abxLPS_bka_redo

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Question: Effect of antibiotics and LPS challenge on phys variables - BKA?

Method: beta regression, compare abx * LPS *dates, jan 24, jan 26, feb1, feb 8 + iguanaID random effect

```
gi <- read.csv("C:/Users/claud/OneDrive - USU/Desktop/Antibiotic study 2022/antibioticAnalysis/data/AbxI
View(gi)

library("rstatix")
```

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

```
##
## Attaching package: 'rstatix'
```

```
## The following object is masked from 'package:stats':
##
##     filter
```

```
library("tidyverse")
```

```
## Warning: package 'tidyverse' was built under R version 4.1.3
```

```
## Warning: package 'ggplot2' was built under R version 4.1.3
```

```
## Warning: package 'tibble' was built under R version 4.1.3
```

```
## Warning: package 'tidyr' was built under R version 4.1.3
```

```
## Warning: package 'readr' was built under R version 4.1.3
```

```
## Warning: package 'purrr' was built under R version 4.1.3
```

```
## Warning: package 'dplyr' was built under R version 4.1.3
```

```
## Warning: package 'stringr' was built under R version 4.1.3
```

```
## Warning: package 'forcats' was built under R version 4.1.3
```

```
## Warning: package 'lubridate' was built under R version 4.1.3
```

```
## -- Attaching core tidyverse packages ----------------------- tidyverse 2.0.0 --
## v dplyr     1.1.1     v readr     2.1.4
## v forcats   1.0.0     v stringr   1.5.0
## v ggplot2   3.4.2     v tibble    3.2.1
## v lubridate 1.9.2     v tidyr     1.3.0
## v purrr     1.0.1

## -- Conflicts ------------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks rstatix::filter(), stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```r
library("dplyr")
library("ggpubr")
```

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

```r
library("ggrepel")
```

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

```r
library("betareg")
```

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

```r
library('lmtest')
```

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

```
## Loading required package: zoo
```

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

```
##
## Attaching package: 'zoo'
##
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```
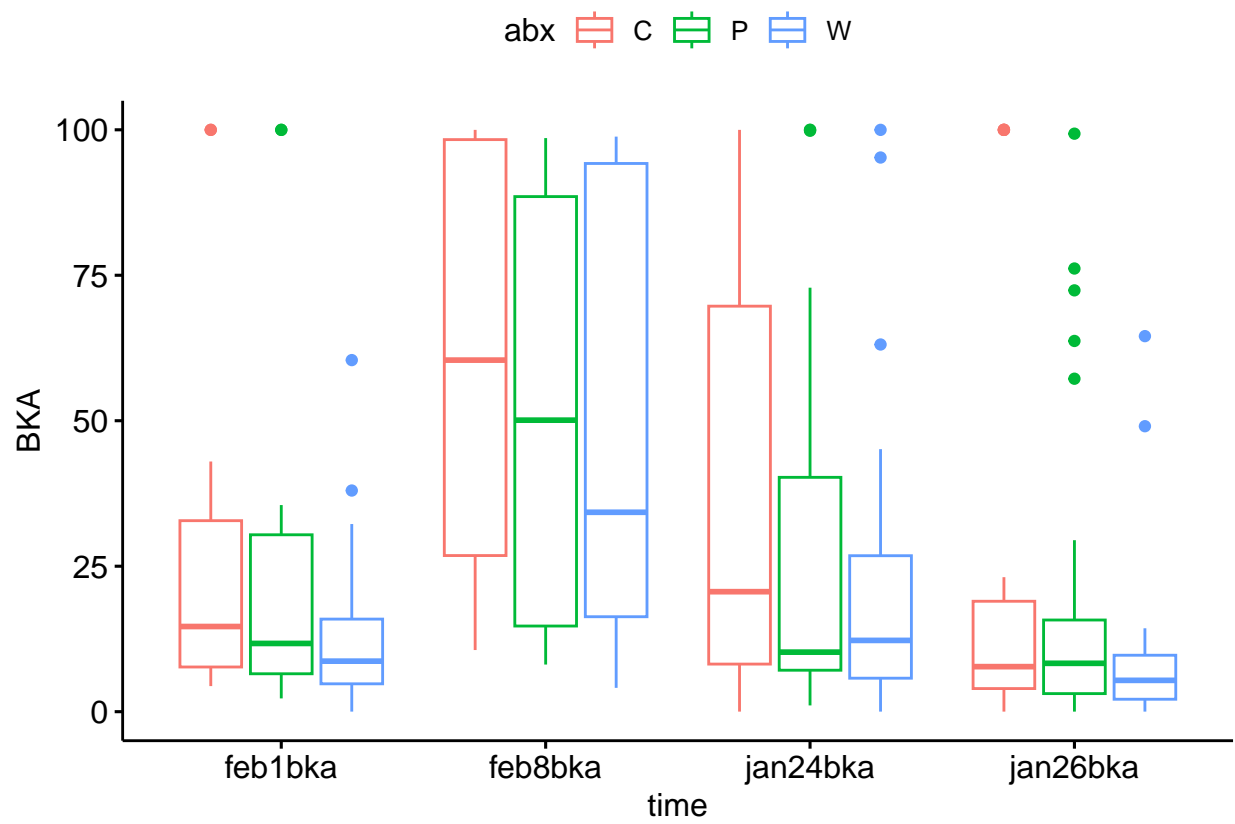
```
library('emmeans')
```

Warning: package 'emmeans' was built under R version 4.1.2

```
str(gi)
gi$tx <- as.factor(gi$tx)
gi$abx <- as.factor(gi$abx)
gi$lps <- as.factor(gi$lps)
gi$iguanaID <- as.numeric(gi$iguanaID)
str(gi)
# convert to wide
data <- gi %>%
  select(jan24bka, jan26bka, feb1bka, feb8bka, iguanaID, abx, tx, lps) %>%
  gather(key = "time", value = "BKA", jan24bka, jan26bka, feb1bka, feb8bka) %>%
  convert_as_factor(iguanaID, time) %>%
  na.exclude()
View(data)

# need to replace over 1 == 1, same for 0
data$BKA[data$BKA > 100] <- 99.99
data$BKA[data$BKA < 0] <- 0.01

data2 <- data %>%
  mutate(decimal = BKA/100)
View(data2)

range(data2$decimal) #looks good
# visualization
ggboxplot(data2, x = "time", y = "BKA", color = "abx")
```
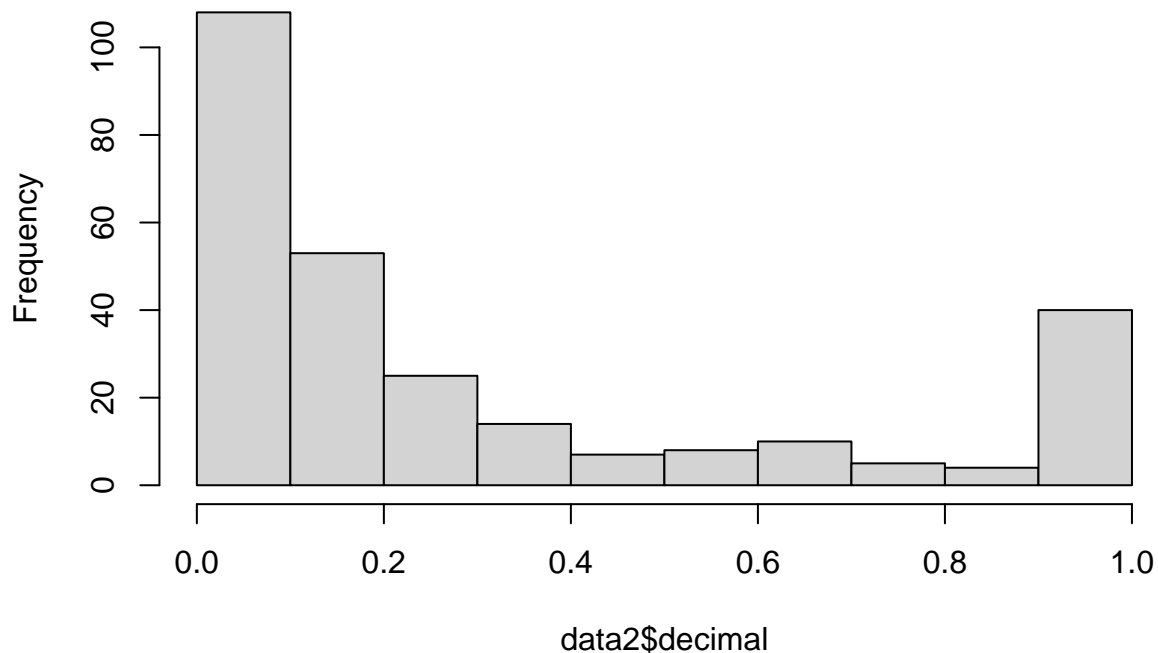
```
# normality
hist(data2$decimal) #skewed
```

Histogram of data2$decimal


```r
# add new column
data3 <- data2 %>%
  unite(txtime, abx, time, lps, sep = "", remove = FALSE)
View(data3)
null <- (data2$decimal~1)
```

```r
# summary stats
data2 %>%
  group_by(abx) %>%
  get_summary_stats(BKA, type = "mean_se")
```

```
## # A tibble: 3 x 5
##   abx   variable     n  mean    se
##   <fct> <chr>    <dbl> <dbl> <dbl>
## 1 C     BKA         90  36.7  3.92
## 2 P     BKA         94  30.3  3.40
## 3 W     BKA         90  24.2  3.21
```

```r
data2$iguanaID <- as.numeric(data2$iguanaID)
data3$iguanaID <- as.numeric(data3$iguanaID)
```

```r
# 3-way model
mod1 <- betareg::betareg(data2$decimal ~ data2$abx * data2$lps * data2$time + data2$iguanaID) #note tha
```

```
## Warning in betareg.fit(X, Y, Z, weights, offset, link, link.phi, type, control):
```

```
## no valid starting value for precision parameter found, using 1 instead
```

```
Anova(mod1)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: data2$decimal
##                               Df   Chisq Pr(>Chisq)
## data2$abx                      2 12.2543   0.002183 **
## data2$lps                      1  0.6210   0.430662
## data2$time                     3 28.4746  2.887e-06 ***
## data2$iguanaID                 1  0.5560   0.455877
## data2$abx:data2$lps            2  0.6813   0.711304
## data2$abx:data2$time           6  2.5045   0.867959
## data2$lps:data2$time           3  1.5617   0.668108
## data2$abx:data2$lps:data2$time 6  3.2398   0.778206
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
lrtest(mod1, null)
```

```
## Warning in betareg.fit(X, Y, Z, weights, offset, link, link.phi, type, control):
## no valid starting value for precision parameter found, using 1 instead
```

```
## Likelihood ratio test
##
## Model 1: data2$decimal ~ data2$abx * data2$lps * data2$time + data2$iguanaID
## Model 2: data2$decimal ~ 1
##   #Df LogLik  Df  Chisq Pr(>Chisq)
## 1  26 186.47
## 2   2 162.17 -24 48.596   0.002128 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
emmeans(mod1, list(pairwise ~ abx), adjust = "tukey")
```

```
## NOTE: Results may be misleading due to involvement in interactions
```

```
## $'emmeans of abx'
##  abx emmean     SE  df asymp.LCL asymp.UCL
##  C    0.490 0.0324 Inf     0.427     0.554
##  P    0.411 0.0302 Inf     0.352     0.470
##  W    0.342 0.0285 Inf     0.286     0.398
##
## Results are averaged over the levels of: lps, time
## Confidence level used: 0.95
##
## $'pairwise differences of abx'
##  1      estimate     SE  df z.ratio p.value
##  C - P    0.0790 0.0443 Inf   1.785  0.1745
##  C - W    0.1484 0.0431 Inf   3.445  0.0017
```

```
##  P - W    0.0694 0.0411 Inf    1.691   0.2088
##
## Results are averaged over the levels of: lps, time
## P value adjustment: tukey method for comparing a family of 3 estimates
```

```
emmeans(mod1, list(pairwise ~ time), adjust = "tukey")
```

```
## NOTE: Results may be misleading due to involvement in interactions
```

```
## $`emmeans of time`
##  time       emmean     SE  df asymp.LCL asymp.UCL
##  feb1bka    0.376 0.0370 Inf     0.304     0.449
##  feb8bka    0.572 0.0371 Inf     0.499     0.644
##  jan24bka   0.406 0.0353 Inf     0.337     0.475
##  jan26bka   0.303 0.0310 Inf     0.242     0.364
##
## Results are averaged over the levels of: abx, lps
## Confidence level used: 0.95
##
## $`pairwise differences of time`
##  1                   estimate     SE  df z.ratio p.value
##  feb1bka - feb8bka    -0.1953 0.0527 Inf  -3.703  0.0012
##  feb1bka - jan24bka   -0.0300 0.0507 Inf  -0.591  0.9348
##  feb1bka - jan26bka    0.0733 0.0475 Inf   1.541  0.4129
##  feb8bka - jan24bka    0.1653 0.0515 Inf   3.211  0.0072
##  feb8bka - jan26bka    0.2685 0.0489 Inf   5.493  <.0001
##  jan24bka - jan26bka   0.1033 0.0464 Inf   2.227  0.1160
##
## Results are averaged over the levels of: abx, lps
## P value adjustment: tukey method for comparing a family of 4 estimates
```

```
# tx_time model
mod2 <- betareg::betareg(decimal ~ txtime + iguanaID, data=data3)
```

```
## Warning in betareg.fit(X, Y, Z, weights, offset, link, link.phi, type, control):
## no valid starting value for precision parameter found, using 1 instead
```

```
Anova(mod2)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: decimal
##          Df  Chisq Pr(>Chisq)
## txtime   23 49.292    0.00114 **
## iguanaID  1  0.556    0.45588
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# compare the two models
lrtest(mod1, mod2) # exactly the same!
```

```
## Likelihood ratio test
##
## Model 1: data2$decimal ~ data2$abx * data2$lps * data2$time + data2$iguanaID
## Model 2: decimal ~ txtime + iguanaID
##   #Df LogLik Df Chisq Pr(>Chisq)
## 1  26 186.47
## 2  26 186.47  0     0          1
```

```
# pairwise
emmeans(mod2, list(pairwise ~ txtime), adjust = "tukey")
```

```
## $`emmeans of txtime`
##  txtime      emmean     SE  df asymp.LCL asymp.UCL
##  Cfeb1bkaL    0.421 0.0980 Inf     0.229     0.613
##  Cfeb1bkaP    0.458 0.1120 Inf     0.238     0.677
##  Cfeb8bkaL    0.600 0.0878 Inf     0.428     0.772
##  Cfeb8bkaP    0.690 0.0766 Inf     0.540     0.840
##  Cjan24bkaL   0.504 0.0922 Inf     0.323     0.685
##  Cjan24bkaP   0.460 0.0915 Inf     0.280     0.639
##  Cjan26bkaL   0.333 0.0801 Inf     0.176     0.490
##  Cjan26bkaP   0.456 0.0914 Inf     0.277     0.635
##  Pfeb1bkaL    0.320 0.0816 Inf     0.160     0.480
##  Pfeb1bkaP    0.502 0.0922 Inf     0.321     0.682
##  Pfeb8bkaL    0.508 0.0963 Inf     0.319     0.697
##  Pfeb8bkaP    0.555 0.0909 Inf     0.377     0.733
##  Pjan24bkaL   0.499 0.0922 Inf     0.318     0.680
##  Pjan24bkaP   0.372 0.0850 Inf     0.205     0.539
##  Pjan26bkaL   0.234 0.0624 Inf     0.112     0.356
##  Pjan26bkaP   0.299 0.0749 Inf     0.153     0.446
##  Wfeb1bkaL    0.321 0.0857 Inf     0.153     0.489
##  Wfeb1bkaP    0.238 0.0631 Inf     0.114     0.361
##  Wfeb8bkaL    0.531 0.0959 Inf     0.344     0.719
##  Wfeb8bkaP    0.545 0.0954 Inf     0.358     0.732
##  Wjan24bkaL   0.290 0.0765 Inf     0.140     0.440
##  Wjan24bkaP   0.313 0.0771 Inf     0.162     0.464
##  Wjan26bkaL   0.245 0.0674 Inf     0.113     0.377
##  Wjan26bkaP   0.251 0.0658 Inf     0.122     0.380
##
## Confidence level used: 0.95
##
## $`pairwise differences of txtime`
##  1                     estimate     SE  df z.ratio p.value
##  Cfeb1bkaL - Cfeb1bkaP  -0.03699 0.1487 Inf  -0.249  1.0000
##  Cfeb1bkaL - Cfeb8bkaL  -0.17981 0.1317 Inf  -1.366  0.9997
##  Cfeb1bkaL - Cfeb8bkaP  -0.26935 0.1246 Inf  -2.162  0.8889
##  Cfeb1bkaL - Cjan24bkaL -0.08354 0.1345 Inf  -0.621  1.0000
##  Cfeb1bkaL - Cjan24bkaP -0.03906 0.1340 Inf  -0.292  1.0000
##  Cfeb1bkaL - Cjan26bkaL  0.08765 0.1263 Inf   0.694  1.0000
##  Cfeb1bkaL - Cjan26bkaP -0.03580 0.1339 Inf  -0.267  1.0000
##  Cfeb1bkaL - Pfeb1bkaL   0.10054 0.1273 Inf   0.790  1.0000
##  Cfeb1bkaL - Pfeb1bkaP  -0.08103 0.1345 Inf  -0.602  1.0000
##  Cfeb1bkaL - Pfeb8bkaL  -0.08732 0.1374 Inf  -0.636  1.0000
##  Cfeb1bkaL - Pfeb8bkaP  -0.13450 0.1337 Inf  -1.006  1.0000
##  Cfeb1bkaL - Pjan24bkaL -0.07856 0.1345 Inf  -0.584  1.0000
```

```
## Cfeb1bkaL - Pjan24bkaP   0.04861 0.1295 Inf    0.375  1.0000
## Cfeb1bkaL - Pjan26bkaL   0.18640 0.1158 Inf    1.609  0.9962
## Cfeb1bkaL - Pjan26bkaP   0.12113 0.1230 Inf    0.985  1.0000
## Cfeb1bkaL - Wfeb1bkaL    0.09978 0.1299 Inf    0.768  1.0000
## Cfeb1bkaL - Wfeb1bkaP    0.18291 0.1162 Inf    1.574  0.9973
## Cfeb1bkaL - Wfeb8bkaL   -0.11093 0.1371 Inf   -0.809  1.0000
## Cfeb1bkaL - Wfeb8bkaP   -0.12445 0.1368 Inf   -0.910  1.0000
## Cfeb1bkaL - Wjan24bkaL   0.13014 0.1240 Inf    1.049  1.0000
## Cfeb1bkaL - Wjan24bkaP   0.10765 0.1244 Inf    0.865  1.0000
## Cfeb1bkaL - Wjan26bkaL   0.17566 0.1186 Inf    1.481  0.9989
## Cfeb1bkaL - Wjan26bkaP   0.16976 0.1177 Inf    1.442  0.9993
## Cfeb1bkaP - Cfeb8bkaL   -0.14281 0.1424 Inf   -1.003  1.0000
## Cfeb1bkaP - Cfeb8bkaP   -0.23236 0.1358 Inf   -1.711  0.9914
## Cfeb1bkaP - Cjan24bkaL  -0.04655 0.1451 Inf   -0.321  1.0000
## Cfeb1bkaP - Cjan24bkaP  -0.00207 0.1446 Inf   -0.014  1.0000
## Cfeb1bkaP - Cjan26bkaL   0.12465 0.1376 Inf    0.906  1.0000
## Cfeb1bkaP - Cjan26bkaP   0.00119 0.1445 Inf    0.008  1.0000
## Cfeb1bkaP - Pfeb1bkaL    0.13753 0.1385 Inf    0.993  1.0000
## Cfeb1bkaP - Pfeb1bkaP   -0.04404 0.1451 Inf   -0.304  1.0000
## Cfeb1bkaP - Pfeb8bkaL   -0.05033 0.1478 Inf   -0.341  1.0000
## Cfeb1bkaP - Pfeb8bkaP   -0.09750 0.1443 Inf   -0.676  1.0000
## Cfeb1bkaP - Pjan24bkaL  -0.04157 0.1451 Inf   -0.286  1.0000
## Cfeb1bkaP - Pjan24bkaP   0.08560 0.1405 Inf    0.609  1.0000
## Cfeb1bkaP - Pjan26bkaL   0.22340 0.1281 Inf    1.744  0.9890
## Cfeb1bkaP - Pjan26bkaP   0.15812 0.1346 Inf    1.175  1.0000
## Cfeb1bkaP - Wfeb1bkaL    0.13677 0.1409 Inf    0.970  1.0000
## Cfeb1bkaP - Wfeb1bkaP    0.21990 0.1284 Inf    1.712  0.9913
## Cfeb1bkaP - Wfeb8bkaL   -0.07394 0.1475 Inf   -0.501  1.0000
## Cfeb1bkaP - Wfeb8bkaP   -0.08745 0.1472 Inf   -0.594  1.0000
## Cfeb1bkaP - Wjan24bkaL   0.16713 0.1355 Inf    1.233  0.9999
## Cfeb1bkaP - Wjan24bkaP   0.14464 0.1358 Inf    1.065  1.0000
## Cfeb1bkaP - Wjan26bkaL   0.21266 0.1306 Inf    1.628  0.9956
## Cfeb1bkaP - Wjan26bkaP   0.20675 0.1298 Inf    1.593  0.9967
## Cfeb8bkaL - Cfeb8bkaP   -0.08954 0.1162 Inf   -0.771  1.0000
## Cfeb8bkaL - Cjan24bkaL   0.09627 0.1273 Inf    0.756  1.0000
## Cfeb8bkaL - Cjan24bkaP   0.14075 0.1269 Inf    1.109  1.0000
## Cfeb8bkaL - Cjan26bkaL   0.26746 0.1191 Inf    2.246  0.8469
## Cfeb8bkaL - Cjan26bkaP   0.14400 0.1268 Inf    1.136  1.0000
## Cfeb8bkaL - Pfeb1bkaL    0.28035 0.1201 Inf    2.334  0.7947
## Cfeb8bkaL - Pfeb1bkaP    0.09877 0.1273 Inf    0.776  1.0000
## Cfeb8bkaL - Pfeb8bkaL    0.09248 0.1303 Inf    0.710  1.0000
## Cfeb8bkaL - Pfeb8bkaP    0.04531 0.1262 Inf    0.359  1.0000
## Cfeb8bkaL - Pjan24bkaL   0.10125 0.1273 Inf    0.795  1.0000
## Cfeb8bkaL - Pjan24bkaP   0.22841 0.1224 Inf    1.866  0.9752
## Cfeb8bkaL - Pjan26bkaL   0.36621 0.1081 Inf    3.389  0.1087
## Cfeb8bkaL - Pjan26bkaP   0.30094 0.1157 Inf    2.601  0.5960
## Cfeb8bkaL - Wfeb1bkaL    0.27959 0.1229 Inf    2.274  0.8309
## Cfeb8bkaL - Wfeb1bkaP    0.36272 0.1085 Inf    3.343  0.1239
## Cfeb8bkaL - Wfeb8bkaL    0.06887 0.1299 Inf    0.530  1.0000
## Cfeb8bkaL - Wfeb8bkaP    0.05536 0.1295 Inf    0.427  1.0000
## Cfeb8bkaL - Wjan24bkaL   0.30994 0.1168 Inf    2.654  0.5533
## Cfeb8bkaL - Wjan24bkaP   0.28746 0.1171 Inf    2.455  0.7105
## Cfeb8bkaL - Wjan26bkaL   0.35547 0.1111 Inf    3.201  0.1823
## Cfeb8bkaL - Wjan26bkaP   0.34957 0.1101 Inf    3.175  0.1945
```

```
## Cfeb8bkaP - Cjan24bkaL  0.18581 0.1199 Inf   1.550  0.9978
## Cfeb8bkaP - Cjan24bkaP  0.23029 0.1195 Inf   1.928  0.9641
## Cfeb8bkaP - Cjan26bkaL  0.35700 0.1113 Inf   3.207  0.1791
## Cfeb8bkaP - Cjan26bkaP  0.23354 0.1194 Inf   1.956  0.9580
## Cfeb8bkaP - Pfeb1bkaL   0.36989 0.1124 Inf   3.290  0.1438
## Cfeb8bkaP - Pfeb1bkaP   0.18831 0.1199 Inf   1.571  0.9973
## Cfeb8bkaP - Pfeb8bkaL   0.18203 0.1231 Inf   1.479  0.9989
## Cfeb8bkaP - Pfeb8bkaP   0.13485 0.1187 Inf   1.136  1.0000
## Cfeb8bkaP - Pjan24bkaL  0.19079 0.1199 Inf   1.591  0.9968
## Cfeb8bkaP - Pjan24bkaP  0.31795 0.1148 Inf   2.769  0.4613
## Cfeb8bkaP - Pjan26bkaL  0.45575 0.0995 Inf   4.582  0.0011
## Cfeb8bkaP - Pjan26bkaP  0.39048 0.1077 Inf   3.626  0.0519
## Cfeb8bkaP - Wfeb1bkaL   0.36913 0.1154 Inf   3.198  0.1835
## Cfeb8bkaP - Wfeb1bkaP   0.45226 0.0999 Inf   4.525  0.0015
## Cfeb8bkaP - Wfeb8bkaL   0.15842 0.1226 Inf   1.292  0.9999
## Cfeb8bkaP - Wfeb8bkaP   0.14490 0.1222 Inf   1.186  1.0000
## Cfeb8bkaP - Wjan24bkaL  0.39948 0.1089 Inf   3.670  0.0449
## Cfeb8bkaP - Wjan24bkaP  0.37700 0.1092 Inf   3.452  0.0900
## Cfeb8bkaP - Wjan26bkaL  0.44501 0.1027 Inf   4.332  0.0035
## Cfeb8bkaP - Wjan26bkaP  0.43911 0.1017 Inf   4.319  0.0037
## Cjan24bkaL - Cjan24bkaP  0.04448 0.1299 Inf   0.342  1.0000
## Cjan24bkaL - Cjan26bkaL  0.17119 0.1221 Inf   1.402  0.9995
## Cjan24bkaL - Cjan26bkaP  0.04774 0.1298 Inf   0.368  1.0000
## Cjan24bkaL - Pfeb1bkaL   0.18408 0.1231 Inf   1.495  0.9987
## Cjan24bkaL - Pfeb1bkaP   0.00251 0.1304 Inf   0.019  1.0000
## Cjan24bkaL - Pfeb8bkaL  -0.00378 0.1333 Inf  -0.028  1.0000
## Cjan24bkaL - Pfeb8bkaP  -0.05096 0.1295 Inf  -0.394  1.0000
## Cjan24bkaL - Pjan24bkaL  0.00498 0.1304 Inf   0.038  1.0000
## Cjan24bkaL - Pjan24bkaP  0.13215 0.1254 Inf   1.054  1.0000
## Cjan24bkaL - Pjan26bkaL  0.26995 0.1113 Inf   2.425  0.7325
## Cjan24bkaL - Pjan26bkaP  0.20467 0.1188 Inf   1.723  0.9906
## Cjan24bkaL - Wfeb1bkaL   0.18332 0.1259 Inf   1.456  0.9991
## Cjan24bkaL - Wfeb1bkaP   0.26645 0.1118 Inf   2.384  0.7610
## Cjan24bkaL - Wfeb8bkaL  -0.02739 0.1330 Inf  -0.206  1.0000
## Cjan24bkaL - Wfeb8bkaP  -0.04091 0.1327 Inf  -0.308  1.0000
## Cjan24bkaL - Wjan24bkaL  0.21368 0.1198 Inf   1.783  0.9855
## Cjan24bkaL - Wjan24bkaP  0.19119 0.1202 Inf   1.591  0.9968
## Cjan24bkaL - Wjan26bkaL  0.25920 0.1143 Inf   2.269  0.8342
## Cjan24bkaL - Wjan26bkaP  0.25330 0.1133 Inf   2.235  0.8526
## Cjan24bkaP - Cjan26bkaL  0.12671 0.1215 Inf   1.043  1.0000
## Cjan24bkaP - Cjan26bkaP  0.00326 0.1293 Inf   0.025  1.0000
## Cjan24bkaP - Pfeb1bkaL   0.13960 0.1225 Inf   1.140  1.0000
## Cjan24bkaP - Pfeb1bkaP  -0.04197 0.1299 Inf  -0.323  1.0000
## Cjan24bkaP - Pfeb8bkaL  -0.04826 0.1329 Inf  -0.363  1.0000
## Cjan24bkaP - Pfeb8bkaP  -0.09544 0.1290 Inf  -0.740  1.0000
## Cjan24bkaP - Pjan24bkaL -0.03950 0.1299 Inf  -0.304  1.0000
## Cjan24bkaP - Pjan24bkaP  0.08767 0.1248 Inf   0.702  1.0000
## Cjan24bkaP - Pjan26bkaL  0.22547 0.1106 Inf   2.039  0.9357
## Cjan24bkaP - Pjan26bkaP  0.16019 0.1181 Inf   1.357  0.9997
## Cjan24bkaP - Wfeb1bkaL   0.13884 0.1252 Inf   1.109  1.0000
## Cjan24bkaP - Wfeb1bkaP   0.22197 0.1110 Inf   2.000  0.9471
## Cjan24bkaP - Wfeb8bkaL  -0.07187 0.1325 Inf  -0.542  1.0000
## Cjan24bkaP - Wfeb8bkaP  -0.08539 0.1322 Inf  -0.646  1.0000
## Cjan24bkaP - Wjan24bkaL  0.16920 0.1191 Inf   1.420  0.9994
```

```
##  Cjan24bkaP - Wjan24bkaP   0.14671 0.1195 Inf    1.228   0.9999
##  Cjan24bkaP - Wjan26bkaL   0.21472 0.1135 Inf    1.892   0.9709
##  Cjan24bkaP - Wjan26bkaP   0.20882 0.1126 Inf    1.855   0.9767
##  Cjan26bkaL - Cjan26bkaP  -0.12346 0.1214 Inf   -1.017   1.0000
##  Cjan26bkaL - Pfeb1bkaL    0.01289 0.1138 Inf    0.113   1.0000
##  Cjan26bkaL - Pfeb1bkaP   -0.16869 0.1221 Inf   -1.381   0.9996
##  Cjan26bkaL - Pfeb8bkaL   -0.17498 0.1253 Inf   -1.397   0.9995
##  Cjan26bkaL - Pfeb8bkaP   -0.22215 0.1213 Inf   -1.832   0.9799
##  Cjan26bkaL - Pjan24bkaL  -0.16621 0.1221 Inf   -1.361   0.9997
##  Cjan26bkaL - Pjan24bkaP  -0.03905 0.1164 Inf   -0.335   1.0000
##  Cjan26bkaL - Pjan26bkaL   0.09875 0.1009 Inf    0.979   1.0000
##  Cjan26bkaL - Pjan26bkaP   0.03348 0.1091 Inf    0.307   1.0000
##  Cjan26bkaL - Wfeb1bkaL    0.01213 0.1168 Inf    0.104   1.0000
##  Cjan26bkaL - Wfeb1bkaP    0.09525 0.1013 Inf    0.940   1.0000
##  Cjan26bkaL - Wfeb8bkaL   -0.19859 0.1250 Inf   -1.589   0.9968
##  Cjan26bkaL - Wfeb8bkaP   -0.21210 0.1247 Inf   -1.702   0.9920
##  Cjan26bkaL - Wjan24bkaL   0.04248 0.1102 Inf    0.385   1.0000
##  Cjan26bkaL - Wjan24bkaP   0.02000 0.1106 Inf    0.181   1.0000
##  Cjan26bkaL - Wjan26bkaL   0.08801 0.1041 Inf    0.846   1.0000
##  Cjan26bkaL - Wjan26bkaP   0.08211 0.1031 Inf    0.797   1.0000
##  Cjan26bkaP - Pfeb1bkaL    0.13635 0.1224 Inf    1.114   1.0000
##  Cjan26bkaP - Pfeb1bkaP   -0.04523 0.1298 Inf   -0.348   1.0000
##  Cjan26bkaP - Pfeb8bkaL   -0.05152 0.1328 Inf   -0.388   1.0000
##  Cjan26bkaP - Pfeb8bkaP   -0.09869 0.1289 Inf   -0.766   1.0000
##  Cjan26bkaP - Pjan24bkaL  -0.04275 0.1298 Inf   -0.329   1.0000
##  Cjan26bkaP - Pjan24bkaP   0.08441 0.1247 Inf    0.677   1.0000
##  Cjan26bkaP - Pjan26bkaL   0.22221 0.1105 Inf    2.012   0.9438
##  Cjan26bkaP - Pjan26bkaP   0.15694 0.1180 Inf    1.330   0.9998
##  Cjan26bkaP - Wfeb1bkaL    0.13559 0.1251 Inf    1.084   1.0000
##  Cjan26bkaP - Wfeb1bkaP    0.21871 0.1109 Inf    1.973   0.9542
##  Cjan26bkaP - Wfeb8bkaL   -0.07513 0.1324 Inf   -0.567   1.0000
##  Cjan26bkaP - Wfeb8bkaP   -0.08864 0.1321 Inf   -0.671   1.0000
##  Cjan26bkaP - Wjan24bkaL   0.16594 0.1190 Inf    1.394   0.9996
##  Cjan26bkaP - Wjan24bkaP   0.14346 0.1194 Inf    1.202   1.0000
##  Cjan26bkaP - Wjan26bkaL   0.21147 0.1134 Inf    1.865   0.9753
##  Cjan26bkaP - Wjan26bkaP   0.20557 0.1124 Inf    1.828   0.9804
##  Pfeb1bkaL - Pfeb1bkaP    -0.18157 0.1231 Inf   -1.475   0.9989
##  Pfeb1bkaL - Pfeb8bkaL    -0.18786 0.1262 Inf   -1.488   0.9988
##  Pfeb1bkaL - Pfeb8bkaP    -0.23504 0.1223 Inf   -1.922   0.9653
##  Pfeb1bkaL - Pjan24bkaL   -0.17910 0.1231 Inf   -1.455   0.9991
##  Pfeb1bkaL - Pjan24bkaP   -0.05194 0.1175 Inf   -0.442   1.0000
##  Pfeb1bkaL - Pjan26bkaL    0.08586 0.1021 Inf    0.841   1.0000
##  Pfeb1bkaL - Pjan26bkaP    0.02059 0.1102 Inf    0.187   1.0000
##  Pfeb1bkaL - Wfeb1bkaL    -0.00076 0.1178 Inf   -0.006   1.0000
##  Pfeb1bkaL - Wfeb1bkaP     0.08237 0.1025 Inf    0.803   1.0000
##  Pfeb1bkaL - Wfeb8bkaL    -0.21147 0.1260 Inf   -1.679   0.9933
##  Pfeb1bkaL - Wfeb8bkaP    -0.22499 0.1256 Inf   -1.791   0.9847
##  Pfeb1bkaL - Wjan24bkaL    0.02959 0.1113 Inf    0.266   1.0000
##  Pfeb1bkaL - Wjan24bkaP    0.00711 0.1117 Inf    0.064   1.0000
##  Pfeb1bkaL - Wjan26bkaL    0.07512 0.1052 Inf    0.714   1.0000
##  Pfeb1bkaL - Wjan26bkaP    0.06922 0.1042 Inf    0.664   1.0000
##  Pfeb1bkaP - Pfeb8bkaL    -0.00629 0.1334 Inf   -0.047   1.0000
##  Pfeb1bkaP - Pfeb8bkaP    -0.05346 0.1295 Inf   -0.413   1.0000
##  Pfeb1bkaP - Pjan24bkaL    0.00248 0.1304 Inf    0.019   1.0000
```

```
## Pfeb1bkaP - Pjan24bkaP   0.12964 0.1254 Inf   1.034  1.0000
## Pfeb1bkaP - Pjan26bkaL   0.26744 0.1113 Inf   2.402  0.7485
## Pfeb1bkaP - Pjan26bkaP   0.20216 0.1188 Inf   1.702  0.9920
## Pfeb1bkaP - Wfeb1bkaL    0.18081 0.1259 Inf   1.437  0.9993
## Pfeb1bkaP - Wfeb1bkaP    0.26394 0.1118 Inf   2.362  0.7761
## Pfeb1bkaP - Wfeb8bkaL   -0.02990 0.1330 Inf  -0.225  1.0000
## Pfeb1bkaP - Wfeb8bkaP   -0.04341 0.1327 Inf  -0.327  1.0000
## Pfeb1bkaP - Wjan24bkaL   0.21117 0.1198 Inf   1.762  0.9875
## Pfeb1bkaP - Wjan24bkaP   0.18868 0.1202 Inf   1.570  0.9973
## Pfeb1bkaP - Wjan26bkaL   0.25670 0.1143 Inf   2.247  0.8464
## Pfeb1bkaP - Wjan26bkaP   0.25079 0.1133 Inf   2.213  0.8641
## Pfeb8bkaL - Pfeb8bkaP   -0.04717 0.1324 Inf  -0.356  1.0000
## Pfeb8bkaL - Pjan24bkaL   0.00876 0.1334 Inf   0.066  1.0000
## Pfeb8bkaL - Pjan24bkaP   0.13593 0.1285 Inf   1.058  1.0000
## Pfeb8bkaL - Pjan26bkaL   0.27373 0.1148 Inf   2.385  0.7607
## Pfeb8bkaL - Pjan26bkaP   0.20845 0.1220 Inf   1.708  0.9916
## Pfeb8bkaL - Wfeb1bkaL    0.18710 0.1289 Inf   1.452  0.9992
## Pfeb8bkaL - Wfeb1bkaP    0.27023 0.1152 Inf   2.346  0.7867
## Pfeb8bkaL - Wfeb8bkaL   -0.02361 0.1359 Inf  -0.174  1.0000
## Pfeb8bkaL - Wfeb8bkaP   -0.03712 0.1355 Inf  -0.274  1.0000
## Pfeb8bkaL - Wjan24bkaL   0.21746 0.1230 Inf   1.767  0.9870
## Pfeb8bkaL - Wjan24bkaP   0.19497 0.1234 Inf   1.580  0.9971
## Pfeb8bkaL - Wjan26bkaL   0.26299 0.1176 Inf   2.236  0.8523
## Pfeb8bkaL - Wjan26bkaP   0.25708 0.1167 Inf   2.203  0.8694
## Pfeb8bkaP - Pjan24bkaL   0.05594 0.1295 Inf   0.432  1.0000
## Pfeb8bkaP - Pjan24bkaP   0.18310 0.1246 Inf   1.470  0.9990
## Pfeb8bkaP - Pjan26bkaL   0.32090 0.1104 Inf   2.906  0.3579
## Pfeb8bkaP - Pjan26bkaP   0.25563 0.1179 Inf   2.168  0.8862
## Pfeb8bkaP - Wfeb1bkaL    0.23428 0.1250 Inf   1.874  0.9739
## Pfeb8bkaP - Wfeb1bkaP    0.31740 0.1109 Inf   2.863  0.3889
## Pfeb8bkaP - Wfeb8bkaL    0.02356 0.1320 Inf   0.178  1.0000
## Pfeb8bkaP - Wfeb8bkaP    0.01005 0.1317 Inf   0.076  1.0000
## Pfeb8bkaP - Wjan24bkaL   0.26463 0.1190 Inf   2.224  0.8586
## Pfeb8bkaP - Wjan24bkaP   0.24215 0.1193 Inf   2.029  0.9386
## Pfeb8bkaP - Wjan26bkaL   0.31016 0.1134 Inf   2.736  0.4875
## Pfeb8bkaP - Wjan26bkaP   0.30426 0.1124 Inf   2.706  0.5110
## Pjan24bkaL - Pjan24bkaP  0.12716 0.1254 Inf   1.014  1.0000
## Pjan24bkaL - Pjan26bkaL  0.26496 0.1113 Inf   2.380  0.7638
## Pjan24bkaL - Pjan26bkaP  0.19969 0.1188 Inf   1.681  0.9932
## Pjan24bkaL - Wfeb1bkaL   0.17834 0.1259 Inf   1.417  0.9994
## Pjan24bkaL - Wfeb1bkaP   0.26147 0.1117 Inf   2.340  0.7906
## Pjan24bkaL - Wfeb8bkaL  -0.03237 0.1330 Inf  -0.243  1.0000
## Pjan24bkaL - Wfeb8bkaP  -0.04589 0.1327 Inf  -0.346  1.0000
## Pjan24bkaL - Wjan24bkaL  0.20869 0.1198 Inf   1.742  0.9892
## Pjan24bkaL - Wjan24bkaP  0.18621 0.1202 Inf   1.550  0.9978
## Pjan24bkaL - Wjan26bkaL  0.25422 0.1142 Inf   2.225  0.8580
## Pjan24bkaL - Wjan26bkaP  0.24832 0.1133 Inf   2.192  0.8749
## Pjan24bkaP - Pjan26bkaL  0.13780 0.1050 Inf   1.313  0.9998
## Pjan24bkaP - Pjan26bkaP  0.07253 0.1129 Inf   0.643  1.0000
## Pjan24bkaP - Wfeb1bkaL   0.05117 0.1203 Inf   0.425  1.0000
## Pjan24bkaP - Wfeb1bkaP   0.13430 0.1054 Inf   1.274  0.9999
## Pjan24bkaP - Wfeb8bkaL  -0.15954 0.1282 Inf  -1.244  0.9999
## Pjan24bkaP - Wfeb8bkaP  -0.17305 0.1279 Inf  -1.353  0.9997
## Pjan24bkaP - Wjan24bkaL  0.08153 0.1140 Inf   0.715  1.0000
```

```
## Pjan24bkaP - Wjan24bkaP   0.05905 0.1143 Inf    0.516  1.0000
## Pjan24bkaP - Wjan26bkaL   0.12706 0.1080 Inf    1.176  1.0000
## Pjan24bkaP - Wjan26bkaP   0.12115 0.1071 Inf    1.132  1.0000
## Pjan26bkaL - Pjan26bkaP  -0.06527 0.0967 Inf   -0.675  1.0000
## Pjan26bkaL - Wfeb1bkaL   -0.08662 0.1053 Inf   -0.822  1.0000
## Pjan26bkaL - Wfeb1bkaP   -0.00350 0.0879 Inf   -0.040  1.0000
## Pjan26bkaL - Wfeb8bkaL   -0.29734 0.1145 Inf   -2.597  0.5992
## Pjan26bkaL - Wfeb8bkaP   -0.31085 0.1141 Inf   -2.724  0.4972
## Pjan26bkaL - Wjan24bkaL  -0.05627 0.0980 Inf   -0.574  1.0000
## Pjan26bkaL - Wjan24bkaP  -0.07875 0.0985 Inf   -0.800  1.0000
## Pjan26bkaL - Wjan26bkaL  -0.01074 0.0910 Inf   -0.118  1.0000
## Pjan26bkaL - Wjan26bkaP  -0.01664 0.0899 Inf   -0.185  1.0000
## Pjan26bkaP - Wfeb1bkaL   -0.02135 0.1132 Inf   -0.189  1.0000
## Pjan26bkaP - Wfeb1bkaP    0.06178 0.0972 Inf    0.636  1.0000
## Pjan26bkaP - Wfeb8bkaL   -0.23206 0.1217 Inf   -1.907  0.9683
## Pjan26bkaP - Wfeb8bkaP   -0.24558 0.1214 Inf   -2.023  0.9405
## Pjan26bkaP - Wjan24bkaL   0.00900 0.1064 Inf    0.085  1.0000
## Pjan26bkaP - Wjan24bkaP  -0.01348 0.1068 Inf   -0.126  1.0000
## Pjan26bkaP - Wjan26bkaL   0.05453 0.1001 Inf    0.545  1.0000
## Pjan26bkaP - Wjan26bkaP   0.04863 0.0990 Inf    0.491  1.0000
## Wfeb1bkaL - Wfeb1bkaP     0.08313 0.1058 Inf    0.786  1.0000
## Wfeb1bkaL - Wfeb8bkaL    -0.21071 0.1286 Inf   -1.638  0.9952
## Wfeb1bkaL - Wfeb8bkaP    -0.22423 0.1283 Inf   -1.747  0.9887
## Wfeb1bkaL - Wjan24bkaL    0.03036 0.1143 Inf    0.266  1.0000
## Wfeb1bkaL - Wjan24bkaP    0.00787 0.1147 Inf    0.069  1.0000
## Wfeb1bkaL - Wjan26bkaL    0.07588 0.1084 Inf    0.700  1.0000
## Wfeb1bkaL - Wjan26bkaP    0.06998 0.1074 Inf    0.651  1.0000
## Wfeb1bkaP - Wfeb8bkaL    -0.29384 0.1149 Inf   -2.558  0.6309
## Wfeb1bkaP - Wfeb8bkaP    -0.30735 0.1145 Inf   -2.683  0.5296
## Wfeb1bkaP - Wjan24bkaL   -0.05277 0.0985 Inf   -0.536  1.0000
## Wfeb1bkaP - Wjan24bkaP   -0.07526 0.0989 Inf   -0.761  1.0000
## Wfeb1bkaP - Wjan26bkaL   -0.00724 0.0916 Inf   -0.079  1.0000
## Wfeb1bkaP - Wjan26bkaP   -0.01315 0.0904 Inf   -0.145  1.0000
## Wfeb8bkaL - Wfeb8bkaP    -0.01351 0.1352 Inf   -0.100  1.0000
## Wfeb8bkaL - Wjan24bkaL    0.24107 0.1228 Inf    1.964  0.9562
## Wfeb8bkaL - Wjan24bkaP    0.21858 0.1231 Inf    1.776  0.9862
## Wfeb8bkaL - Wjan26bkaL    0.28660 0.1173 Inf    2.443  0.7192
## Wfeb8bkaL - Wjan26bkaP    0.28069 0.1164 Inf    2.411  0.7419
## Wfeb8bkaP - Wjan24bkaL    0.25458 0.1224 Inf    2.079  0.9222
## Wfeb8bkaP - Wjan24bkaP    0.23210 0.1228 Inf    1.891  0.9711
## Wfeb8bkaP - Wjan26bkaL    0.30011 0.1170 Inf    2.566  0.6247
## Wfeb8bkaP - Wjan26bkaP    0.29421 0.1161 Inf    2.535  0.6488
## Wjan24bkaL - Wjan24bkaP  -0.02248 0.1080 Inf   -0.208  1.0000
## Wjan24bkaL - Wjan26bkaL   0.04553 0.1013 Inf    0.449  1.0000
## Wjan24bkaL - Wjan26bkaP   0.03962 0.1002 Inf    0.395  1.0000
## Wjan24bkaP - Wjan26bkaL   0.06801 0.1017 Inf    0.668  1.0000
## Wjan24bkaP - Wjan26bkaP   0.06211 0.1007 Inf    0.617  1.0000
## Wjan26bkaL - Wjan26bkaP  -0.00590 0.0935 Inf   -0.063  1.0000
##
## P value adjustment: tukey method for comparing a family of 24 estimates
```