

# The Effect of Vitamin C on Tooth Growth in Guinea Pigs

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## Synopsis

I download the ToothGrowth data in the R datasets package so that analyze the effect of the vitamin C on the Tooth growth in Guinea pigs. First I'm going to provide basic summarises to understand clearly the variables and observations of the dataset. Then I perform some basic exploratory data analyses to finally use confidence intervals and/or hypothesis tests.

Before to go forward, please to take a look on the [ToothGrowth R package description](#)

## 1. Load the ToothGrowth data

I load my dataset and store it in a variable called “*mdata*”.

```
library(dplyr)
library(ggplot2)
library(RColorBrewer)

data("ToothGrowth")
mdata <- ToothGrowth
sum(is.na(mdata))
```

```
## [1] 0
```

Note that there are no missing values in our dataset.

## 2. Provide a basic summary of the data

```
head(mdata)
```

```
##      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
```

The dataset is composed of the 3 variables : *len* , *supp* and *dose*

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```
str(mdata)
```

```
## '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 ...
## $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

The dataset contains 60 observations. The variable *supp* which represents the delivery methods, have 2 levels inside : “OJ” = “Orange Juice” and “CV” = “Ascorbic Acid”.

### 3. Perform some basic exploratory data analyses

We have understood that the measures taken in the dataset represents tooth growth compared to the dose of vitamin C and the delivery methods. To understand the split by subject/observation I compute a table between *dose* and *supp* :

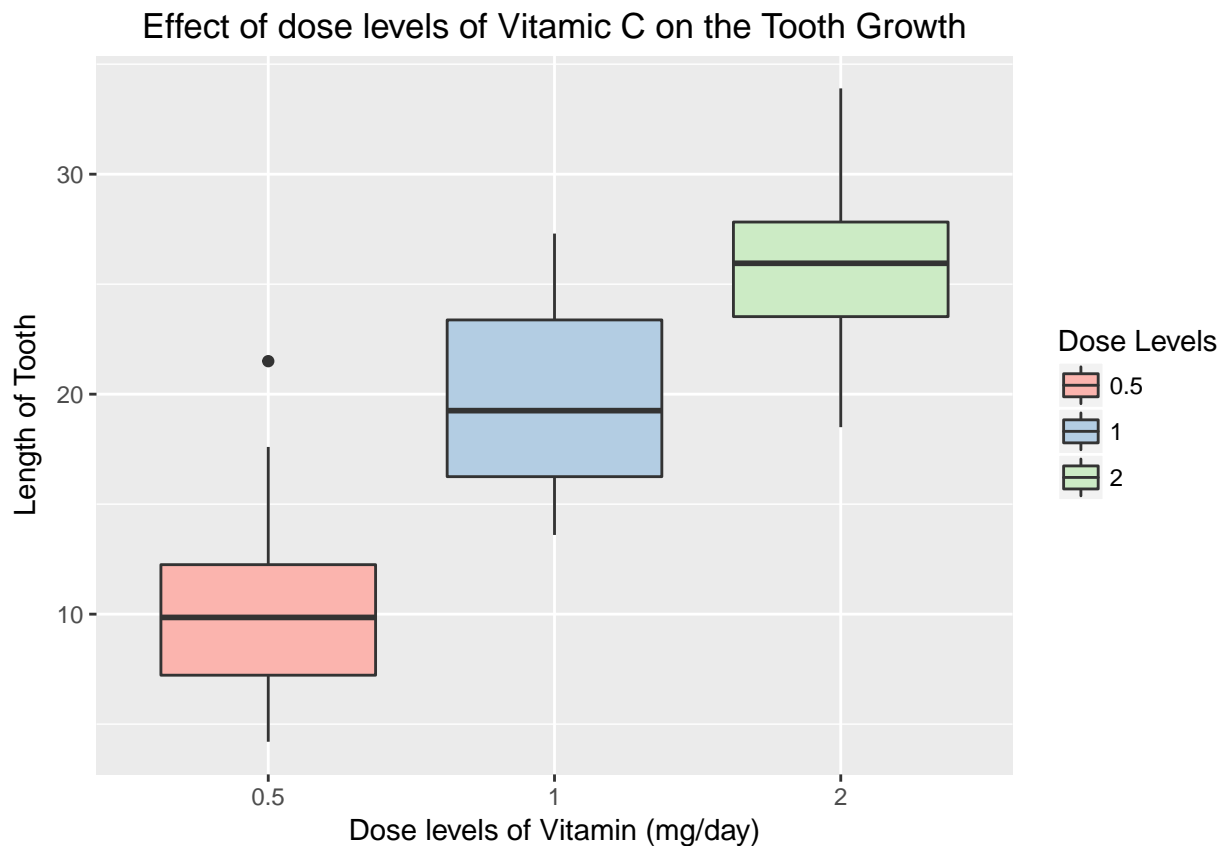
```
table(mdata$dose, mdata$supp)
```

```
##
##      OJ VC
## 0.5 10 10
## 1   10 10
## 2   10 10
```

In this way, we can observed that the dataset splits 30 pigs by delivery methods and as we have 3 dose levels for each observation, there are 10 subjects by dose levels.

*For example we have 10 pigs which had 0.5 mg/day of vitamin C given by Orange Juice method*

Now we’re going to go more deeper into the analyzes. It will be interesting to see if the dose levels of vitamin C have an impact on the tooth growth. For that I realize with ggplot function a boxplot to vizualise the study (code in Appendix):



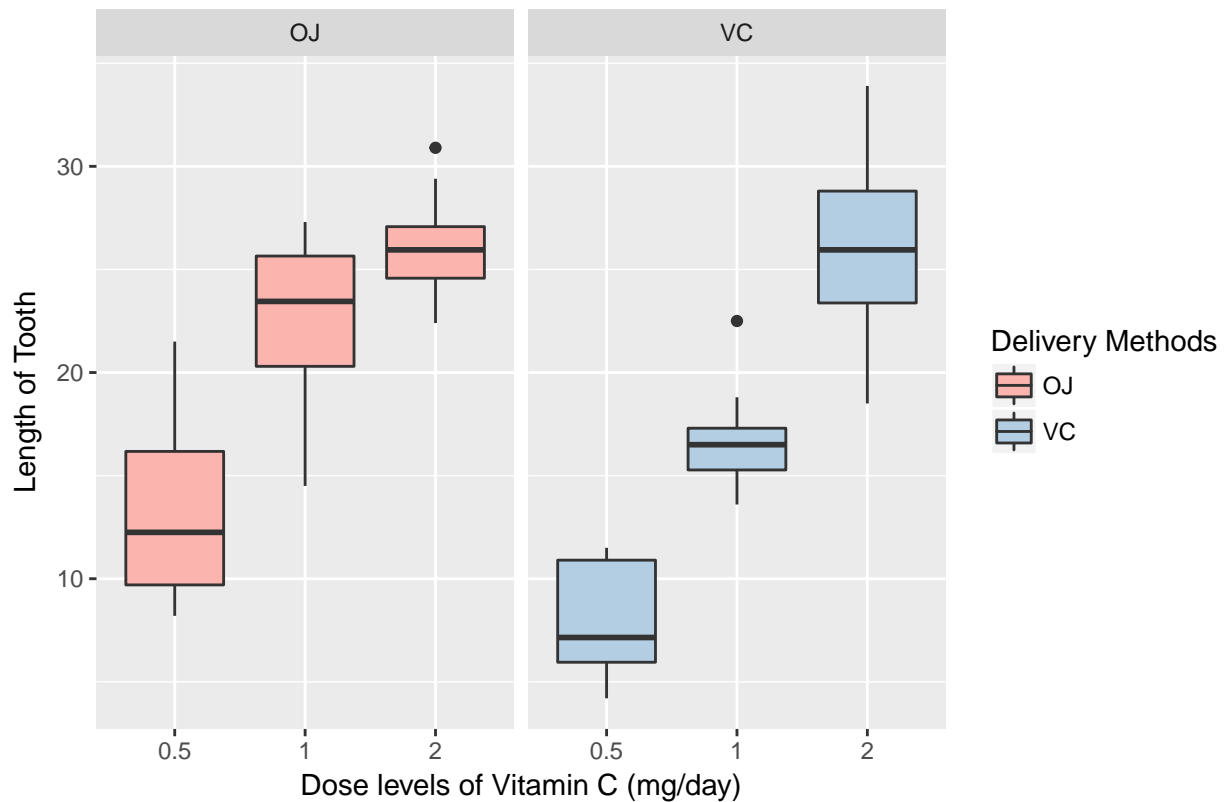
Write the mean values by dose levels :

```
## # A tibble: 3 × 2
##   dose   len
##   <dbl> <dbl>
## 1  0.5 10.605
## 2  1.0 19.735
## 3  2.0 26.100
```

Quickly, thank to the boxplot and the table above, we can conclude that indeed as more the pigs have a daily dose of vitamin C, as more their tooth growth is important.

Now we want to see if the delivery methods of vitamin C as well have an impact on the tooth growth of the pigs. I take the same proceed to realize it :

Comparaison effect of dose levels of Vitamin C on the Tooth Growth by Delivery Methods



- Means in terms of delivery methods

```
## # A tibble: 2 × 2
##   supp   len
##   <fctr> <dbl>
## 1    OJ 20.66333
## 2    VC 16.96333
```

We can conclude that effectively the delivery methods influence the length of tooth at each degree of dosage. With the table above we understand that feed pigs of vitamin C with Orange Juice will produce better tooth growth than with Ascorbic Acid.

**- Means of Orange Juice by dose**

```
## Source: local data frame [3 x 3]
## Groups: supp [1]
##
##      supp  dose   len
##   <fctr> <dbl> <dbl>
## 1     OJ   0.5 13.23
## 2     OJ   1.0 22.70
## 3     OJ   2.0 26.06
```

**- Means of Ascorbic Acid by dose**

```
## Source: local data frame [3 x 3]
## Groups: supp [1]
##
##      supp  dose   len
##   <fctr> <dbl> <dbl>
## 1     VC   0.5  7.98
## 2     VC   1.0 16.77
## 3     VC   2.0 26.14
```

However, note that at 2 mg/day, there is no difference in the tooth growth between OJ or VC absorption (26.06 VS 26.14).

**4. Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose**