Statistical Inference Course Project Part 2

Intoduction

In this paper we study response in the length of odontoblasts (teeth) in each of 10 guinea pigs to two delivery methods (orange juice or ascorbic acid).

First of all, load dataset and compute quick summary.

```
data(ToothGrowth)
summary(ToothGrowth)
```

```
##       len       supp         dose
##  Min.   : 4.2   OJ:30   Min.   :0.50
##  1st Qu.:13.1   VC:30   1st Qu.:0.50
##  Median :19.2           Median :1.00
##  Mean   :18.8           Mean   :1.17
##  3rd Qu.:25.3           3rd Qu.:2.00
##  Max.   :33.9           Max.   :2.00
```

Analysis

We can suppose form Appendix, Fig. 1 that with bigger dose of vitamin C tooth grows faster. Another hypothesis that supplement type OJ also leads to faster tooth grows.

We will use t-test it's rather robust method and samples with 20-30 cases in group are sufficient for analithis.

First let's check hypothesis about supplement type with independent t-test:

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = 1.915, df = 55.31, p-value = 0.06063
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.171  7.571
## sample estimates:
## mean in group OJ mean in group VC
##            20.66            16.96
```

P-value slightly greater than 0.05, 95% confidence interval includes zero, so at 95% level there is no difference in tooth length between different supplement type. If we will consider this problem with 90% level there is a difference exists in tooth length.

Now we check difference between doses. It will be better to use ANOVA or regression but in this assignment we are limited to t-test.

```
t.test(len ~ dose,data=ToothGrowth,subset = dose %in% c(0.5,1)) # test  between dose 0.5 and 1
```

```
##
##  Welch Two Sample t-test
```

```
##
## data:  len by dose
## t = -6.477, df = 37.99, p-value = 1.268e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.984  -6.276
## sample estimates:
## mean in group 0.5   mean in group 1
##             10.61             19.73
```

```
t.test(len ~ dose,data=ToothGrowth,subset = dose %in% c(1,2)) # test  between dose 1 and 2
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -4.901, df = 37.1, p-value = 1.906e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -8.996 -3.734
## sample estimates:
## mean in group 1 mean in group 2
##           19.73           26.10
```

```
t.test(len ~ dose,data=ToothGrowth,subset = dose %in% c(0.5,2)) # test  between dose 0.5 and 2
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -11.8, df = 36.88, p-value = 4.398e-14
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -18.16 -12.83
## sample estimates:
## mean in group 0.5   mean in group 2
##             10.61             26.10
```

P-value is far less than 0.05 so there is significant differences between tooth lens in groups with different doses. P-value is so small that even with multiple comparisons adjustments (such as Bonferroni adjustment) there will be significant difference.

Conclusion

There is significant difference in the tooth length between groups with different doses of vitamin C (bigger dose - tooth length higher). But supplement type doesn't has strong influence on tooth growth.

Appendix

```r
par(mfrow=c(1,2))
boxplot(len ~ supp, data=ToothGrowth,xlab="Supplement type", ylab="Tooth length", main="Fig 1a. Tooth l
boxplot(len ~ dose, data=ToothGrowth,xlab="Dose in milligrams", ylab="Tooth length", main="Fig 1b. Toot
```

Fig 1a. Tooth length vs supplement

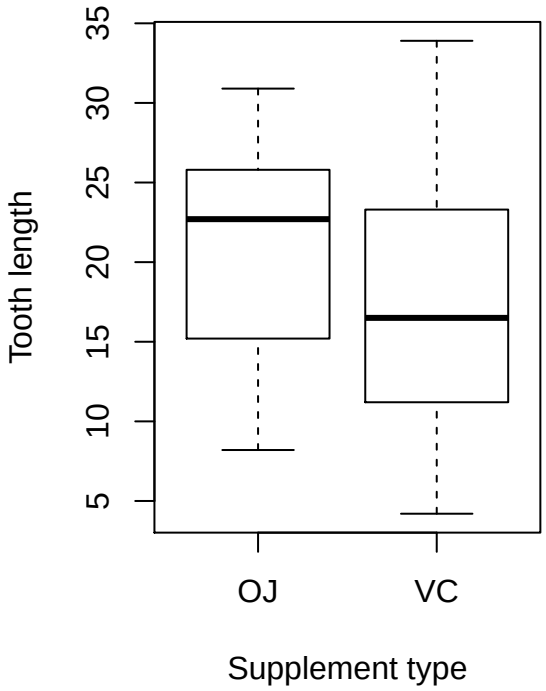

Fig 1b. Tooth length vs dose