Effect of Vitamin C dose and delivery method on guinea pig tooth growth

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Synopsis

Load some libraries

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following object is masked from '.startup':
##
##     n

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(ggplot2)
```

Exploratory Data Analysis

Let's first load the data and get some basic information from the data set. We also transform the dose variable to a factor, which will be easier to use later on.

```
df <- ToothGrowth
df <- df %>%
    mutate(dose = as.factor(dose)) %>%
    rename(delivery = supp)
str(df)
```

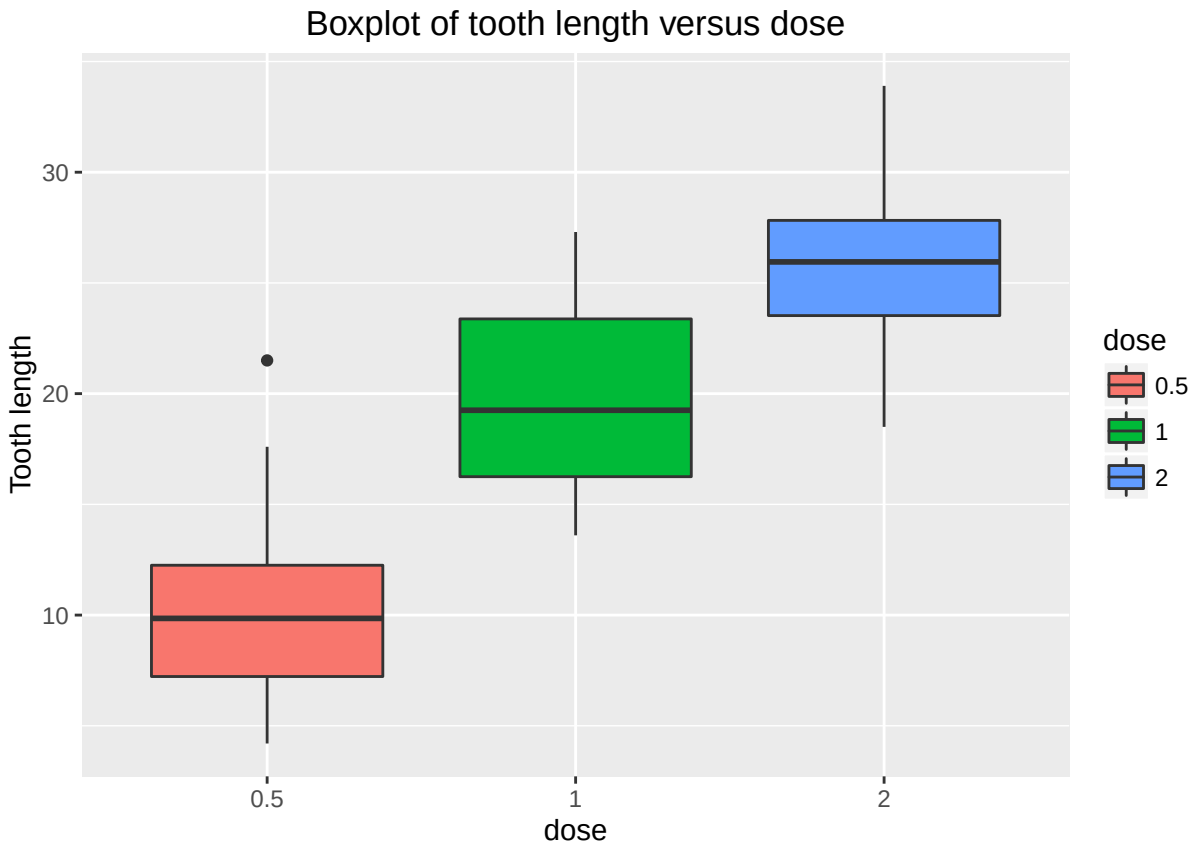
```
## 'data.frame':    60 obs. of  3 variables:
##  $ len     : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ delivery: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose    : Factor w/ 3 levels "0.5","1","2": 1 1 1 1 1 1 1 1 1 1 ...
```

We are looking at 60 observations of tooth length where there are 2 delivery methods (orange juice (OJ) and ascorbic acid (VC)) and 3 dose levels (0.5, 1, 2).

Visualisation of the effect of the dose amount on tooth growth

As shown in this figure, there might be an effect of the dose amount on the tooth growth. We will explore this in more detail later.

```
ggplot(data=df, aes(x=dose,y=len)) +
    geom_boxplot(aes(fill=dose)) +
    labs(x = "dose",
         y="Tooth length",
         title="Boxplot of tooth length versus dose");
```



Visualisation of the effect of the delivery method on tooth growth

As shown in this figure, there does not seem to be much of an effect of the delivery method on tooth growth. We will explore this in more detail later.

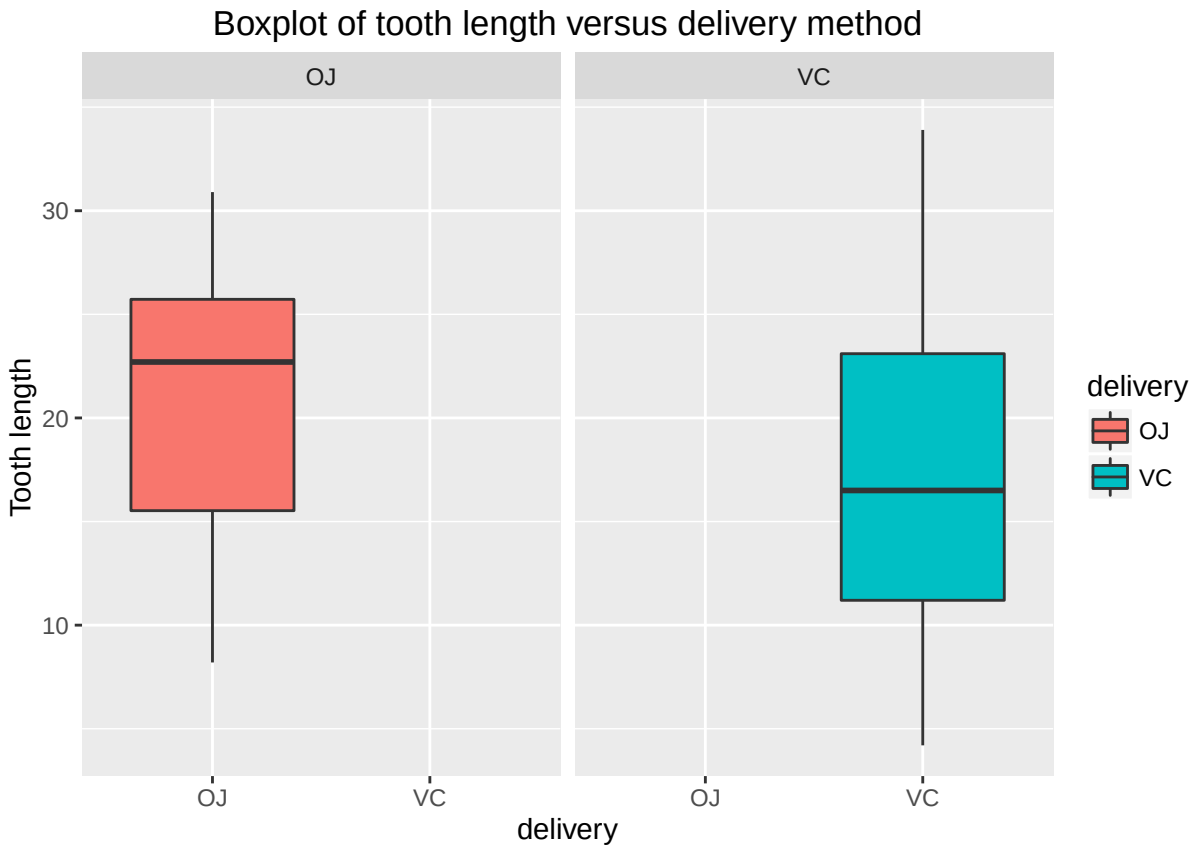
```
ggplot(data=df, aes(x=delivery,y=len)) +
    geom_boxplot(aes(fill=delivery)) +
    labs(x = "delivery",
         y="Tooth length",
         title="Boxplot of tooth length versus delivery method");
```

##

Visualisation of the effect of dose and the delivery method on tooth growth

For each delivery method, let's look at the effect of the dose on the tooth growth.

```
ggplot(data=df, aes(x=delivery,y=len)) +
    geom_boxplot(aes(fill=delivery)) + facet_wrap(~ delivery) +
    labs(x = "delivery",
         y="Tooth length",
         title="Boxplot of tooth length versus delivery method");
```



Questions and Key Assumptions

Our analysis will seek to answer two questions:

1. Does the dose amount change the tooth growth?
2. Does the delivery method change the tooth growth?

For our analysis to hold, we make the following key assumptions about the data:

-

Hypothesis Tests

Does the dose amount change the tooth growth?

Does the delivery method change the tooth growth?

The null hypothesis is that the delivery method does not affect the tooth growth. The alternative then is that the delivery method does affect the tooth growth. We perform hypothesis testing to see if we can reject the null hypothesis.

Conclusions

Appendix