Stat 425 Project #3

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DATA

```
eData=read.csv(file="dietox.csv")
```

Data cleaning

```
pig_id <- unique(eData$Pig) # 72 pigs among 24 litters -- pigs per litter better be 3!!!

weight_change=c(1:72)
vitamineE=c(1:72)
copper=c(1:72)

for (val in 1:72) {
weight_change[val] <- eData$Weight[eData$Pig==pig_id[val] & eData$Time==11]-eData$Start[eData$Pig==pig_
vitamineE[val] <- eData$Evit[eData$Pig==pig_id[val] & eData$Time==11]
copper[val] <- eData$Cu[eData$Pig==pig_id[val] & eData$Time==11]
}

vitamineE <- as.factor(vitamineE)
copper <- as.factor(copper)

##THE ONLY DATA THAT IS MEANINGFUL TO THE EXPERIMENT ARE VITAMINE E AND COPPER

#making sure data looks good, it looks fine here
new.Data=data.frame(vitamineE,copper,weight_change)
new.Data
```

```
##    vitamineE copper weight_change
## 1    Evit000  Cu000      65.09998
## 2    Evit000  Cu035      71.39996
## 3    Evit200  Cu175      70.79997
## 4    Evit100  Cu035      70.50000
## 5    Evit100  Cu175      81.29997
## 6    Evit000  Cu000      64.79999
## 7    Evit200  Cu035      69.09999
## 8    Evit200  Cu000      66.00000
## 9    Evit000  Cu000      64.79996
## 10   Evit200  Cu035      66.79997
```

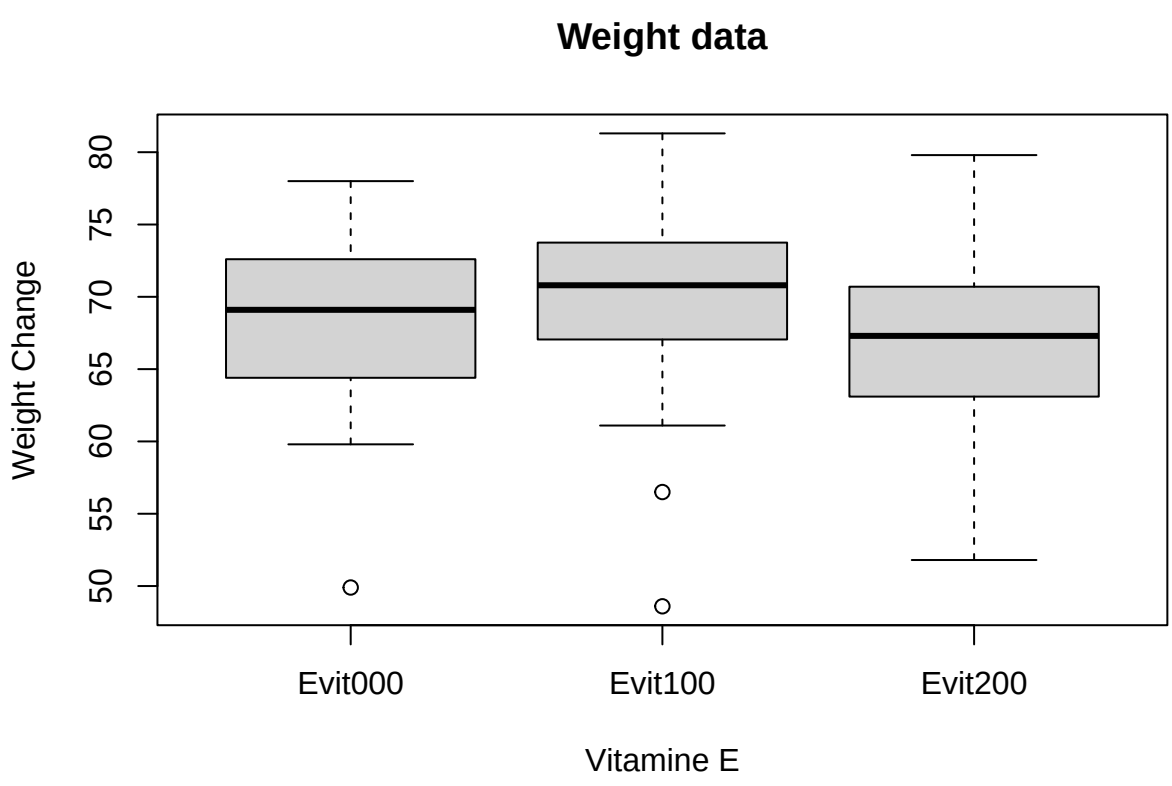
```
## 11   Evit000  Cu175      49.89996
## 12   Evit000  Cu035      64.09997
## 13   Evit100  Cu035      67.19996
## 14   Evit100  Cu175      70.10001
## 15   Evit000  Cu175      74.20000
## 16   Evit100  Cu000      56.50000
## 17   Evit000  Cu000      69.09998
## 18   Evit000  Cu175      64.59998
## 19   Evit100  Cu035      69.39996
## 20   Evit200  Cu175      63.20001
## 21   Evit200  Cu035      56.79997
## 22   Evit000  Cu000      72.59999
## 23   Evit000  Cu035      61.29999
## 24   Evit100  Cu175      72.00000
## 25   Evit200  Cu000      66.79997
## 26   Evit100  Cu000      61.10001
## 27   Evit100  Cu175      64.29997
## 28   Evit200  Cu000      68.50000
## 29   Evit100  Cu175      76.90001
## 30   Evit200  Cu000      73.00000
## 31   Evit200  Cu175      65.50000
## 32   Evit200  Cu000      63.09997
## 33   Evit200  Cu175      70.70001
## 34   Evit000  Cu000      78.00000
## 35   Evit000  Cu035      61.19995
## 36   Evit200  Cu035      62.50000
## 37   Evit100  Cu175      61.79999
## 38   Evit200  Cu035      68.49995
## 39   Evit200  Cu175      79.79999
## 40   Evit100  Cu175      76.00000
## 41   Evit100  Cu000      73.10001
## 42   Evit200  Cu000      67.29997
## 43   Evit000  Cu035      69.59997
## 44   Evit100  Cu000      72.39996
## 45   Evit100  Cu000      66.90001
## 46   Evit000  Cu000      71.89996
## 47   Evit200  Cu035      69.20000
## 48   Evit100  Cu175      74.40000
## 49   Evit100  Cu035      77.29997
## 50   Evit100  Cu000      78.90000
## 51   Evit200  Cu035      71.69996
## 52   Evit100  Cu000      70.49995
## 53   Evit200  Cu000      74.39996
## 54   Evit000  Cu035      65.19995
## 55   Evit000  Cu175      74.20001
## 56   Evit100  Cu035      71.29997
## 57   Evit200  Cu175      74.40000
## 58   Evit000  Cu175      59.79999
## 59   Evit200  Cu035      60.99995
## 60   Evit000  Cu035      64.19996
## 61   Evit100  Cu035      48.59998
## 62   Evit100  Cu035      71.09996
## 63   Evit000  Cu175      72.60001
## 64   Evit200  Cu035      57.09997
```

```
## 65   Evit200  Cu000      55.20001
## 66   Evit200  Cu175      51.79997
## 67   Evit000  Cu175      74.30000
## 68   Evit100  Cu000      72.29999
## 69   Evit000  Cu035      77.50000
## 70   Evit100  Cu035      68.00000
## 71   Evit200  Cu175      67.70001
## 72   Evit000  Cu175      70.30000
```

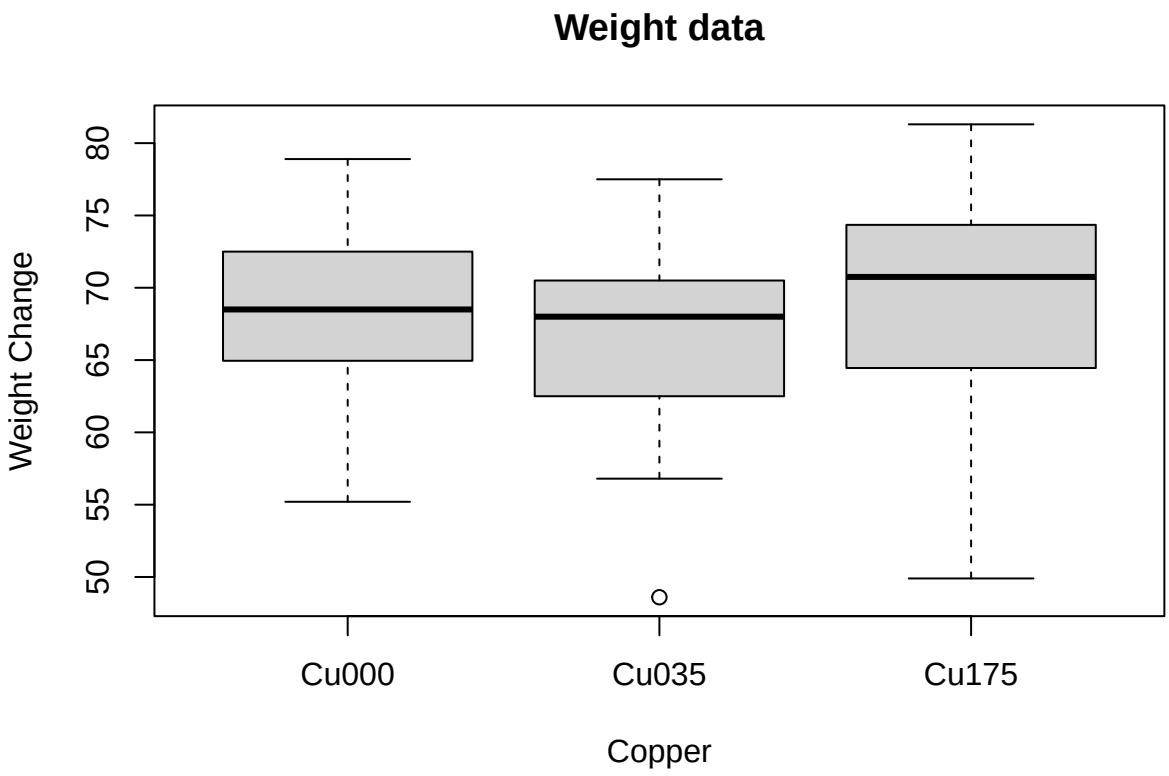
```
#Should we only look at the data when time=11 so we know how it affected them at
#the end of the experiment with the middle not really  mattering?

# time==1 - time==1
```

```
#Just graphing things out
boxplot(weight_change~vitamineE,data=eData,
        main="Weight data",
        xlab="Vitamine E",
        ylab="Weight Change")
```




```
boxplot(weight_change~copper,data=eData,
        main="Weight data",
        xlab="Copper",
        ylab="Weight Change")
```

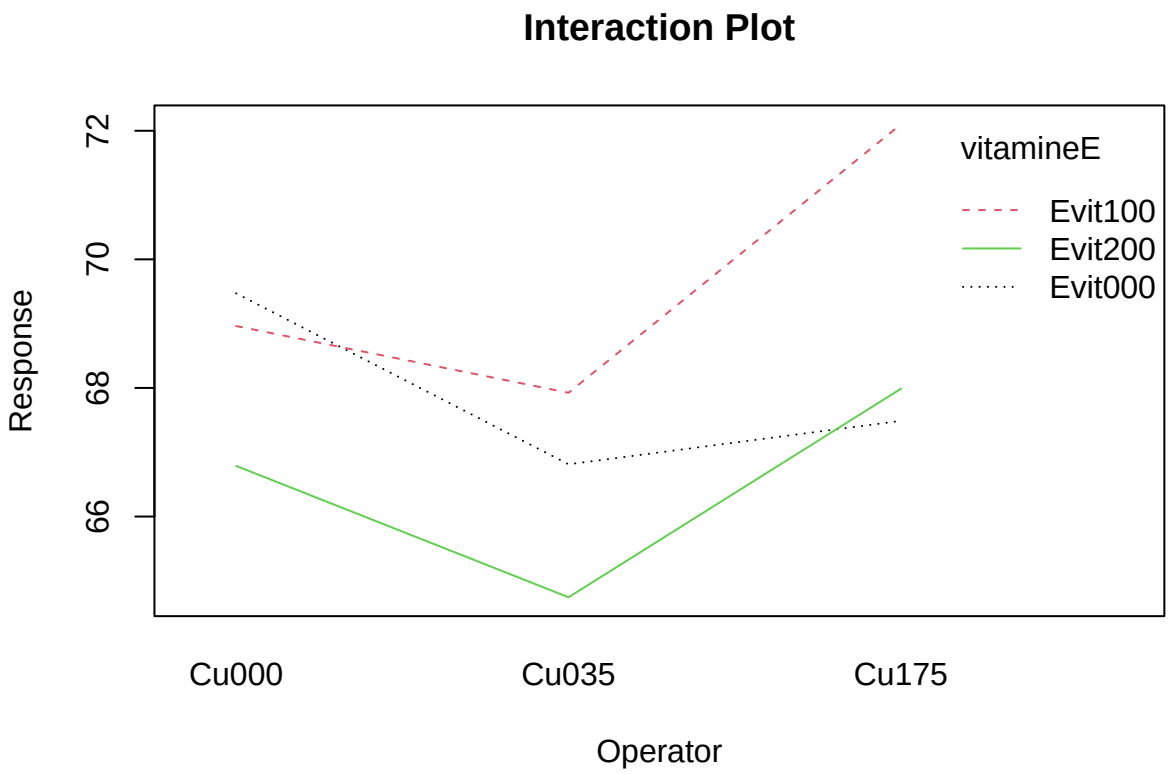



```
#ANOVA
weight.aov=aov(weight_change~vitamineE+copper+vitamineE:copper)
summary(weight.aov)
```

```
##                   Df Sum Sq Mean Sq F value Pr(>F)
## vitamineE          2  127.9   63.94   1.318  0.275
## copper             2   94.3   47.16   0.972  0.384
## vitamineE:copper   4   55.3   13.83   0.285  0.887
## Residuals         63 3055.7   48.50
```

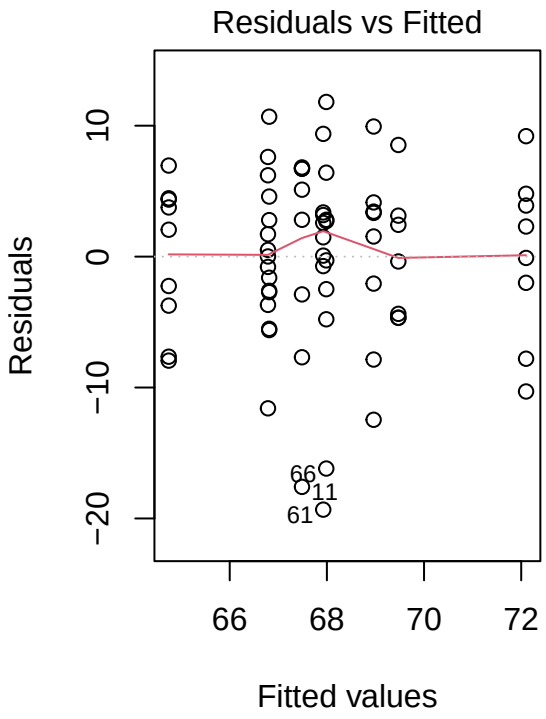
#Not much interaction?? Idk how this works lol

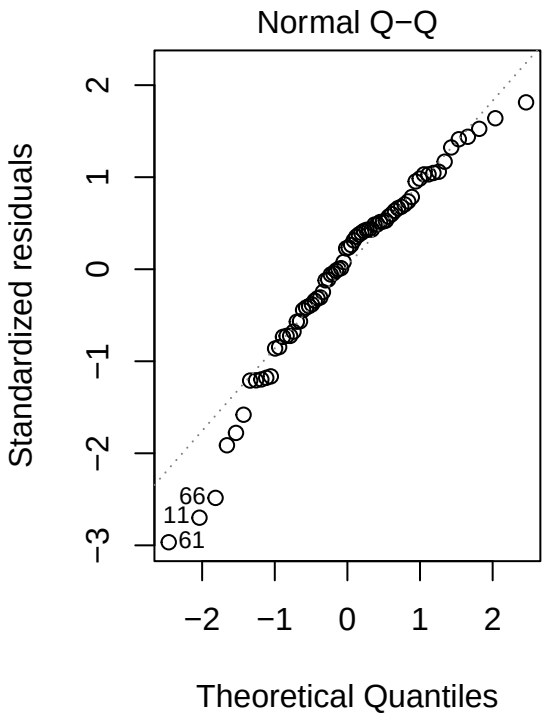
```
interaction.plot(x.factor=copper, trace.factor=vitamineE, response=weight_change,col=1:20,
                 xlab="Operator",
                 ylab="Response",
                 main="Interaction Plot")
```



#Seems to meet asumptions well enough

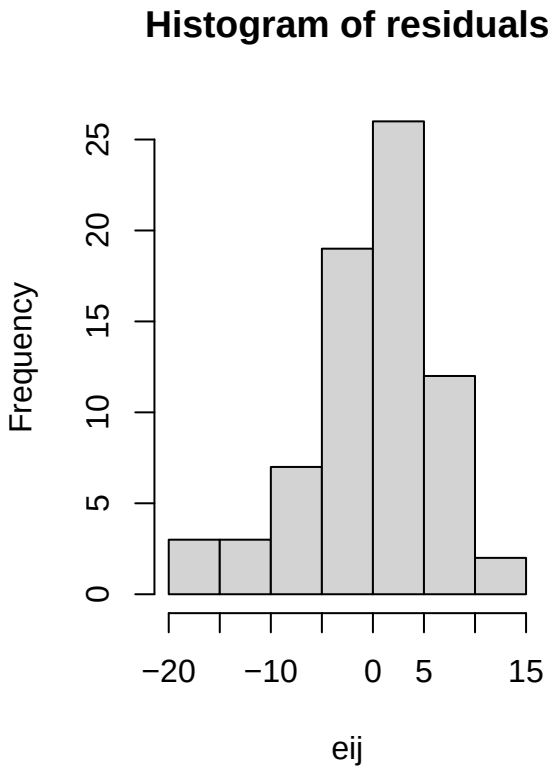
```
par(mfrow=c(1,2))
plot(weight.aov, 1:2)
```

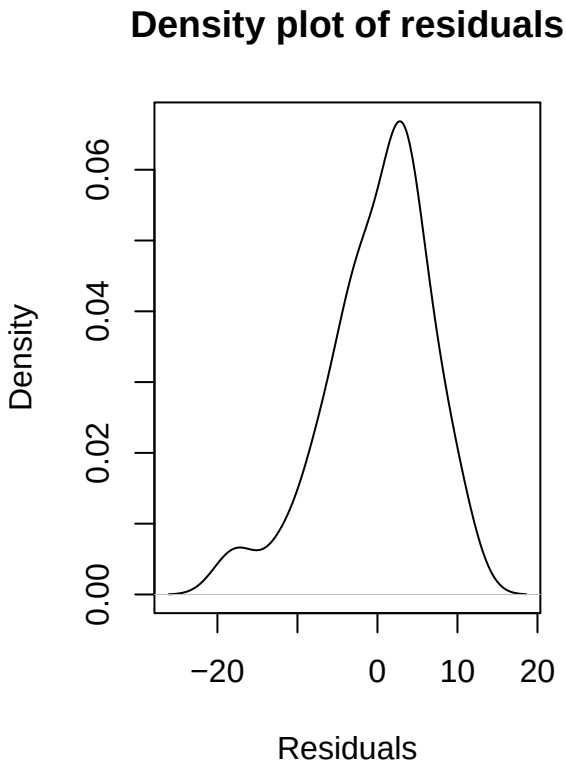




#Looks to be skewed

```
par(mfrow=c(1,2))
eij=residuals(weight.aov)
hist(eij,main="Histogram of residuals")
plot(density(eij),main="Density plot of residuals",ylab="Density",xlab="Residuals")
```





#shows data is normally distributed

```
shapiro.test(weight_change)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  weight_change
## W = 0.96921, p-value = 0.07455
```

#Equal variances holds

```
library(DescTools)
```

```
## Warning: package 'DescTools' was built under R version 4.1.2
```

```
LeveneTest(weight_change~vitamineE, data=eData)
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##       Df F value Pr(>F)
## group  2  0.0479 0.9533
##       69
```

```r
LeveneTest(weight_change~copper, data=eData)
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##       Df F value Pr(>F)
## group  2  0.4773 0.6225
##       69
```

#1 difference in mean which is contradictory to our ANOVA

```r
PostHocTest(weight.aov, method="lsd")
```

```
##
##   Posthoc multiple comparisons of means : Fisher LSD
##     95% family-wise confidence level
##
## $vitamineE
##                       diff    lwr.ci    upr.ci   pval
## Evit100-Evit000  1.805984 -2.255043 5.8670115 0.3776
## Evit200-Evit000 -1.420519 -5.441603 2.6005662 0.4828
## Evit200-Evit100 -3.226503 -7.203717 0.7507113 0.1100
##
## $copper
##                    diff    lwr.ci   upr.ci   pval
## Cu035-Cu000 -1.8693361 -5.890421 2.151749 0.3564
## Cu175-Cu000  0.8363921 -3.224635 4.897420 0.6821
## Cu175-Cu035  2.7057281 -1.271486 6.682942 0.1788
##
## $`vitamineE:copper`
##                                       diff      lwr.ci    upr.ci   pval
## Evit100:Cu000-Evit000:Cu000 -0.50891732  -7.7118301  6.693995 0.8882
## Evit200:Cu000-Evit000:Cu000 -2.68392357  -9.8868363  4.518989 0.4593
## Evit000:Cu035-Evit000:Cu000 -2.65893982  -9.8618526  4.543973 0.4634
## Evit100:Cu035-Evit000:Cu000 -1.54643357  -8.7493463  5.656479 0.6694
## Evit200:Cu035-Evit000:Cu000 -4.72699079 -11.7406758  2.286694 0.1829
## Evit000:Cu175-Evit000:Cu000 -1.98391482  -9.1868276  5.218998 0.5840
## Evit100:Cu175-Evit000:Cu000  2.62858518  -4.5743276  9.831498 0.4685
## Evit200:Cu175-Evit000:Cu000 -1.48391357  -8.6868263  5.718999 0.6820
## Evit200:Cu000-Evit100:Cu000 -2.17500625  -9.1336811  4.783669 0.5345
## Evit000:Cu035-Evit100:Cu000 -2.15002250  -9.1086973  4.808652 0.5392
## Evit100:Cu035-Evit100:Cu000 -1.03751625  -7.9961911  5.921159 0.7667
## Evit200:Cu035-Evit100:Cu000 -4.21807347 -10.9806898  2.544543 0.2172
## Evit000:Cu175-Evit100:Cu000 -1.47499750  -8.4336723  5.483677 0.6733
## Evit100:Cu175-Evit100:Cu000  3.13750250  -3.8211723 10.096177 0.3710
## Evit200:Cu175-Evit100:Cu000 -0.97499625  -7.9336711  5.983679 0.7804
## Evit000:Cu035-Evit200:Cu000  0.02498375  -6.9336911  6.983659 0.9943
## Evit100:Cu035-Evit200:Cu000  1.13749000  -5.8211848  8.096165 0.7450
## Evit200:Cu035-Evit200:Cu000 -2.04306722  -8.8056836  4.719549 0.5482
## Evit000:Cu175-Evit200:Cu000  0.70000875  -6.2586661  7.658684 0.8413
## Evit100:Cu175-Evit200:Cu000  5.31250875  -1.6461661 12.271184 0.1321
## Evit200:Cu175-Evit200:Cu000  1.20001000  -5.7586648  8.158685 0.7315
## Evit100:Cu035-Evit000:Cu035  1.11250625  -5.8461686  8.071181 0.7504
## Evit200:Cu035-Evit000:Cu035 -2.06805097  -8.8306673  4.694565 0.5433
```

```
## Evit000:Cu175-Evit000:Cu035  0.67502500  -6.2836498  7.633700 0.8469
## Evit100:Cu175-Evit000:Cu035  5.28752500  -1.6711498 12.246200 0.1339
## Evit200:Cu175-Evit000:Cu035  1.17502625  -5.7836486  8.133701 0.7369
## Evit200:Cu035-Evit100:Cu035 -3.18055722  -9.9431736  3.582059 0.3509
## Evit000:Cu175-Evit100:Cu035 -0.43748125  -7.3961561  6.521194 0.9004
## Evit100:Cu175-Evit100:Cu035  4.17501875  -2.7836561 11.133694 0.2350
## Evit200:Cu175-Evit100:Cu035  0.06252000  -6.8961548  7.021195 0.9857
## Evit000:Cu175-Evit200:Cu035  2.74307597  -4.0195404  9.505692 0.4207
## Evit100:Cu175-Evit200:Cu035  7.35557597   0.5929596 14.118192 0.0335 *
## Evit200:Cu175-Evit200:Cu035  3.24307722  -3.5195391 10.005694 0.3416
## Evit100:Cu175-Evit000:Cu175  4.61250000  -2.3461748 11.571175 0.1901
## Evit200:Cu175-Evit000:Cu175  0.50000125  -6.4586736  7.458676 0.8863
## Evit200:Cu175-Evit100:Cu175 -4.11249875 -11.0711736  2.846176 0.2420
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

#No difference given Tukey HSD which supports our ANOVA

```
PostHocTest(weight.aov, method="hsd")
```

```
##
##   Posthoc multiple comparisons of means : Tukey HSD
##     95% family-wise confidence level
##
## $vitamineE
##                       diff    lwr.ci   upr.ci   pval
## Evit100-Evit000  1.805984 -3.071958 6.683926 0.6494
## Evit200-Evit000 -1.420519 -6.250483 3.409445 0.7609
## Evit200-Evit100 -3.226503 -8.003771 1.550766 0.2443
##
## $copper
##                    diff   lwr.ci   upr.ci   pval
## Cu035-Cu000 -1.8693361 -6.69930 2.960628 0.6241
## Cu175-Cu000  0.8363921 -4.04155 5.714334 0.9110
## Cu175-Cu035  2.7057281 -2.07154 7.482996 0.3682
##
## $`vitamineE:copper`
##                                      diff     lwr.ci    upr.ci   pval
## Evit100:Cu000-Evit000:Cu000 -0.50891732 -12.086478 11.068643 1.0000
## Evit200:Cu000-Evit000:Cu000 -2.68392357 -14.261484  8.893637 0.9979
## Evit000:Cu035-Evit000:Cu000 -2.65893982 -14.236501  8.918621 0.9980
## Evit100:Cu035-Evit000:Cu000 -1.54643357 -13.123994 10.031127 1.0000
## Evit200:Cu035-Evit000:Cu000 -4.72699079 -16.000397  6.546416 0.9128
## Evit000:Cu175-Evit000:Cu000 -1.98391482 -13.561476  9.593646 0.9998
## Evit100:Cu175-Evit000:Cu000  2.62858518  -8.948976 14.206146 0.9982
## Evit200:Cu175-Evit000:Cu000 -1.48391357 -13.061474 10.093647 1.0000
## Evit200:Cu000-Evit100:Cu000 -2.17500625 -13.359993  9.009980 0.9994
## Evit000:Cu035-Evit100:Cu000 -2.15002250 -13.335009  9.034964 0.9994
## Evit100:Cu035-Evit100:Cu000 -1.03751625 -12.222503 10.147470 1.0000
## Evit200:Cu035-Evit100:Cu000 -4.21807347 -15.087926  6.651779 0.9425
## Evit000:Cu175-Evit100:Cu000 -1.47499750 -12.659984  9.709989 1.0000
## Evit100:Cu175-Evit100:Cu000  3.13750250  -8.047484 14.322489 0.9921
```

```
## Evit200:Cu175-Evit100:Cu000 -0.97499625 -12.159983 10.209990 1.0000
## Evit000:Cu035-Evit200:Cu000  0.02498375 -11.160003 11.209970 1.0000
## Evit100:Cu035-Evit200:Cu000  1.13749000 -10.047496 12.322476 1.0000
## Evit200:Cu035-Evit200:Cu000 -2.04306722 -12.912920  8.826786 0.9995
## Evit000:Cu175-Evit200:Cu000  0.70000875 -10.484978 11.884995 1.0000
## Evit100:Cu175-Evit200:Cu000  5.31250875  -5.872478 16.497495 0.8392
## Evit200:Cu175-Evit200:Cu000  1.20001000  -9.984976 12.384996 1.0000
## Evit100:Cu035-Evit000:Cu035  1.11250625 -10.072480 12.297493 1.0000
## Evit200:Cu035-Evit000:Cu035 -2.06805097 -12.937904  8.801802 0.9995
## Evit000:Cu175-Evit000:Cu035  0.67502500 -10.509961 11.860011 1.0000
## Evit100:Cu175-Evit000:Cu035  5.28752500  -5.897461 16.472511 0.8427
## Evit200:Cu175-Evit000:Cu035  1.17502625 -10.009960 12.360013 1.0000
## Evit200:Cu035-Evit100:Cu035 -3.18055722 -14.050410  7.689296 0.9896
## Evit000:Cu175-Evit100:Cu035 -0.43748125 -11.622468 10.747505 1.0000
## Evit100:Cu175-Evit100:Cu035  4.17501875  -7.009968 15.360005 0.9538
## Evit200:Cu175-Evit100:Cu035  0.06252000 -11.122466 11.247506 1.0000
## Evit000:Cu175-Evit200:Cu035  2.74307597  -8.126777 13.612929 0.9962
## Evit100:Cu175-Evit200:Cu035  7.35557597  -3.514277 18.225429 0.4351
## Evit200:Cu175-Evit200:Cu035  3.24307722  -7.626776 14.112930 0.9882
## Evit100:Cu175-Evit000:Cu175  4.61250000  -6.572486 15.797486 0.9201
## Evit200:Cu175-Evit000:Cu175  0.50000125 -10.684985 11.684988 1.0000
## Evit200:Cu175-Evit100:Cu175 -4.11249875 -15.297485  7.072488 0.9576
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```