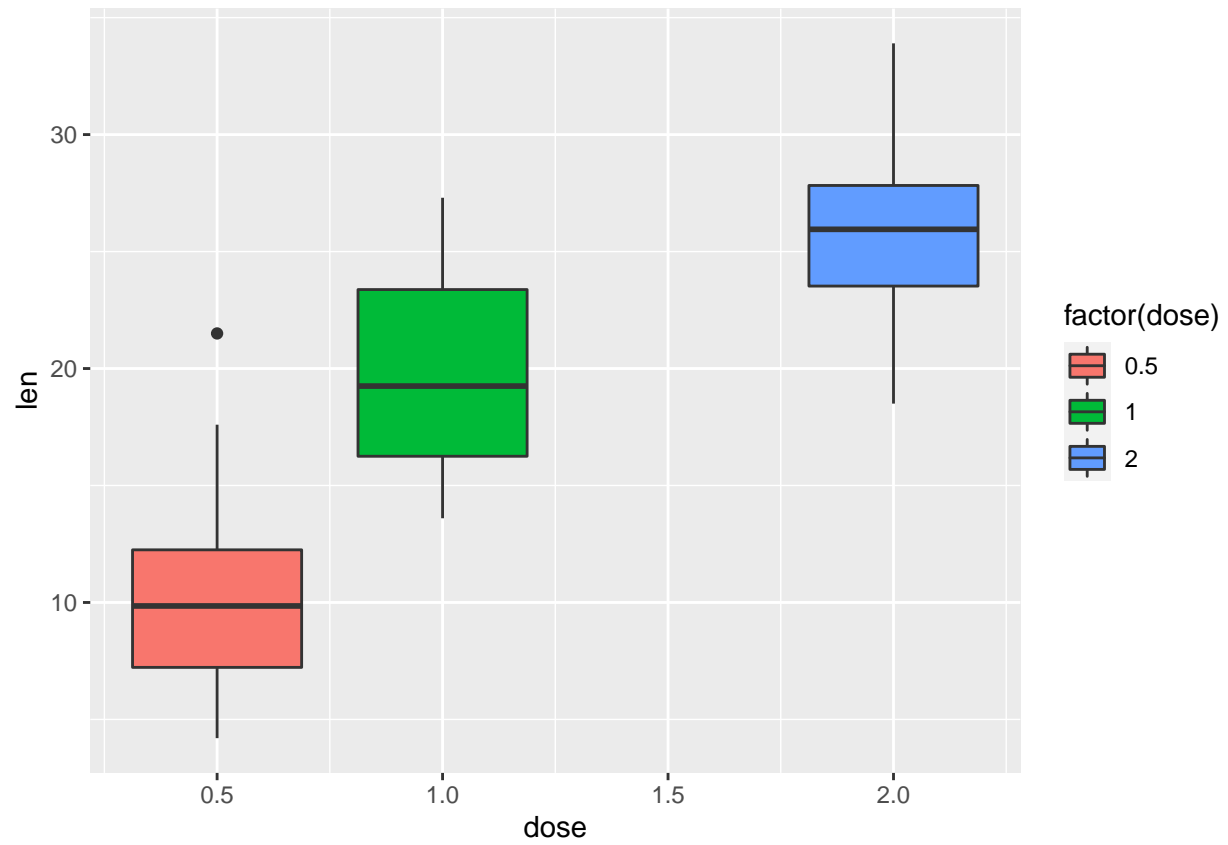
We can see that we have 3 levels of doses which is our 3 variables.

Finally, let us summarize the statistics of our data.

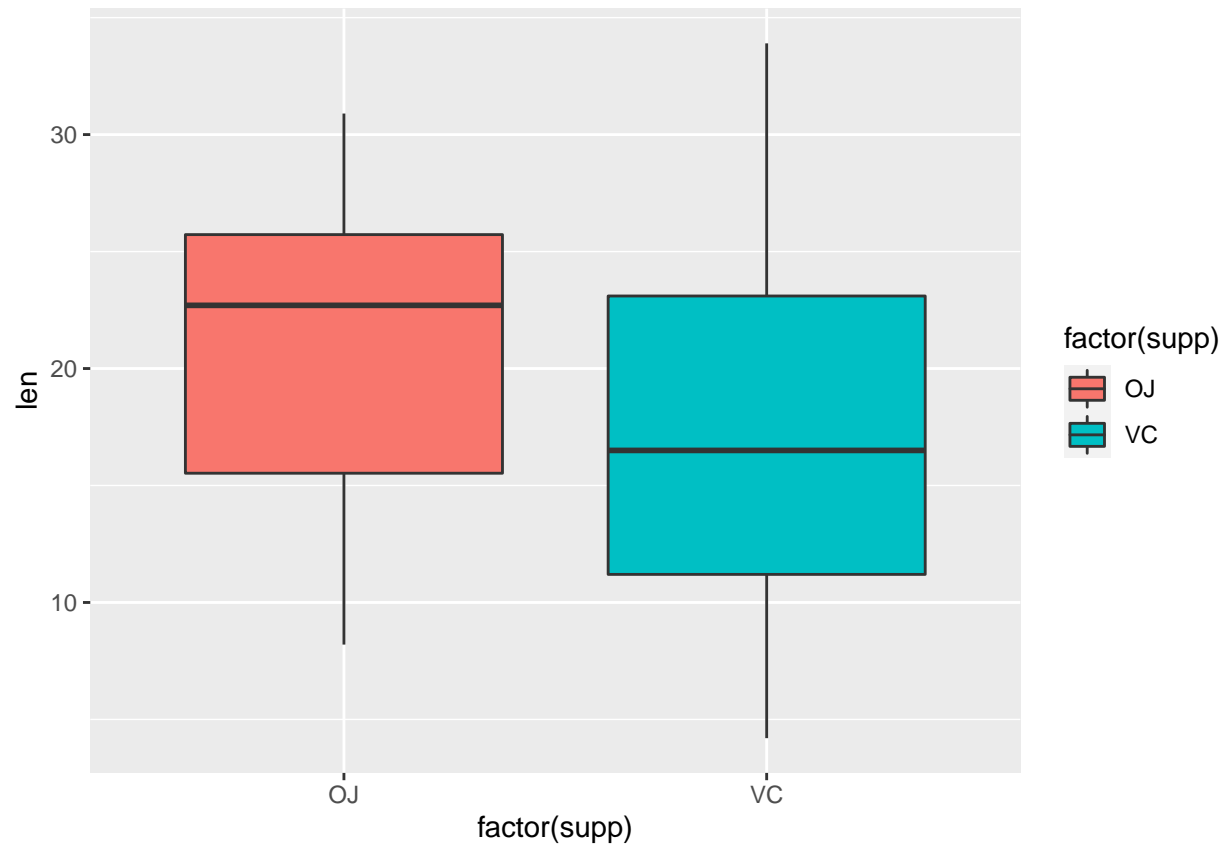
```
## len supp dose
## Min. : 4.20 OJ:30 Min. :0.500
## 1st Qu.:13.07 VC:30 1st Qu.:0.500
## Median :19.25 Median :1.000
## Mean :18.81 Mean :1.167
## 3rd Qu.:25.27 3rd Qu.:2.000
## Max. :33.90 Max. :2.000
```

Let's look at the plot of the data. Let us plot levels of dose against the length of toothgrowth by supplement type.

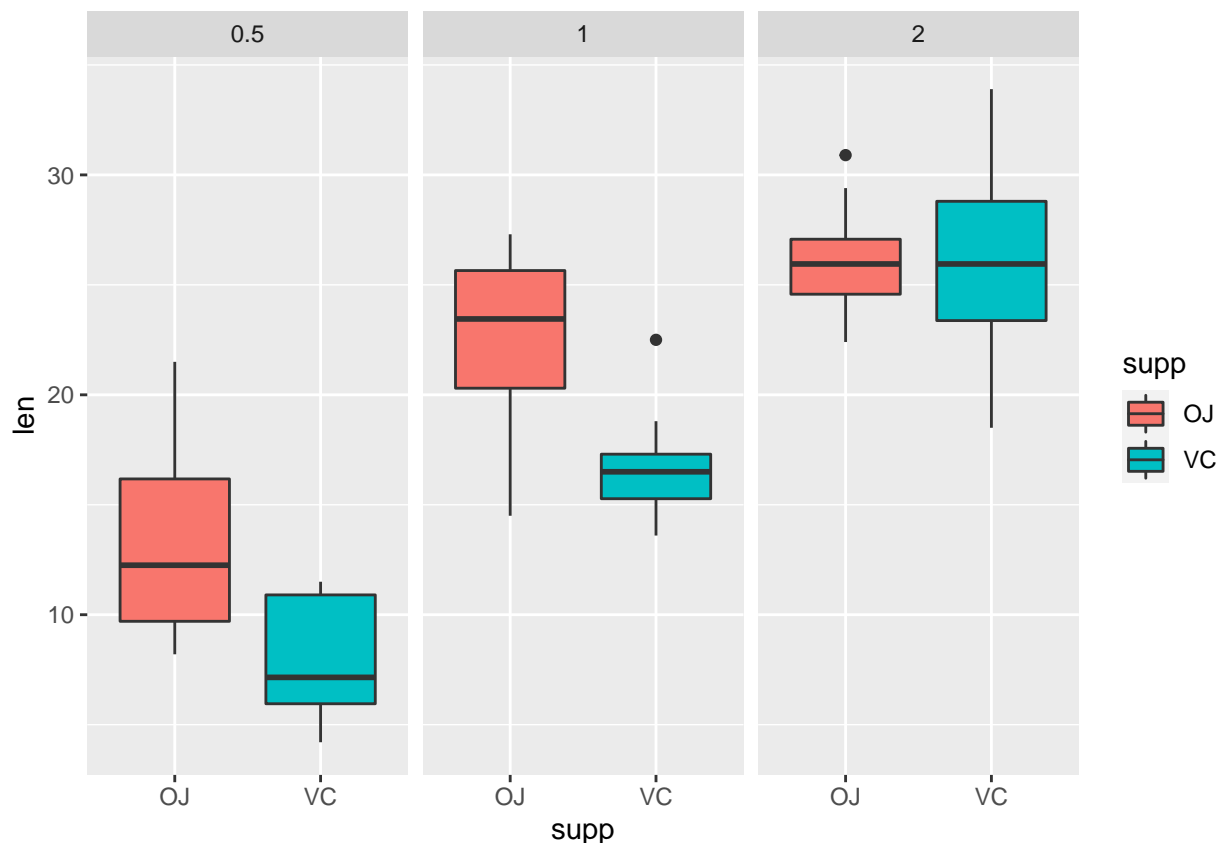




Lets look at boxplot of length of toothgrowth against supplement types.



Lets look at both boxplot together.



That is it to get the feel of the data. We explored our dataset and gained valuable insights on data. Now let us test our hypothesis. We are assuming that supplement type has an effect on tooth growth and also increasing the doses of supplement has an effect on tooth growth.

Since we have 3 factors, let us divide out dataset in 3 different subsets lower, middle and upper of data. Check the summary of the data to create this subset. We have min,1st quartile:0.5, median:1 and max,3rd quartile:2.

Hypothesis testing of tooth growth by supplement type and dose.

Hypothesis:

H0 = True difference in mean is equal to 0.

H1 = True difference in mean is not equal to 0.

```
t.test(len~dose, paired = F, var.equal = F, data = Lower)
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -6.4766, df = 37.986, p-value = 1.268e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.983781  -6.276219
## sample estimates:
## mean in group 0.5    mean in group 1
##      10.605         19.735
```

```
t.test(len~dose, paired = F, var.equal = F, data = Middle)
```

```
##  
## Welch Two Sample t-test  
##  
## data: len by dose  
## t = -11.799, df = 36.883, p-value = 4.398e-14  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -18.15617 -12.83383  
## sample estimates:  
## mean in group 0.5 mean in group 2  
## 10.605 26.100
```

```
t.test(len~dose, paired = F, var.equal = F, data = Upper)
```

```
##  
## Welch Two Sample t-test  
##  
## data: len by dose  
## t = -4.9005, df = 37.101, p-value = 1.906e-05  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -8.996481 -3.733519  
## sample estimates:  
## mean in group 1 mean in group 2  
## 19.735 26.100
```

We reject the null hypothesis. The result shows that p-value is really really small  $< 0.05$  which states that there is statistical difference between two means. Hence, increasing the dose level does lead to enhancement of tooth growth.

Now, let us test by supplement type.

Hypothesis:

$H_0$  = True difference in mean is equal to 0.

$H_1$  = True difference in mean is not equal to 0.

```
t.test(len~supp, paired = F, var.equal = F, data = Tooth_Growth)
```

```
##  
## 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
```

Here, We fail to reject null hypothesis. The result shows that p-value is  $> 0.05$  which states that there is no statistical difference between two means. Hence, supplement type has no effect on tooth growth.