exemp531.R

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```
##########################################################################################
# Codigo R para analise do exemplo 5.2.1 (Singer&Nobre&Rocha2017)
###########################################################################################

library(car)
library(gdata)
```

```
## gdata: read.xls support for 'XLS' (Excel 97-2004) files ENABLED.

##

## gdata: read.xls support for 'XLSX' (Excel 2007+) files ENABLED.

##
## Attaching package: 'gdata'

## The following object is masked from 'package:stats':
##
##     nobs

## The following object is masked from 'package:utils':
##
##     object.size

## The following object is masked from 'package:base':
##
##     startsWith
```

```
library(lattice)
library(reshape)
library(ggplot2)
library(plyr)
```

```
##
## Attaching package: 'plyr'

## The following objects are masked from 'package:reshape':
##
##     rename, round_any
```

```
library(dplyr)
```

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

## The following objects are masked from 'package:plyr':
##
##     arrange, count, desc, failwith, id, mutate, rename, summarise,
##     summarize

## The following object is masked from 'package:reshape':
##
##     rename
```

```
## The following objects are masked from 'package:gdata':
##
##     combine, first, last
```

```
## The following object is masked from 'package:car':
##
##     recode
```

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

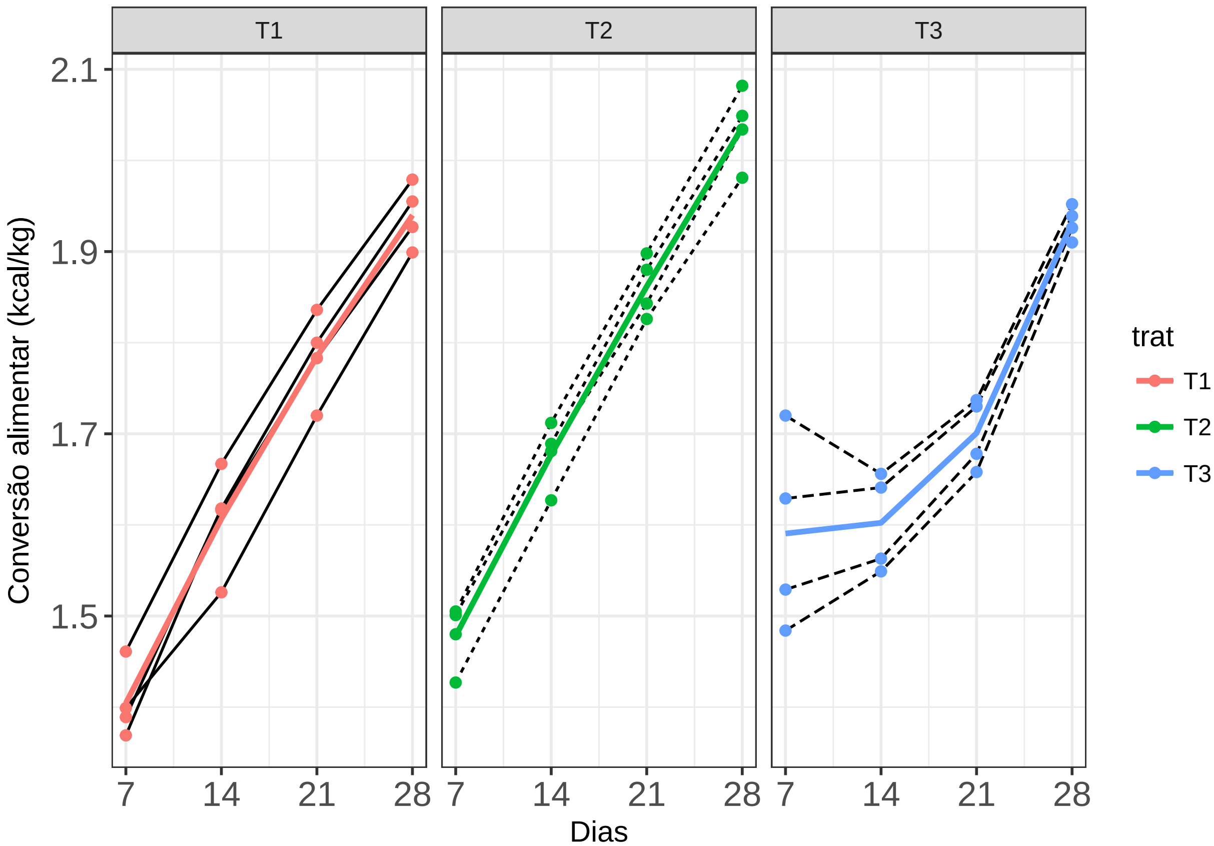
```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(polynom)
library(ez)



##############################################################################################
embrapa <- read.xls("/home/jmsinger/Desktop/exemp531.xls", sheet='Dados', method="tab")


embrapa.long <- reshape(embrapa, varying = c("dia7", "dia14", "dia21", "dia28"),  v.names="convalim",
                        idvar="id", timevar="dias", times=c(7, 14, 21, 28), new.row.names = 1:48, direc

embrapa.sort <- embrapa.long[order(embrapa.long$id),]
embrapa.sort
```

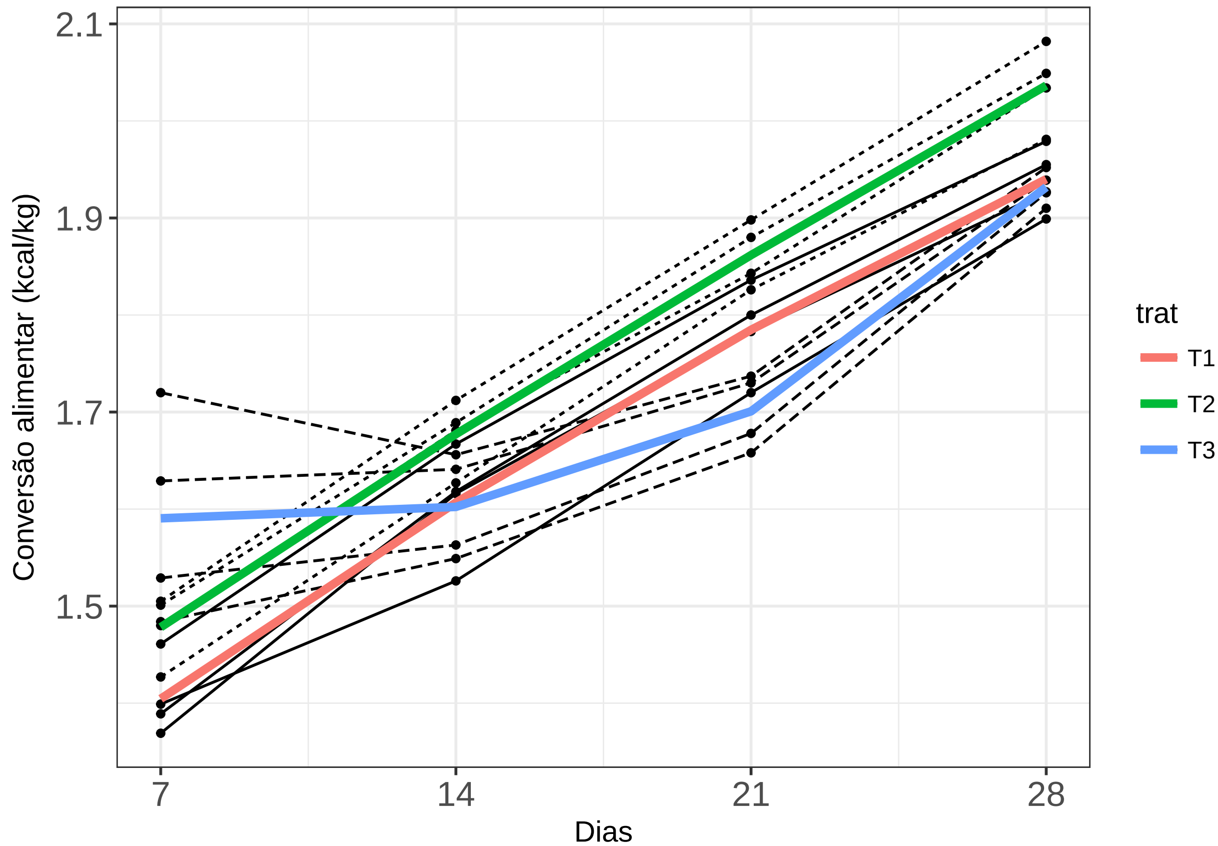
```
##    id trat dias convalim
## 1   1   T1    7    1.399
## 13  1   T1   14    1.526
## 25  1   T1   21    1.720
## 37  1   T1   28    1.899
## 2   2   T1    7    1.369
## 14  2   T1   14    1.616
## 26  2   T1   21    1.783
## 38  2   T1   28    1.927
## 3   3   T1    7    1.389
## 15  3   T1   14    1.618
## 27  3   T1   21    1.800
## 39  3   T1   28    1.955
## 4   4   T1    7    1.461
## 16  4   T1   14    1.667
## 28  4   T1   21    1.836
## 40  4   T1   28    1.979
## 5   5   T2    7    1.427
## 17  5   T2   14    1.627
## 29  5   T2   21    1.826
## 41  5   T2   28    1.981
## 6   6   T2    7    1.480
## 18  6   T2   14    1.681
## 30  6   T2   21    1.843
## 42  6   T2   28    2.034
```

```
## 7   7   T2    7    1.501
## 19  7   T2   14    1.689
## 31  7   T2   21    1.880
## 43  7   T2   28    2.049
## 8   8   T2    7    1.505
## 20  8   T2   14    1.712
## 32  8   T2   21    1.898
## 44  8   T2   28    2.082
## 9   9   T3    7    1.484
## 21  9   T3   14    1.549
## 33  9   T3   21    1.658
## 45  9   T3   28    1.910
## 10 10   T3    7    1.529
## 22 10   T3   14    1.563
## 34 10   T3   21    1.678
## 46 10   T3   28    1.926
## 11 11   T3    7    1.629
## 23 11   T3   14    1.641
## 35 11   T3   21    1.730
## 47 11   T3   28    1.939
## 12 12   T3    7    1.720
## 24 12   T3   14    1.656
## 36 12   T3   21    1.737
## 48 12   T3   28    1.952
```

```
##############################################################################################
# Gráfico de perfis individuais com perfil médio por tratamento
##############################################################################################
profile <- ggplot(embrapa.sort, aes(x=dias, y=convalim, group=id)) +
  geom_line(aes(linetype = trat), size = 0.5) +
  geom_point(aes(color = trat), size = 1.5) +
  scale_x_continuous(breaks=c(7,14,21,28), labels=c("7", "14", "21", "28")) +
  stat_summary(fun.y=mean, geom="line",lwd=1.0, aes(group=trat, color = trat)) +
  xlab("Dias") +
  ylab("Conversão alimentar (kcal/kg)") +
  theme_bw() +
  theme(axis.text.x = element_text(size=13)) +
  theme(axis.text.y = element_text(size=13)) +
  facet_wrap(~trat)
profile
```




```
##############################################################################################
# Gráfico de perfis individuais com perfil médio em conjunto
##############################################################################################
profile <- ggplot(embrapa.sort, aes(x=dias, y=convalim, group=id)) +
           geom_line(aes(linetype = trat), size = 0.5) +
           geom_point(size = 1) +
           scale_x_continuous(breaks=c(7,14,21,28), labels=c("7", "14", "21", "28")) +
           stat_summary(fun.y=mean, geom="line",lwd=1.5, aes(group=trat, color=trat)) +
           xlab("Dias") +
           ylab("Conversão alimentar (kcal/kg)") +
           theme_bw() +
           theme(axis.text.x = element_text(size=13)) +
           theme(axis.text.y = element_text(size=13))
profile
```




```
#####################################################################################
# Gráfico de perfis médios com barras de desvio padrão
#####################################################################################
embrapa.resumo = ddply(embrapa.sort, .(trat, dias), function(x){
  c(mean=mean(x$convalim), sd = sd(x$convalim))
})
embrapa.resumo
```

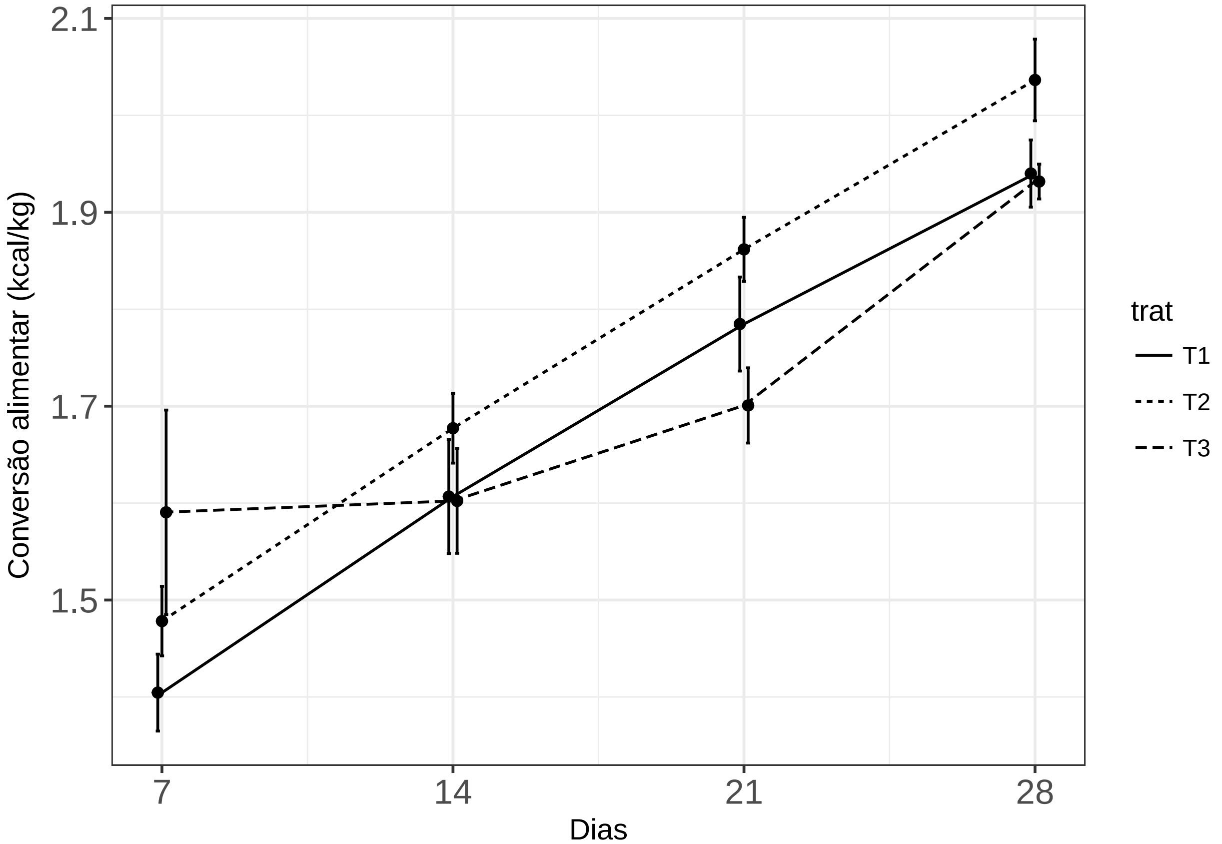
```
##    trat dias    mean         sd
## 1    T1    7 1.40450 0.03967787
## 2    T1   14 1.60675 0.05877287
## 3    T1   21 1.78475 0.04849313
## 4    T1   28 1.94000 0.03462177
## 5    T2    7 1.47825 0.03588291
## 6    T2   14 1.67725 0.03598495
## 7    T2   21 1.86175 0.03304921
## 8    T2   28 2.03650 0.04208325
## 9    T3    7 1.59050 0.10547828
## 10   T3   14 1.60225 0.05405784
## 11   T3   21 1.70075 0.03879326
## 12   T3   28 1.93175 0.01796988
```

```
pd <- position_dodge(width = 0.3)
mean.profile  = ggplot(embrapa.resumo, aes(x=dias, y=mean)) +
                geom_line(aes(linetype=trat)) +
                geom_point(aes(position=trat), position=pd) +
                scale_x_continuous(breaks=c(7,14,21,28), labels=c("7", "14", "21", "28")) +
                geom_errorbar(aes(ymin=mean-sd, ymax=mean+sd, position=trat), width=0.3, position=pd) +
```

```
                xlab("Dias") +
                ylab("Conversão alimentar (kcal/kg)") +
                theme_bw() +
                theme(axis.text.x = element_text(size=13)) +
                theme(axis.text.y = element_text(size=13))
```

```
## Warning: Ignoring unknown aesthetics: position

## Warning: Ignoring unknown aesthetics: position
```

```
mean.profile
```




```
###########################################################################################
# Análise de perfis via MANOVA
###########################################################################################

fit.manova <- manova(cbind(dia7, dia14, dia21, dia28) ~ trat -1, data=embrapa, contrasts = list(trat = c
fit.manova$coefficients
```

```
##            dia7   dia14   dia21   dia28
## tratT1 1.40450 1.60675 1.78475 1.94000
## tratT2 1.47825 1.67725 1.86175 2.03650
## tratT3 1.59050 1.60225 1.70075 1.93175
```

```
summary(fit.manova)
```

```
##           Df Pillai approx F num Df den Df   Pr(>F)
## trat       3 1.9825   3.8966     12     24 0.002223 **
## Residuals  9
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Teste interacao tratXtempo
C <- matrix(c(1, -1, 0, 1, 0, -1), ncol = 3,  by = T)
U <- matrix(c(1, 0, 0, -1, 1, 0, 0, -1, 1, 0, 0, -1), nrow = 4, by = T)
C
```

```
##      [,1] [,2] [,3]
## [1,]    1   -1    0
## [2,]    1    0   -1
```

```r
U
```

```
##      [,1] [,2] [,3]
## [1,]    1    0    0
## [2,]   -1    1    0
## [3,]    0   -1    1
## [4,]    0    0   -1
```

```r
interacao <- linearHypothesis(model = fit.manova, hypothesis.matrix = C, P = U)
interacao
```

```
##
##  Response transformation matrix:
##       [,1] [,2] [,3]
## dia7     1    0    0
## dia14   -1    1    0
## dia21    0   -1    1
## dia28    0    0   -1
##
## Sum of squares and products for the hypothesis:
##             [,1]        [,2]        [,3]
## [1,]  0.09515117  0.04163617 -0.03336875
## [2,]  0.04163617  0.01834467 -0.01431050
## [3,] -0.03336875 -0.01431050  0.01237650
##
## Sum of squares and products for error:
##            [,1]      [,2]       [,3]
## [1,] 0.01765350 0.0005365 0.00050975
## [2,] 0.00053650 0.0020140 0.00092750
## [3,] 0.00050975 0.0009275 0.00308350
##
## Multivariate Tests:
##                  Df test stat approx F num Df den Df     Pr(>F)
## Pillai            2  1.133852  3.49086      6     16 0.02116630 *
## Wilks             2  0.032098 10.69043      6     14 0.00015175 ***
## Hotelling-Lawley  2 24.984335 24.98434      6     12  4.071e-06 ***
## Roy               2 24.775659 66.06842      3      8  5.488e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Teste interacao TratT1eT2XTempo
C <- matrix(c(1, -1, 0), ncol = 3,  by = T)
U <- matrix(c(1, 0, 0, -1, 1, 0, 0, -1, 1, 0, 0, -1), nrow = 4, by = T)

interacaoT1T2 <- linearHypothesis(model = fit.manova, hypothesis.matrix = C, P = U)
```

```r
interacaoT1T2
```

```
##
##  Response transformation matrix:
##       [,1] [,2] [,3]
## dia7     1    0    0
## dia14   -1    1    0
## dia21    0   -1    1
## dia28    0    0   -1
##
## Sum of squares and products for the hypothesis:
##             [,1]       [,2]        [,3]
## [1,]  2.1125e-05 -4.225e-05 -0.00012675
## [2,] -4.2250e-05  8.450e-05  0.00025350
## [3,] -1.2675e-04  2.535e-04  0.00076050
##
## Sum of squares and products for error:
##            [,1]      [,2]       [,3]
## [1,] 0.01765350 0.0005365 0.00050975
## [2,] 0.00053650 0.0020140 0.00092750
## [3,] 0.00050975 0.0009275 0.00308350
##
## Multivariate Tests:
##                  Df test stat  approx F num Df den Df  Pr(>F)
## Pillai            1 0.2013436 0.5882401      3      7 0.64187
## Wilks             1 0.7986564 0.5882401      3      7 0.64187
## Hotelling-Lawley  1 0.2521029 0.5882401      3      7 0.64187
## Roy               1 0.2521029 0.5882401      3      7 0.64187
```

```r
# Teste efeito TratT1T2
C <- matrix(c(1, -1, 0), ncol = 3,  by = T)
U <- matrix(c(1, 1, 1, 1), nrow = 4, by = T)

efeitoT1T2 <- linearHypothesis(model = fit.manova, hypothesis.matrix = C, P = U)
efeitoT1T2
```

```
##
##  Response transformation matrix:
##       [,1]
## dia7     1
## dia14    1
## dia21    1
## dia28    1
##
## Sum of squares and products for the hypothesis:
##           [,1]
## [1,] 0.2019301
##
## Sum of squares and products for error:
##           [,1]
## [1,] 0.2816615
##
## Multivariate Tests:
##                  Df test stat approx F num Df den Df   Pr(>F)
## Pillai            1 0.4175633 6.452324      1      9 0.031703 *
```

```
## Wilks              1 0.5824367 6.452324      1      9 0.031703 *
## Hotelling-Lawley  1 0.7169248 6.452324      1      9 0.031703 *
## Roy               1 0.7169248 6.452324      1      9 0.031703 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Teste efeito Tempo para TratT1T2
C <- matrix(c(1, 1, 0), ncol = 3,  by = T)
U <- matrix(c(1, 0, 0, -1, 1, 0, 0, -1, 1, 0, 0, -1), nrow = 4, by = T)

efeitoTempoT1T2 <- linearHypothesis(model = fit.manova, hypothesis.matrix = C, P = U)
efeitoTempoT1T2
```

```
##
##  Response transformation matrix:
##       [,1] [,2] [,3]
## dia7     1    0    0
## dia14   -1    1    0
## dia21    0   -1    1
## dia28    0    0   -1
##
## Sum of squares and products for the hypothesis:
##           [,1]      [,2]     [,3]
## [1,] 0.3220031 0.2909063 0.264825
## [2,] 0.2909063 0.2628125 0.239250
## [3,] 0.2648250 0.2392500 0.217800
##
## Sum of squares and products for error:
##            [,1]      [,2]       [,3]
## [1,] 0.01765350 0.0005365 0.00050975
## [2,] 0.00053650 0.0020140 0.00092750
## [3,] 0.00050975 0.0009275 0.00308350
##
## Multivariate Tests:
##                  Df test stat approx F num Df den Df     Pr(>F)
## Pillai            1   0.99379 373.4174      3      7 4.3827e-08 ***
## Wilks             1   0.00621 373.4174      3      7 4.3827e-08 ***
## Hotelling-Lawley  1 160.03605 373.4174      3      7 4.3827e-08 ***
## Roy               1 160.03605 373.4174      3      7 4.3827e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Teste efeito linear de Tempo para TratT1T2
C <- matrix(c(1, 1, 0), ncol = 3,  by = T)
U <- matrix(c(1, -1, -1, 3, -1, -3, 1, 1), nrow = 4, by = T)
C
```

```
##      [,1] [,2] [,3]
## [1,]    1    1    0
```

```
U
```

```
##      [,1] [,2]
## [1,]    1   -1
## [2,]   -1    3
## [3,]   -1   -3
## [4,]    1    1
```

```r
efeitolinearTempoT1T2 <- linearHypothesis(model = fit.manova, hypothesis.matrix = C, P = U)
efeitolinearTempoT1T2
```

```
##
##  Response transformation matrix:
##       [,1] [,2]
## dia7     1   -1
## dia14   -1    3
## dia21   -1   -3
## dia28    1    1
##
## Sum of squares and products for the hypothesis:
##              [,1]         [,2]
## [1,]  0.010153125 -0.000890625
## [2,] -0.000890625  0.000078125
##
## Sum of squares and products for error:
##            [,1]       [,2]
## [1,]  0.0197175 -0.0153520
## [2,] -0.0153520  0.0239565
##
## Multivariate Tests:
##                  Df test stat approx F num Df den Df   Pr(>F)
## Pillai            1 0.4788041 3.674658      2      8 0.073791 .
## Wilks             1 0.5211959 3.674658      2      8 0.073791 .
## Hotelling-Lawley  1 0.9186645 3.674658      2      8 0.073791 .
## Roy               1 0.9186645 3.674658      2      8 0.073791 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Alternativamente podemos gerar os contrastes baseados em polinomios ortogonais como
ct<-contr.poly(4)
U <- as.matrix(ct[,2-3])
C
```

```
##      [,1] [,2] [,3]
## [1,]    1    1    0
```

```r
U
```

```
##        .Q         .C
## [1,]  0.5 -0.2236068
## [2,] -0.5  0.6708204
## [3,] -0.5 -0.6708204
## [4,]  0.5  0.2236068
```

```r
efeitolinearTempoT1T2 <- linearHypothesis(model = fit.manova, hypothesis.matrix = C, P = U)
efeitolinearTempoT1T2
```

```
##
##  Response transformation matrix:
##         .Q         .C
## dia7   0.5 -0.2236068
## dia14 -0.5  0.6708204
## dia21 -0.5 -0.6708204
## dia28  0.5  0.2236068
```

```
##
## Sum of squares and products for the hypothesis:
##                .Q           .C
## .Q  0.0025382813 -9.95749e-05
## .C -0.0000995749  3.90625e-06
##
## Sum of squares and products for error:
##               .Q           .C
## .Q  0.004929375 -0.001716406
## .C -0.001716406  0.001197825
##
## Multivariate Tests:
##                  Df test stat approx F num Df den Df   Pr(>F)
## Pillai            1 0.4788041 3.674658      2      8 0.073791 .
## Wilks             1 0.5211959 3.674658      2      8 0.073791 .
## Hotelling-Lawley  1 0.9186645 3.674658      2      8 0.073791 .
## Roy               1 0.9186645 3.674658      2      8 0.073791 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Teste efeito quadratico de Tempo para TratT3
C <- matrix(c(0, 0, 1), ncol = 3,  by = T)
U <- matrix(c(-1, 3, -3,  1), nrow = 4, by = T)
C
```

```
##      [,1] [,2] [,3]
## [1,]    0    0    1
```

```r
U
```

```
##      [,1]
## [1,]   -1
## [2,]    3
## [3,]   -3
## [4,]    1
```

```r
# Alternativamente podemos gerar os contrastes baseados em polinomios ortogonais como
# ct<-contr.poly(4)
# U <- as.matrix(ct[, 3])

efeitoquadraticoTempoT3 <- linearHypothesis(model = fit.manova, hypothesis.matrix = C, P = U)
efeitoquadraticoTempoT3
```

```
##
##  Response transformation matrix:
##       [,1]
## dia7    -1
## dia14    3
## dia21   -3
## dia28    1
##
## Sum of squares and products for the hypothesis:
##            [,1]
## [1,] 0.00837225
##
## Sum of squares and products for error:
##           [,1]
```

```
## [1,] 0.0239565
##
## Multivariate Tests:
##                  Df test stat approx F num Df den Df Pr(>F)
## Pillai            1 0.2589723 3.145295      1      9 0.1099
## Wilks             1 0.7410277 3.145295      1      9 0.1099
## Hotelling-Lawley  1 0.3494772 3.145295      1      9 0.1099
## Roy               1 0.3494772 3.145295      1      9 0.1099
```

```r
# Teste para comparacao conversao alimentar media
C <- matrix(c(1, -1, 0, 1, 0, -1), ncol = 3,  by = T)
U <- matrix(c(1/4, 1/4, 1/4, 1/4), nrow = 4, by = T)
C
```

```
##      [,1] [,2] [,3]
## [1,]    1   -1    0
## [2,]    1    0   -1
```

```r
U
```

```
##      [,1]
## [1,] 0.25
## [2,] 0.25
## [3,] 0.25
## [4,] 0.25
```

```r
efeitoconvalimmedia <- linearHypothesis(model = fit.manova, hypothesis.matrix = C, P = U)
efeitoconvalimmedia
```

```
##
##  Response transformation matrix:
##       [,1]
## dia7  0.25
## dia14 0.25
## dia21 0.25
## dia28 0.25
##
## Sum of squares and products for the hypothesis:
##            [,1]
## [1,] 0.01342857
##
## Sum of squares and products for error:
##            [,1]
## [1,] 0.01760384
##
## Multivariate Tests:
##                  Df test stat approx F num Df den Df   Pr(>F)
## Pillai            2 0.4327273 3.432692      2      9 0.077994 .
## Wilks             2 0.5672727 3.432692      2      9 0.077994 .
## Hotelling-Lawley  2 0.7628205 3.432692      2      9 0.077994 .
## Roy               2 0.7628205 3.432692      2      9 0.077994 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Estimacao da conversao alimentar media comum
embrapa$convmedia <- (embrapa$dia7+embrapa$dia14+embrapa$dia21+embrapa$dia28)/4
```

```r
fit.convmedia <-lm(embrapa$convmedia~trat-1, data=embrapa)
fit.convmedia <-lm(embrapa$convmedia~1, data=embrapa)
summary(fit.convmedia)
```

```
##
## Call:
## lm(formula = embrapa$convmedia ~ 1, data = embrapa)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.081917 -0.043979  0.007083  0.043271  0.081333
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.71792    0.01533     112   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.05311 on 11 degrees of freedom
```

```r
names(fit.convmedia)
```

```
##  [1] "coefficients"  "residuals"     "effects"       "rank"
##  [5] "fitted.values" "assign"        "qr"            "df.residual"
##  [9] "call"          "terms"         "model"
```

```r
# IC(95%) para conversao alimentar media

liminf <- fit.convmedia$coefficients - 1.96*(summary(fit.convmedia)$sigma/(sqrt(fit.convmedia$df)))
limsup <- fit.convmedia$coefficients + 1.96*(summary(fit.convmedia)$sigma/(sqrt(fit.convmedia$df)))
liminf
```

```
## (Intercept)
##    1.686528
```

```r
limsup
```

```
## (Intercept)
##    1.749305
```

```r
###############################################################################################
# Análise de perfis via ANOVA para medidas repetidas (função aov)
###############################################################################################

embrapa.sort$trat <- as.factor(embrapa.sort$trat)
embrapa.sort$id <- as.factor(embrapa.sort$id)
embrapa.sort$dias <- as.factor(embrapa.sort$dias)

embrapa.ANOVA <- aov(convalim ~ trat*dias + Error(id:trat), data = embrapa.sort)
```

```
## Warning in aov(convalim ~ trat * dias + Error(id:trat), data =
## embrapa.sort): Error() model is singular
```

```r
print(summary(embrapa.ANOVA))
```

```
##
## Error: id:trat
##           Df  Sum Sq  Mean Sq F value Pr(>F)
```

```
## trat       2 0.05371 0.026857   3.433  0.078 .
## Residuals  9 0.07042 0.007824
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Error: Within
##           Df Sum Sq Mean Sq F value   Pr(>F)
## dias       3 1.5218  0.5073  710.18  < 2e-16 ***
## trat:dias  6 0.1096  0.0183   25.58 6.05e-10 ***
## Residuals 27 0.0193  0.0007
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##############################################################################################
# Análise de perfis via ANOVA para medidas repetidas (library ez)
##############################################################################################

ezANOVA(data=embrapa.sort,
        dv=convalim,
        wid=.(id),
        within=.(dias),
        between=trat,
        detailed=TRUE)
```

```
## $ANOVA
##        Effect DFn DFd          SSn        SSd            F            p
## 1 (Intercept)   1   9 141.65940833 0.07041537 18105.913304 3.513953e-16
## 2        trat   2   9   0.05371429 0.07041537     3.432692 7.799443e-02
## 3        dias   3  27   1.52179867 0.01928563   710.175999 8.746813e-26
## 4   trat:dias   6  27   0.10963171 0.01928563    25.580850 6.052022e-10
##   p<.05       ges
## 1     * 0.9993672
## 2       0.3745367
## 3     * 0.9443369
## 4     * 0.5499936
##
## $`Mauchly's Test for Sphericity`
##      Effect          W           p p<.05
## 3      dias 0.08802484 0.002323176     *
## 4 trat:dias 0.08802484 0.002323176     *
##
## $`Sphericity Corrections`
##      Effect      GGe        p[GG] p[GG]<.05      HFe        p[HF]
## 3      dias 0.477092 2.542551e-13         * 0.542265 7.023376e-15
## 4 trat:dias 0.477092 1.205562e-05         * 0.542265 3.463368e-06
##   p[HF]<.05
## 3         *
## 4         *
```