Toothgrowth

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Overview

This project compared the effects of OJ and VC on the tooth growth in guinea pigs, I did a brief summary
with mean and quantile, also a bar plot to show the difference. At last, I did t test to see if the differences
are significant or not with t.test().

Load library

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

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

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

Load data and do a brief summary

plot the comparison of tooth lengths between the two supplements according to different dosage

```
data("ToothGrowth")
dim(ToothGrowth)
```

```
## [1] 60  3
```

```
str(ToothGrowth)
```

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

```
ToothGrowth %>% group_by(supp) %>%
        summarise(mean = mean(len), quantile = quantile(len, probs = seq(0, 1, 0.25)))
```

```
## 'summarise()' regrouping output by 'supp' (override with '.groups' argument)
```

```
## # A tibble: 10 x 3
## # Groups:   supp [2]
##    supp   mean quantile
##    <fct> <dbl>    <dbl>
##  1 OJ     20.7      8.2
##  2 OJ     20.7     15.5
##  3 OJ     20.7     22.7
##  4 OJ     20.7     25.7
##  5 OJ     20.7     30.9
##  6 VC     17.0      4.2
##  7 VC     17.0     11.2
##  8 VC     17.0     16.5
##  9 VC     17.0     23.1
## 10 VC     17.0     33.9
```

```r
ggplot(data = ToothGrowth, aes(x = supp, y = len, fill = as.factor(supp))) +
        geom_bar(stat = "identity") +
        facet_grid(. ~ as.factor(dose)) +
        labs(x = "Supplement", y = "Tooth Length",
            title = "The Effect of Supplements on Tooth Growth in Guinea Pigs") +
        theme(plot.title = element_text(hjust = 0.5)) +
        scale_fill_discrete(name = "Dosage (mg/day)")
```
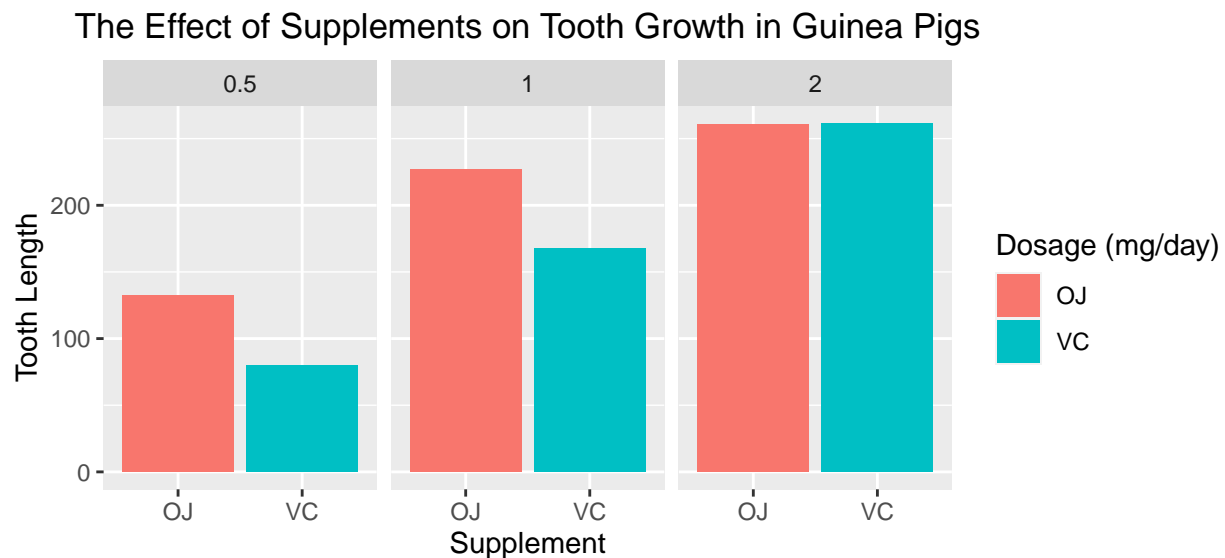

simple t test

```r
# test the overall effect between the 2 supplements
# hypothesis is: there's no difference on the
# effect of tooth growth between the 2 supplements
options(width = 60)
test1 <- t.test(len ~ supp, data = ToothGrowth)
test1$conf.int
```

```
## [1] -0.1710156  7.5710156
## attr(,"conf.level")
## [1] 0.95
```

```r
cat(paste(c("The 95% confidence interval is ", format(test1$conf.int[1],
    digits = 4), " ", format(test1$conf.int[2], digits = 4),
    " that includes 0, so there's no significant difference
          between the two supplements on tooth growth."),
    sep = "", collapse = ""))
```

```
## The 95% confidence interval is -0.171 7.571 that includes 0, so there's no significant difference
##              between the two supplements on tooth growth.
```

```r
# test the effect between the 2 supplements
# according to dosage hypothesis is: there's no
# difference on the effect of tooth growth between
# the 2 supplements with dosage as 0.5, 1, 2
test2 <- t.test(len ~ supp, data = subset(ToothGrowth,
    dose == 0.5))
test3 <- t.test(len ~ supp, data = subset(ToothGrowth,
    dose == 1))
test4 <- t.test(len ~ supp, data = subset(ToothGrowth,
    dose == 2))
cat(paste(c("The p value of t test for the dosage 0.5, 1, 2 are ",
    format(test2$p.value, digits = 4), " ", format(test3$p.value,
        digits = 4), " ", format(test4$p.value, digits = 4),
    " \nrespectively.", " We could see that low dosage of OJ is better thant VC, and the difference
          is significant; but for high dosage there's no significant difference."),
    sep = "", collapse = ""))
```

```
## The p value of t test for the dosage 0.5, 1, 2 are 0.006359 0.001038 0.9639
## respectively. We could see that low dosage of OJ is better thant VC, and the difference
##              is significant; but for high dosage there's no significant difference.
```

Conclusion

The overall effect of OJ and VC on tooth growth are not different; however, when considering different dosage, OJ showed better effect than VC on tooth growth on lower dosage (0.5 and 1), but there's no difference on high dosage (2).