

# Tooth Growth Analysis

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## Overview

THE TOOTHGROWTH DATA<sup>1</sup> consists of measurements of the mean length of the odontoblast cells harvested from 60 guinea pigs. These animals were fed a diet of 6 Vitamin C supplements. The Vitamin C was administered either in the form of Orange Juice (OJ) or chemically pure Vitamin C (VC). Each animal received the same daily dosage of Vitamin C consistently.

This study performs an exploration of this data. The goal of the exploration is to see if we can reasonably infer that either the method of administering vitamin C or the dosage has an impact on the size of odontoblast cells.

## Loading and preparing data

For starters, let's run a summary of ToothGrowth to see what the contents of the dataset are.

	len	supp	dose
1	Min. : 4.20	OJ:30	Min. :0.500
2	1st Qu.:13.07	VC:30	1st Qu.:0.500
3	Median :19.25		Median :1.000
4	Mean :18.81		Mean :1.167
5	3rd Qu.:25.27		3rd Qu.:2.000
6	Max. :33.90		Max. :2.000

<sup>1</sup> Source: C. I. Bliss (1952) The Statistics of Bioassay. Academic Press.

Table 1: ToothGrowth Summary

And true to the data description, we can see that there are 60 observations with two supplements and three dosages.

From this quick analysis we can determine that there are two qualitative variables, the supplement and dosage (supp and dose). And there is one quantitative variable; len. Finally, let's compute some descriptive statistics on the quantitative variable.

	mean	var
1	18.81	58.51

## Data discovery

Plotting ToothGrowth data to have a quick overview.

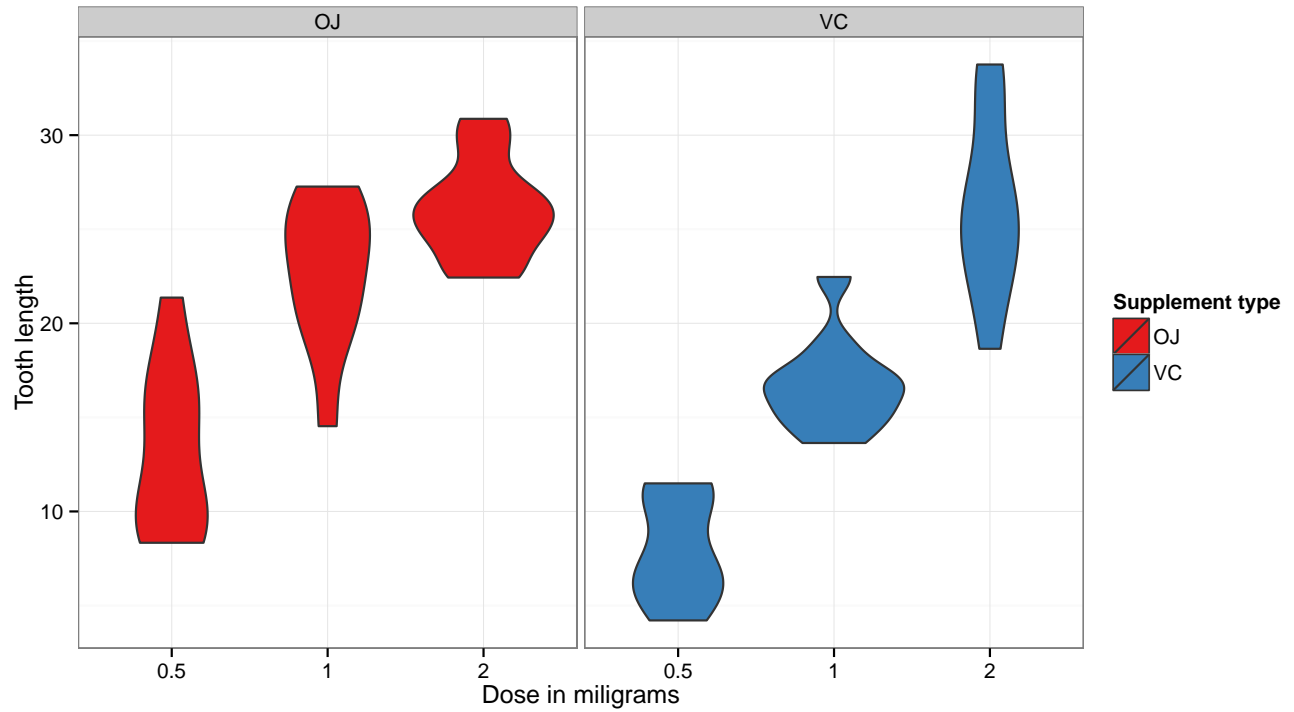


Figure 1: Data overview

Since intervals are not intersect, we could say that there are significant difference in tooth length depends on dosage. We could even build a linear model to describe this dependence, but not there is no need to do it for that assessment. The figure above seems to indicate that the dosage is the most important factor in determining the cell size. This assumption is based on the means for both OJ and VC being 26 microns when the dosage is 2.0.

### Testing delivery methods

Now our aim is to test how tooth length depends on dosage and delivery method. Is there any significant difference between these methods? For every dosage t-test has been done there.

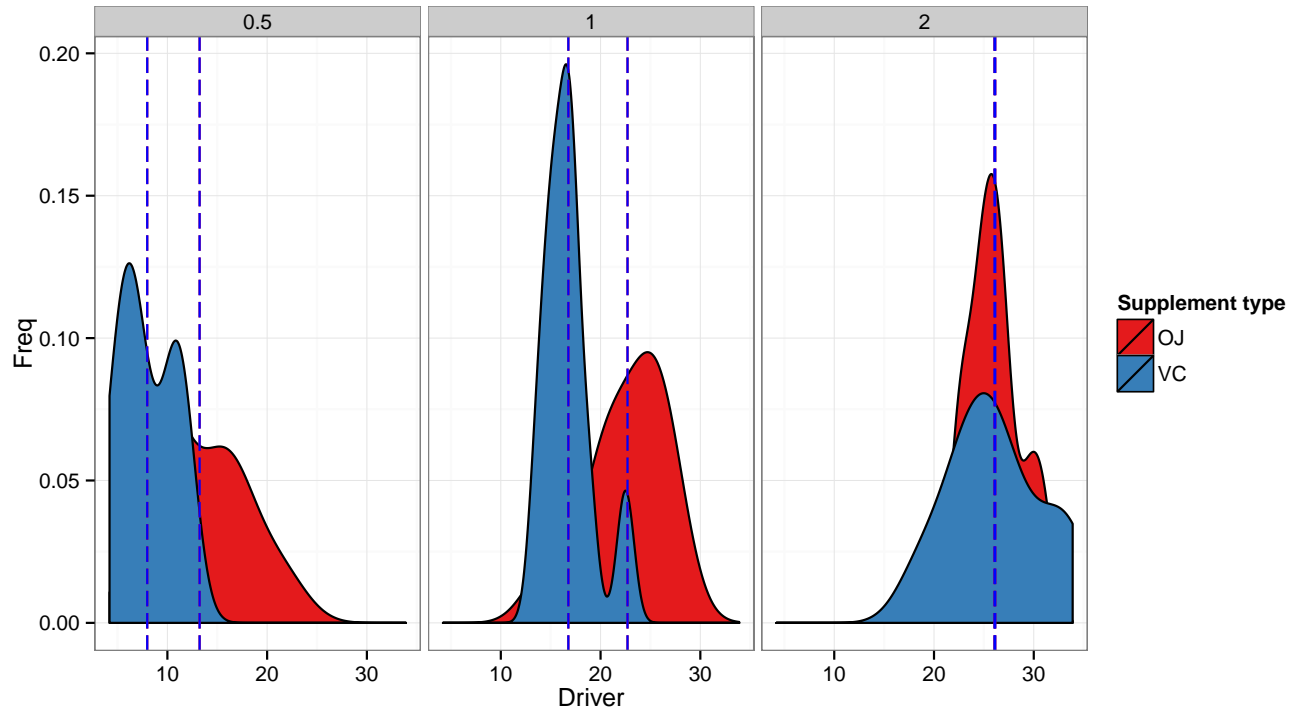


Figure 2: Data overview

```
## [1] "p-Value for dosage 0.5 equals to 0.01."
## [1] "p-Value for dosage 1 equals to 0."
## [1] "p-Value for dosage 2 equals to 0.96."
```

### Assumptions and Conclusions

We can conclude from this analysis that some types of therapies produces better results in growing cells in the teeth of guinea pigs. We have seen that with 95% certainty that administering 2.0ml of vitamin C results in better cell growth than the average. In fact, we see that in general it is better to administer the vitamins in orange juice as the vitamins can be given at 1.0ml or 2.0. It should be noted, that there is a fundamental assumption in this experiment. That is, the vitamin C promotes odontoblast cell growth. There was no control group data, that is, guinea pigs that were give no vitamin C. Therefore the conclusions here are drawn specifically on orange juice vs pure vitamin; and at very specific levels.