Effects of Vitamin C on Tooth Growth in Guinea Pigs

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Overview

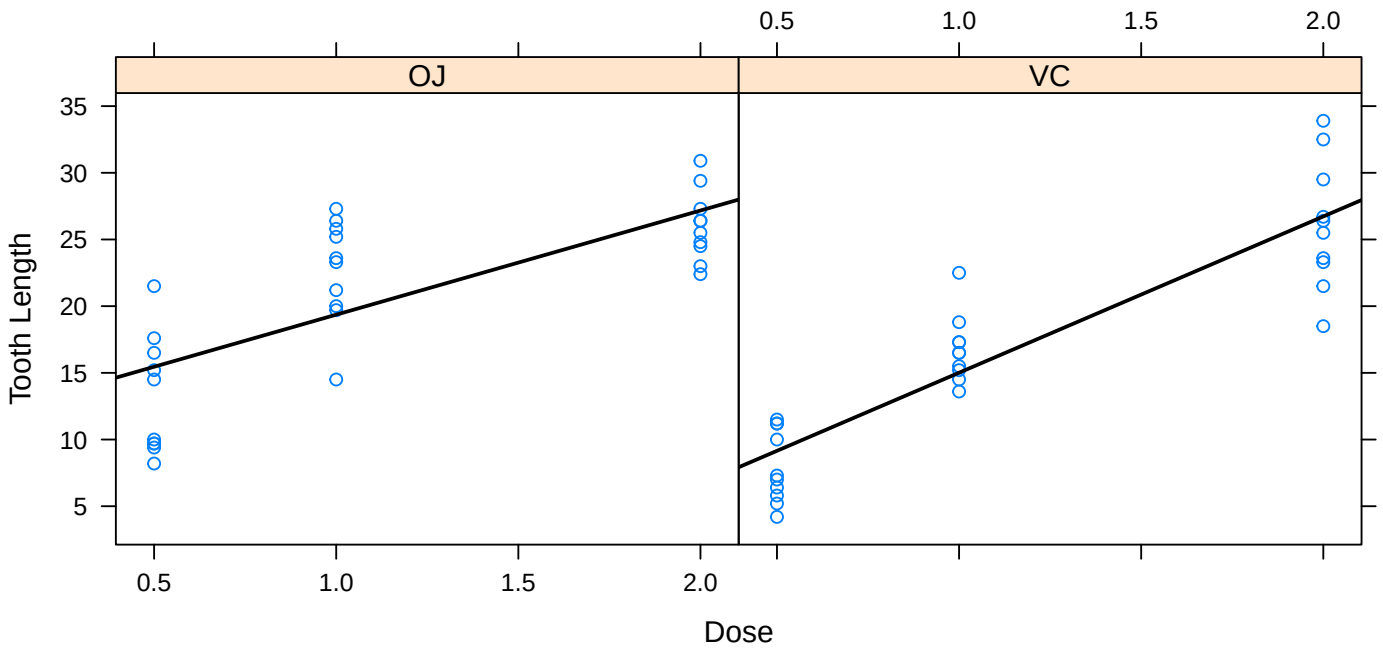
The aim of this paper is to determine how vitamin C affects the overall tooth length in a randomized guinea pig population. Within the report the effects of delivery (supplement) and dosage will be reviewed.

Data

The data for this analysis can be found in the r datasets library under ToothGrowth. Once loaded, the data can be parsed for easier calculation. Code 1

- 2 groups for supplement
- 3 groups for each combination of dosage pairs

A quick summary of the ToothGrowth data set reveals a collection of two distinct groups of sample data based on the type of supplement used. Both these groups indicate a general increase in guinea pig tooth length as the supplement dosage increase. Code 2



Tooth Growth Analysis

For the purposes of this analysis the interest is whether there is a significant difference between dosage amounts or supplement type. For each, confidence intervals will be calculated to numerically view if the null hypothesis can be rejected.

Suppliment:

Looking only at which supplement was used to deliver vitamin C to the guinea pigs the confidence interval indicates that there is not a significant difference between methods. Code 3

Comparisons	Lower Limit	Upper Limit
Suppliment	-0.171	7.571

Dosage:

Ignoring the delivery system (Supplement) the effectiveness can be analyzed by comparing the effectiveness of each group by the others. Code 4

- Group1: Dose 0.5 vs 1.0
- Group1: Dose 1.0 vs 2.0
- Group1: Dose 0.5 vs 2.0

Comparisons	Lower Limit	Upper Limit
Dose 1-2	-11.984	-6.276
Dose 2-3	-8.996	-3.734
Dose 1-3	-18.156	-12.834

Here with in each coupling there is a significant difference between lower dosages and higher ones indicated by the confidence interval residing wholly in the negative region.

Conclusions

- There is no distinctive difference between supplement provided the subjects
- Dosage level increase leads to a significant increase in tooth length

Assumptions

- A random sampling of physically similar guinea pigs were used
- Measurements were taken from independent populations (unpaired)
- The variance between each test group is different

Appendix:

c01 Import and Parse Dataset:

```
library(datasets)
library(lattice)

data("ToothGrowth")
tg <- ToothGrowth
rm(ToothGrowth)
oj <- subset(tg, supp=="OJ")
vc <- subset(tg, supp=="VC")
d12 <- subset(tg, dose %in% c(0.5, 1.0))
d23 <- subset(tg, dose %in% c(1.0, 2.0))
d13 <- subset(tg, dose %in% c(0.5, 2.0))
```

c02 Exploritory lattice:

```
xyplot(tg$len ~ tg$dose | tg$supp,xlab = "Dose",ylab = "Tooth Length", panel = function(x,y,...) {
    panel.xyplot(x,y,...)
    panel.lmline(x,y,col=1,lwd=2)
  })
```

c03 Tabulate confidence intervals (Supplement):

```
library(knitr)
suppCI <- cbind(data.frame("Comparisons"=c("Suppliment")),rbind(
  t.test(len ~ supp, paired = FALSE, var.equal = FALSE, data = tg)$conf
)
)
names(suppCI) <- c("Comparisons","Lower Limit","Upper Limit")
kable(suppCI,digits=3)
```

c04 Tabulate confidence intervals (Dosage):

```
library(knitr)
doseCI <- cbind(data.frame("Comparisons"=c("Dose 1-2","Dose 2-3","Dose 1-3")),rbind(
  t.test(len ~ dose, paired = FALSE, var.equal = FALSE, data = d12)$conf,
  t.test(len ~ dose, paired = FALSE, var.equal = FALSE, data = d23)$conf,
  t.test(len ~ dose, paired = FALSE, var.equal = FALSE, data = d13)$conf
)
)
names(doseCI) <- c("Comparisons","Lower Limit","Upper Limit")
kable(doseCI,digits=3)
```