Verteilungen

21.04.2022

Bibliotheken laden, Hilfsfunktion

```
library(stringr)    # String-verarbeitung
library(ggplot2)    # moderne plots

debug <- T          #      debug output
debug <- F          # kein debug output
Log <- function(string) {
  if(debug){print(string)}
}
```

Resistenzen_U.csv o. Resistenzen_LE8000.csv o.Resistenzen_GT8000.csv einlesen

Diese Tabellen wurden von Resistenzen.Rmd erzeugt. Sie evtl. auch ansehen

```
Schicht <- "GT8000"
Schicht <- "U"
Schicht <- "LE8000"

Resistenzen <- read.csv(paste("Resistenzen_",Schicht,".csv",sep=""))

# csv raussschreiben u. wieder einlesen fügt vorne Index-Spalte an; diese entfernen :
Resistenzen[,1] <- NULL

if(debug){View(Resistenzen)}
```

Verteilungen

```
# Hilfs-Dataframes, implizit sollte genügen!

ResistenzenWM1  <- Resistenzen[Resistenzen["WM.group"]  == "1",]  #    waste milk Group
ResistenzenWM2  <- Resistenzen[Resistenzen["WM.group" ] == "2",]  # no waste milk Group
#if(debug){View(ResistenzenWM2)}

ResistenzenOLS0 <- Resistenzen[Resistenzen["OLS.group"] == "0",]  #    other livestock Group
ResistenzenOLS1 <- Resistenzen[Resistenzen["OLS.group"] == "1",]  # no other livestock  Group
#if(debug){View(ResistenzenOLS0);View(ResistenzenOLS1)}

ResistenzenIAC0 <- Resistenzen[Resistenzen["IAC.group"] == "0",]  #    ill animals in calving box Group
ResistenzenIAC1 <- Resistenzen[Resistenzen["IAC.group"] == "1",]  # no ill animals in calving box Group
#if(debug){View(ResistenzenIAC0);View(ResistenzenIAC1)}

ResistenzenHSC0 <- Resistenzen[Resistenzen["HSC.group"] == "0",]  # stable w\o  outlet
ResistenzenHSC1 <- Resistenzen[Resistenzen["HSC.group"] == "1",]  # stable with outlet
ResistenzenHSC2 <- Resistenzen[Resistenzen["HSC.group"] == "2",]  # outdoors
ResistenzenHSC3 <- Resistenzen[Resistenzen["HSC.group"] == "3",]  # 0+1
ResistenzenHSC4 <- Resistenzen[Resistenzen["HSC.group"] == "4",]  # 1+2
ResistenzenHSC5 <- Resistenzen[Resistenzen["HSC.group"] == "5",]  # 0+2
#if(debug){View(ResistenzenHSC0);View(ResistenzenHSC1);View(ResistenzenHSC2);View(ResistenzenHSC3);View(Resistenze
```

Graphiken und Deskriptive Analyse: Für diesen Fall analysieren wir die (meist links und/oder rechts abgeschnittenen) Verteilungen

```
graphisch <- function(groups,antib, anfang,ende, schrittBin,schrittLab) {

  if (ende < 0) {            # kleiner Trick um zusätzliches Funktionsargument zu vermeiden
    Ende=F
    ende = -ende
  } else{
    Ende=T
  }
  Log(paste("Ende, ende =",Ende,ende))

  dir.create(paste("verteilungen_",Schicht,sep=""))             # directory for writing the plots

  if(groups == "WM.group" ){
    listdfs <- list(Resistenzen    , ResistenzenWM1 , ResistenzenWM2 )  #  implizit sollte genügen! (Vektor klappt
    Titel   <- c(   "WM or not", "WM           ", "no WM     ")
  }
   if(groups == "OLS.group" ){
    listdfs <- list(Resistenzen    , ResistenzenOLS1 , ResistenzenOLS0 )
    Titel   <- c(   "OLS or not", "OLS           ", "no OLS      ")
  }
   if(groups == "IAC.group" ){
    listdfs <- list(Resistenzen    , ResistenzenIAC1 , ResistenzenIAC0 )
    Titel   <- c(   "IAC or not", "IAC           ", "no IAC      ")
  }
  if(groups == "HSC.group"){
    listdfs <- list(Resistenzen    , ResistenzenHSC0, ResistenzenHSC1,
                    ResistenzenHSC2, ResistenzenHSC3, ResistenzenHSC4, ResistenzenHSC5)
    Titel   <- c(   "arbitrary HSC          ",
                    "0: stable w\\o  outlet", "1: stable with outlet", "2: outdoors          ","3 = 0 + 1      ","4
  }

  for (i in 2:length(Titel)){     # nicht 1. plot "XY oder nicht"  deskriptive Statistik - geht sicher o. eigene D
    DF <- listdfs[[i]]            # listdfs kürzer: nur hier explizit?

    numstrings <- str_replace(DF[[antib]], paste0("<=",anfang),  as.character(anfang))
    # z.B. "1" als numerischer Platzhalter für "<=1"
    numstrings <- str_replace(numstrings          , paste0(">",ende)    , as.character(ende)) #+1))
    # z.B. "33" als numerischer Platzhalter für ">32"
    numbers <- as.numeric(numstrings )      # jetzt alles als Zahlen

    Log("numbers =");Log(numbers)
    # Median könnte im "<=" Bereich liegen oder im ">=", entsprechend reagieren:
    median <- median(numbers, na.rm=T)  # (na.rm=T fürs Lesen aus file, vorher war das "NA")
    rel <- "="                          # Relations-Symbol
    Log(paste( "median, anfang =",median, anfang ))
    if(median == anfang){
      rel <- "<="
    }
    if(Ende && median == ende){
      rel <- ">"
    }

    print(paste(antib,"- Resistance,", Titel[i], ":"))
    print(paste("  Median            ", rel, median))

    if(Ende && (max(numbers, na.rm=T) > ende)){  # gibt overflow bin, ist nicht leer: Verteilung nicht nach oben b

      # kleinste Werte kleinstmöglich und grösste Werte kleinstmöglich ergibt Mindestwert des Mittelwertes
      mean <- mean(replace(numbers, numbers==anfang, 0), na.rm=T)

      print(paste("  Mean           >= ", mean  ))
      print("")
    } else {                      # Verteilung nach oben beschränkt
```

```
    if (anfang %in% numbers) {  # Verteilung nach oben beschränkt, nicht nach unten
                                #  (underflow bin gibt's FAST immer)
      mean1 <- mean(numbers, na.rm=T)    # kleinste Werte grösstmöglich gibt Höchstwert des Mittelwertes

      numbers0 <- replace(numbers, numbers==anfang, 0)    # kleinste Werte kleinstmöglich
      mean0 <- mean(numbers0, na.rm=T)                              #   ergibt Mindestwert des Mittelwertes
      print(paste("  Mean   in ", sprintf("%.3f",mean0), "...", sprintf("%.3f",mean1)  ))
      print("")
    } else {                    # Verteilung nach oben und unten beschränkt : einfachster Fall
      print(paste("  Mean   = ", sprintf("%.3f",mean(numbers, na.rm=T)) ) )
      print("")
    }
  }
}

DF2 <- Resistenzen

numstrings <- str_replace(DF2[[antib]], paste0("<=",anfang),  as.character(anfang))   # \\ OBEN SCHON: factor ou
# z.B. "1" als numerischer Platzhalter für "<=1"
numstrings <- str_replace(numstrings          , paste0(">",ende)    , as.character(ende)) #+1))
# z.B. "33" als numerischer Platzhalter für ">32"
numbers <- as.numeric(numstrings )      # jetzt alles als Zahlen
Log(3)

DF2$numbers <- numbers
Log("i, numbers=");Log(i);Log(numbers)

# https://stackoverflow.com/questions/23944355/r-hist-right-left-clump-binning war hier eine Inspiration,
# fieseln für die tick labels weil R sonst aus Platzproblemen das wichtige letzte tick label unterdrückt:
if(Ende) {
  seqAt  <- seq(schrittBin         ,ende+schrittBin,by=schrittLab)  # kleineres ende+... klappt nicht
  seqAt[length(seqAt)]  <- seqAt[length(seqAt)]-schrittBin          # also zurückkorrigieren
  #seqAt  <- seq(schrittBin         ,ende+0.001,by=schrittLab)
} else {
  seqAt  <- seq(schrittBin,ende           ,by=schrittLab)  # 1 Bin weniger
}
Log("seqAt:"); Log(seqAt)
seqLab <- seq(schrittBin+schrittLab,ende           ,by=schrittLab)
seqLab <- seq(schrittBin           ,ende+schrittBin,by=schrittLab)

Log("seqLab:");Log(seqLab)

seqLab_cutR <- seqLab[1:length(seqLab)-1]
Log("seqLab_cutR:");Log(seqLab_cutR)

seqLab_cutLR <- seqLab_cutR[2:length(seqLab_cutR)]
Log("seqLab_cutLR:");Log(seqLab_cutLR)

Labels <- c(paste0("<=",anfang),seqLab_cutLR)
Log("Labels, 1:");Log(Labels)

if(Ende) { Labels <- c(Labels,paste0(">",ende)) }
Log("Labels, 2:");Log(Labels)

Ylab <- "Frequency"
Xlab <- "Dose"

Log("breaks="); Log(seqAt)
Log("labels ="); Log(Labels)

plot <- ggplot(DF2, aes(x=numbers)) +
  scale_x_continuous(trans = "log10", breaks=seqAt, labels=Labels, limits=c(anfang*.8,ende*1.2)) +
  # limits=anfang...ende aber bisschen mehr um dort zu plotten
```

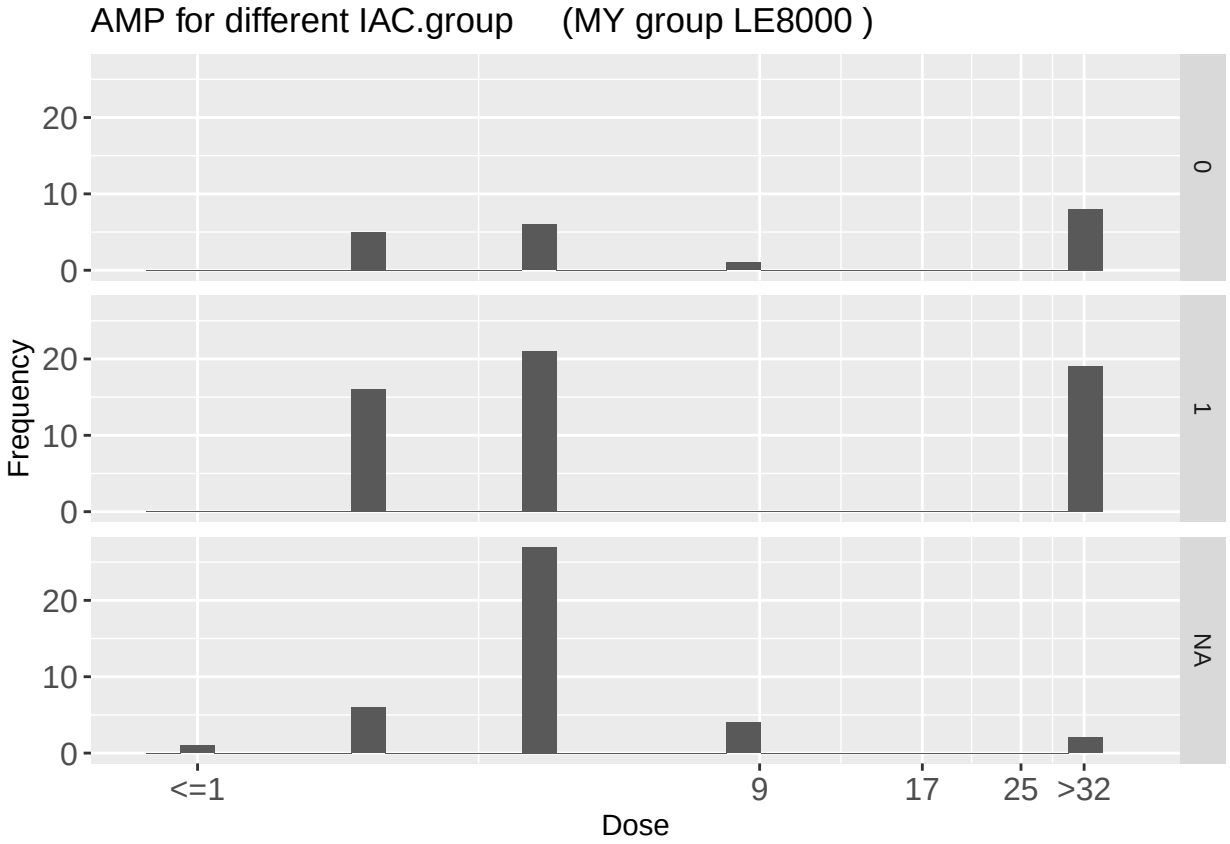
```
    # -0.01 o. *0.9; +1 o. *1.1 genügt nicht
    geom_histogram()                              +
    theme(axis.text.x = element_text(size=12)) +   # HSC.group kleben die labels oft aneinander
    theme(axis.text.y = element_text(size=12)) +   # aber das ist kaum zu ändern: mit < 12 nimmt R oft noch mehr t
    xlab(Xlab) + ylab(Ylab)                       +

    facet_grid(reformulate(".",groups))    +       # vertikal   geschichtet. reformulate gibt Formel (IAC.group ~
    #facet_grid(reformulate(groups,"."))    +      # horizontal geschichtet - war weniger schön.

    ggtitle(paste(antib,"for different",groups, "    (MY group", Schicht,")"))


  print(plot)
  ggsave(paste("verteilungen_",Schicht,"/verteilung_", Schicht,"_",groups,"_",antib,".png", sep=""))

}
```

Ill Animals in Calving Box - Gruppen

Mit “IAC” abgekürzt.

```
  graphisch("IAC.group", "AMP", 1,32, 1,8)
```

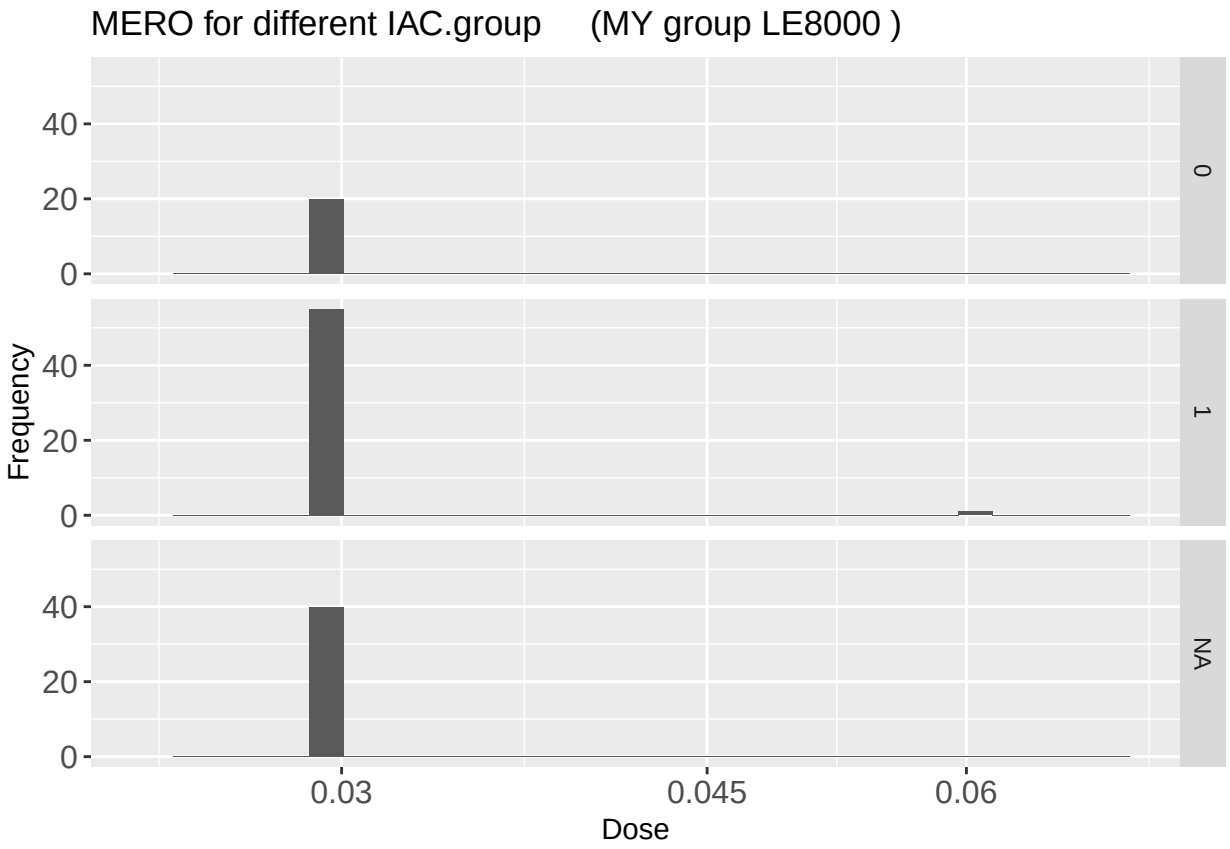
```
## [1] "AMP - Resistance, IAC            :"
## [1] "  Median             = 4"
## [1] "  Mean   =  12.929"
## [1] ""
## [1] "AMP - Resistance, no IAC       :"
## [1] "  Median             = 4"
## [1] "  Mean   =  14.900"
## [1] ""
```




```
  graphisch("IAC.group", "MERO", 0.03,-0.06,   0.015,0.015 )
```

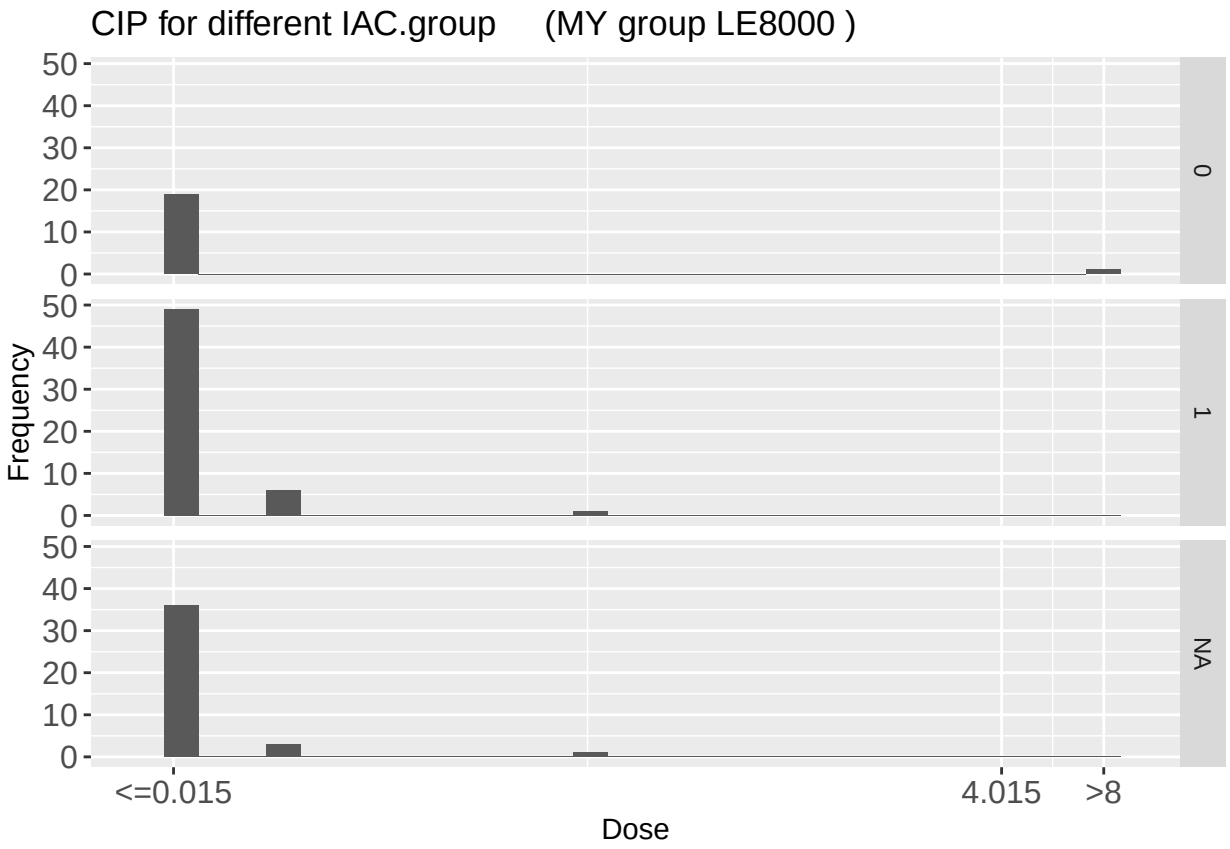
```
## [1] "MERO - Resistance, IAC            :"
## [1] "  Median             <= 0.03"
```

```
## [1] "  Mean   in  0.001 ... 0.031"
## [1] ""
## [1] "MERO - Resistance, no IAC       :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.000 ... 0.030"
## [1] ""
```



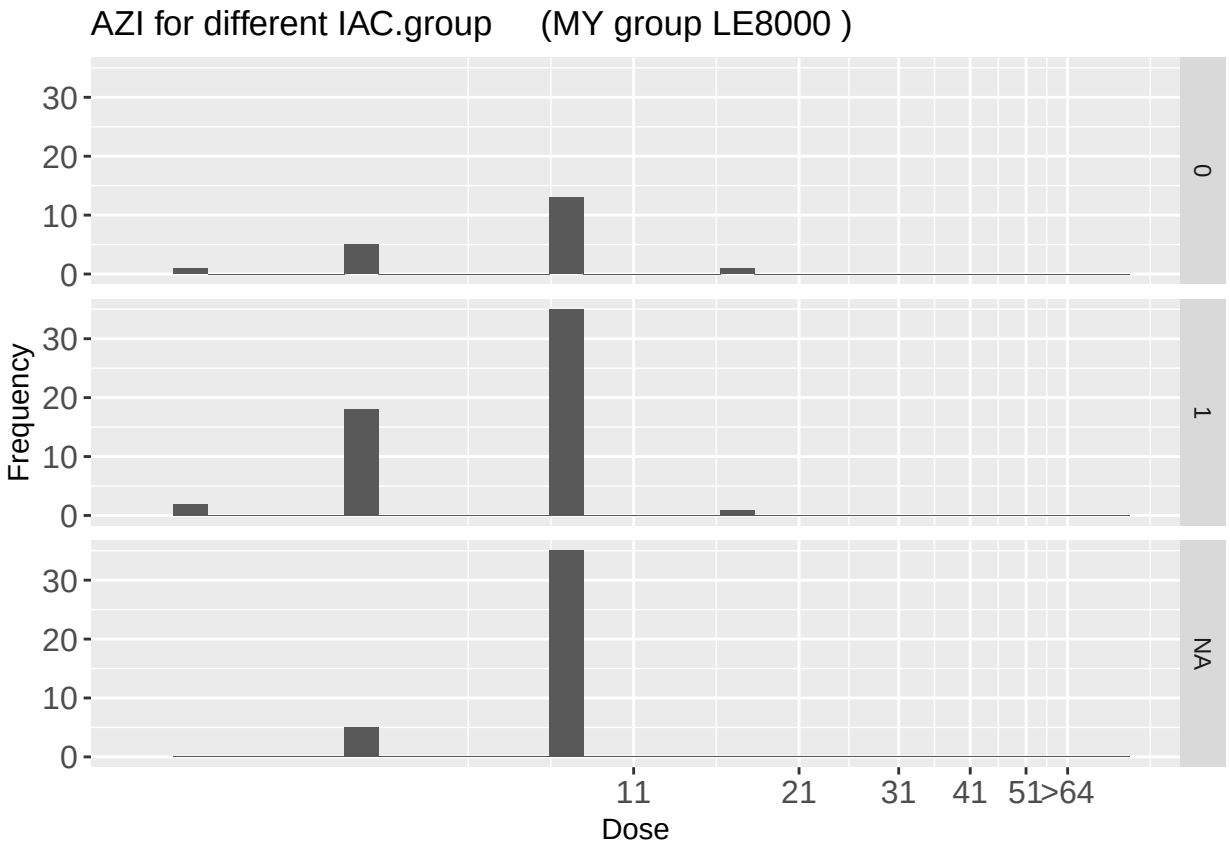

```
graphisch("IAC.group", "CIP" , 0.015,   8   ,   0.015,   4     )
```

```
## [1] "CIP - Resistance, IAC           :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.008 ... 0.021"
## [1] ""
## [1] "CIP - Resistance, no IAC       :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.400 ... 0.414"
## [1] ""
```



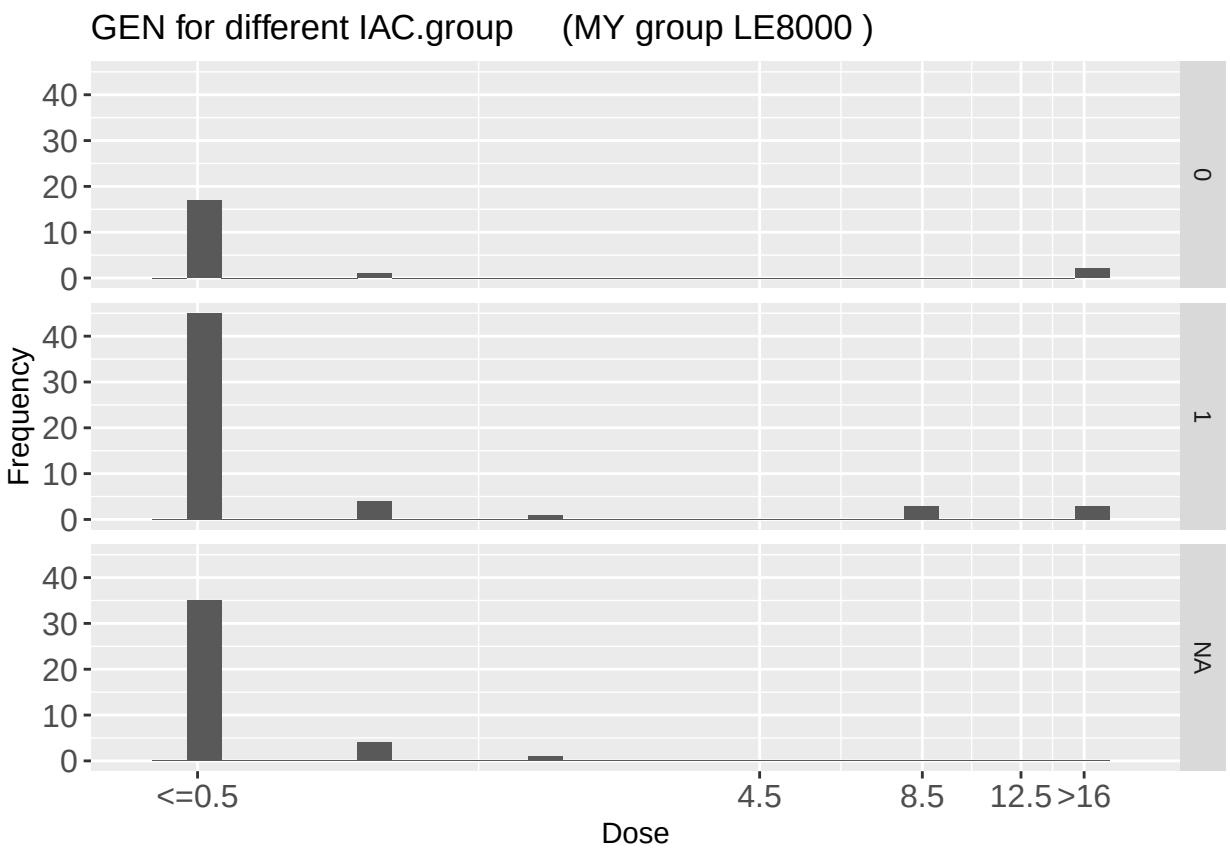

```
graphisch("IAC.group","AZI" , 2,64,   1,10)
```

```
## [1] "AZI - Resistance, IAC            :"
## [1] "  Median             = 8"
## [1] "  Mean   in  6.571 ... 6.643"
## [1] ""
## [1] "AZI - Resistance, no IAC       :"
## [1] "  Median             = 8"
## [1] "  Mean   in  7.000 ... 7.100"
## [1] ""
```



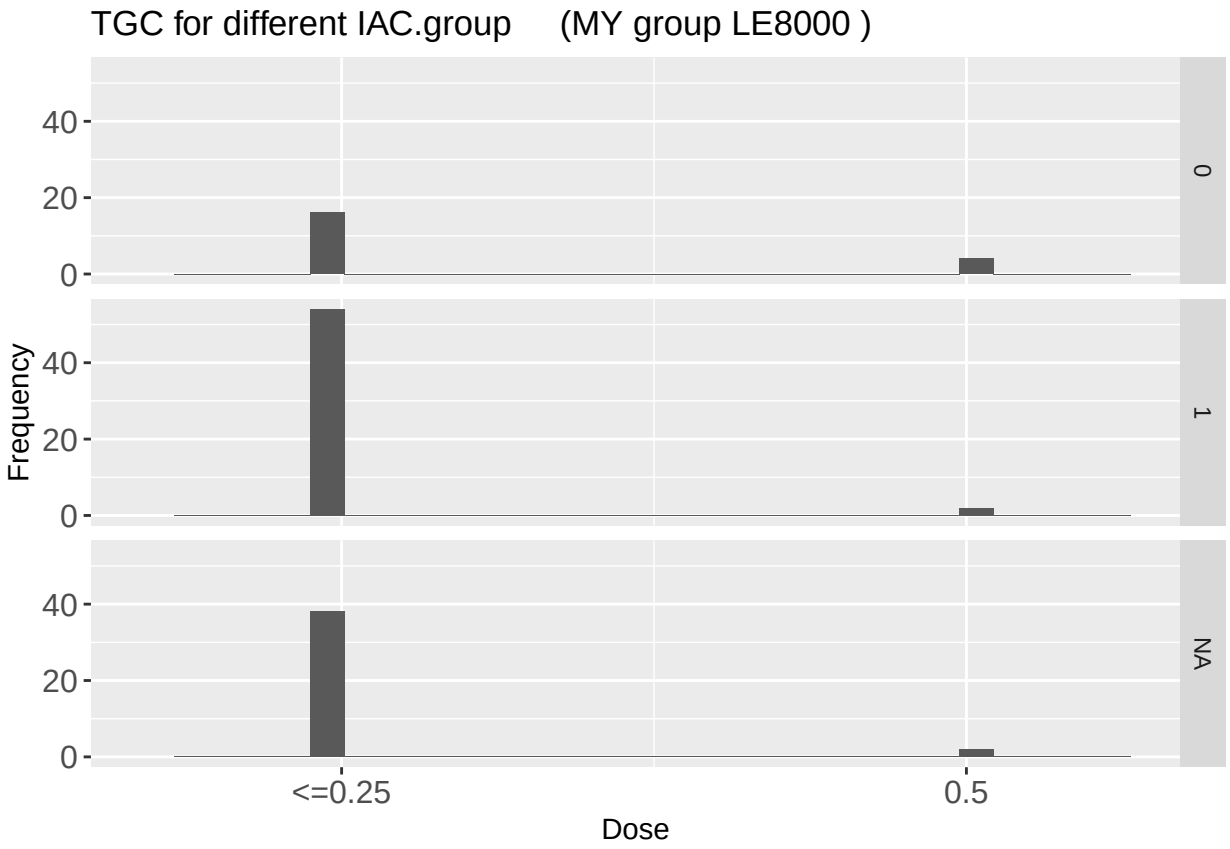

```
graphisch("IAC.group", "GEN" , 0.5  ,  16   ,   0.5  ,   4    )
```

```
## [1] "GEN - Resistance, IAC           :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  1.393 ... 1.795"
## [1] ""
## [1] "GEN - Resistance, no IAC       :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  1.650 ... 2.075"
## [1] ""
```



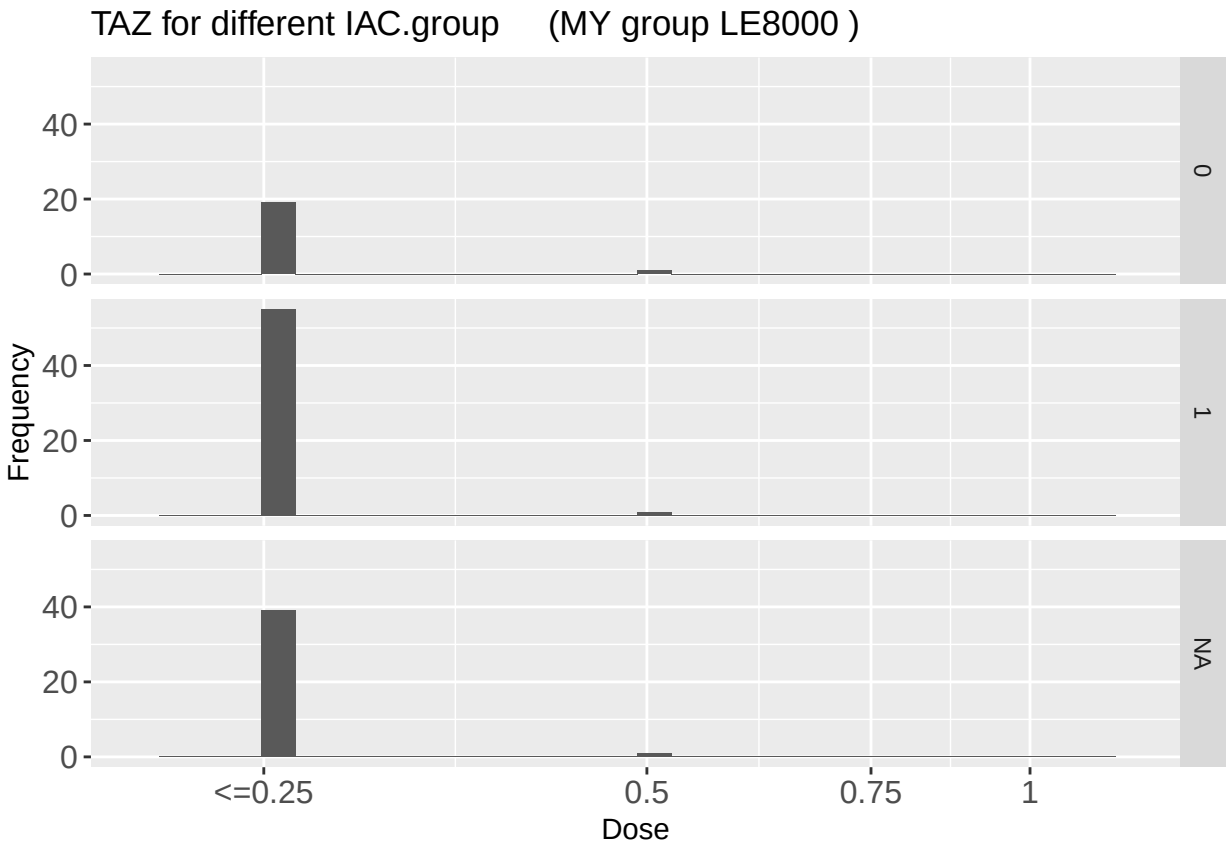

```
graphisch("IAC.group", "TGC" , 0.25 ,  -0.5 ,   0.25 ,   0.25 )
```

```
## [1] "TGC - Resistance, IAC            :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.018 ... 0.259"
## [1] ""
## [1] "TGC - Resistance, no IAC       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.100 ... 0.300"
## [1] ""
```



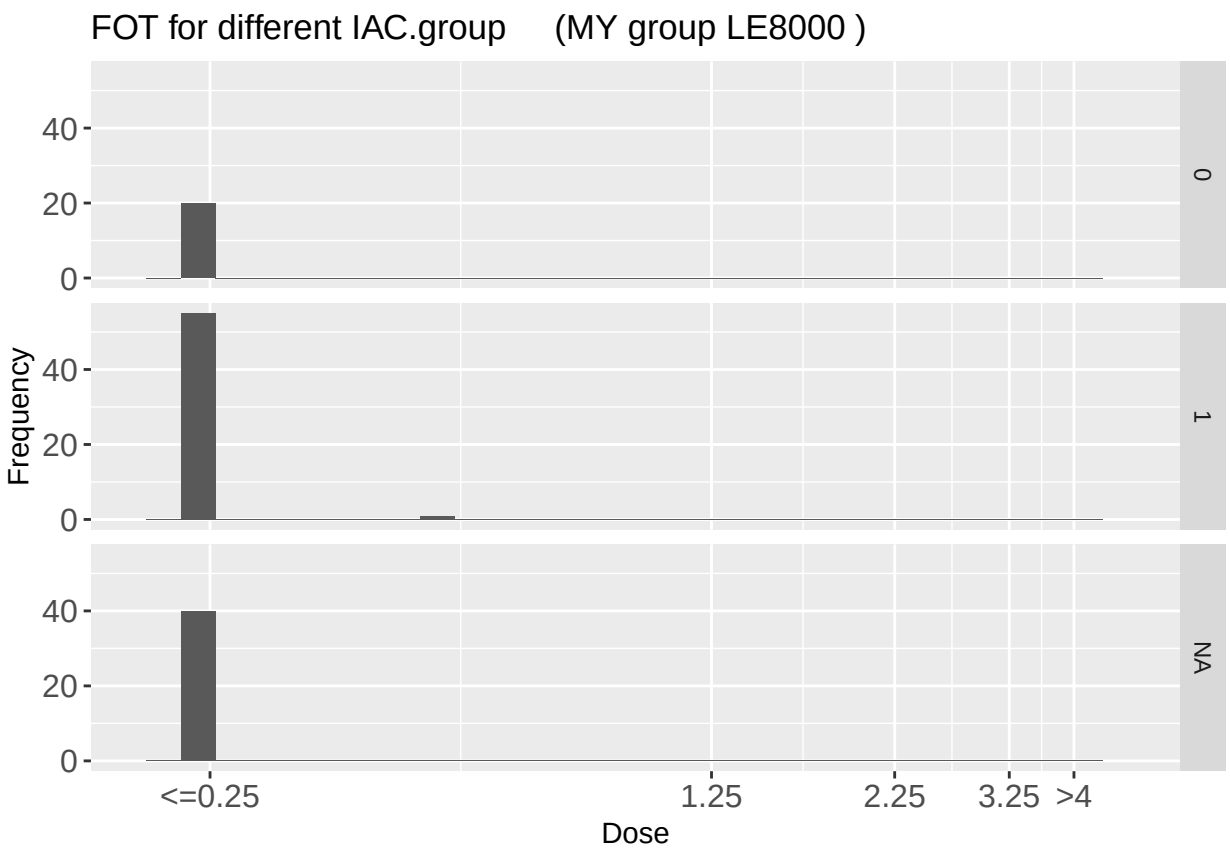

```
graphisch("IAC.group", "TAZ" , 0.25,-1,   0.25,0.25 )
```

```
## [1] "TAZ - Resistance, IAC            :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.009 ... 0.254"
## [1] ""
## [1] "TAZ - Resistance, no IAC       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.025 ... 0.263"
## [1] ""
```



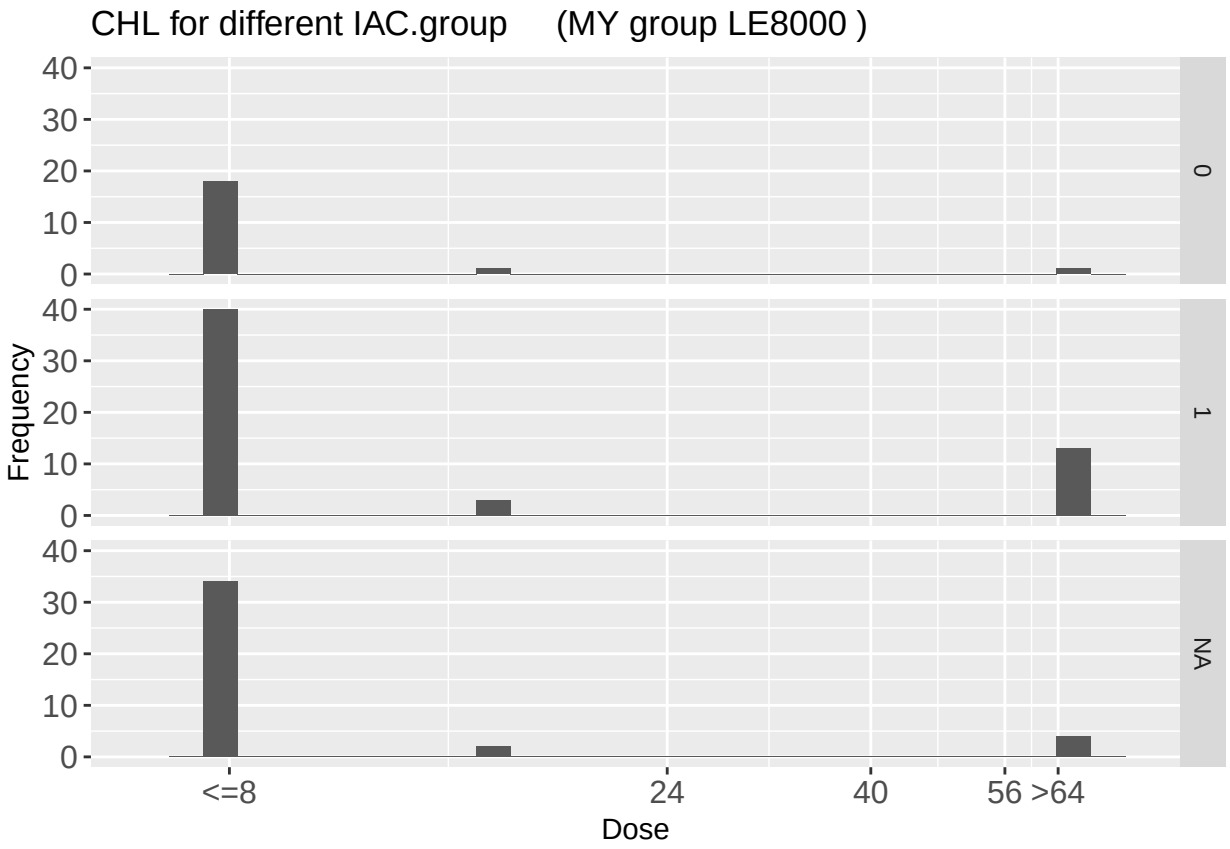

```
graphisch("IAC.group", "FOT" , 0.25,4   ,   0.25,1     )
```

```
## [1] "FOT - Resistance, IAC            :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.009 ... 0.254"
## [1] ""
## [1] "FOT - Resistance, no IAC       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
```



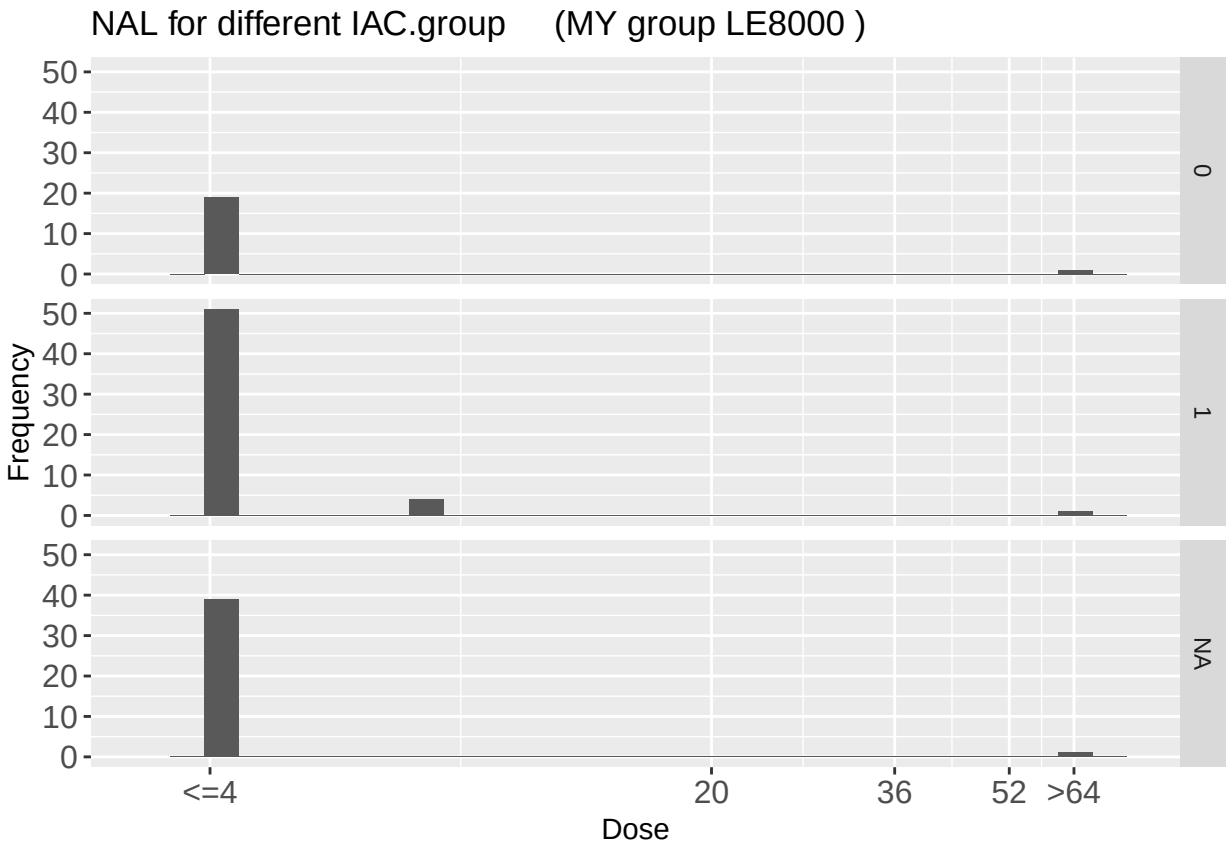

```
graphisch("IAC.group", "CHL" , 8    ,  64   ,   8,16   )
```

```
## [1] "CHL - Resistance, IAC            :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  15.714 ... 21.429"
## [1] ""
## [1] "CHL - Resistance, no IAC       :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  4.000 ... 11.200"
## [1] ""
```



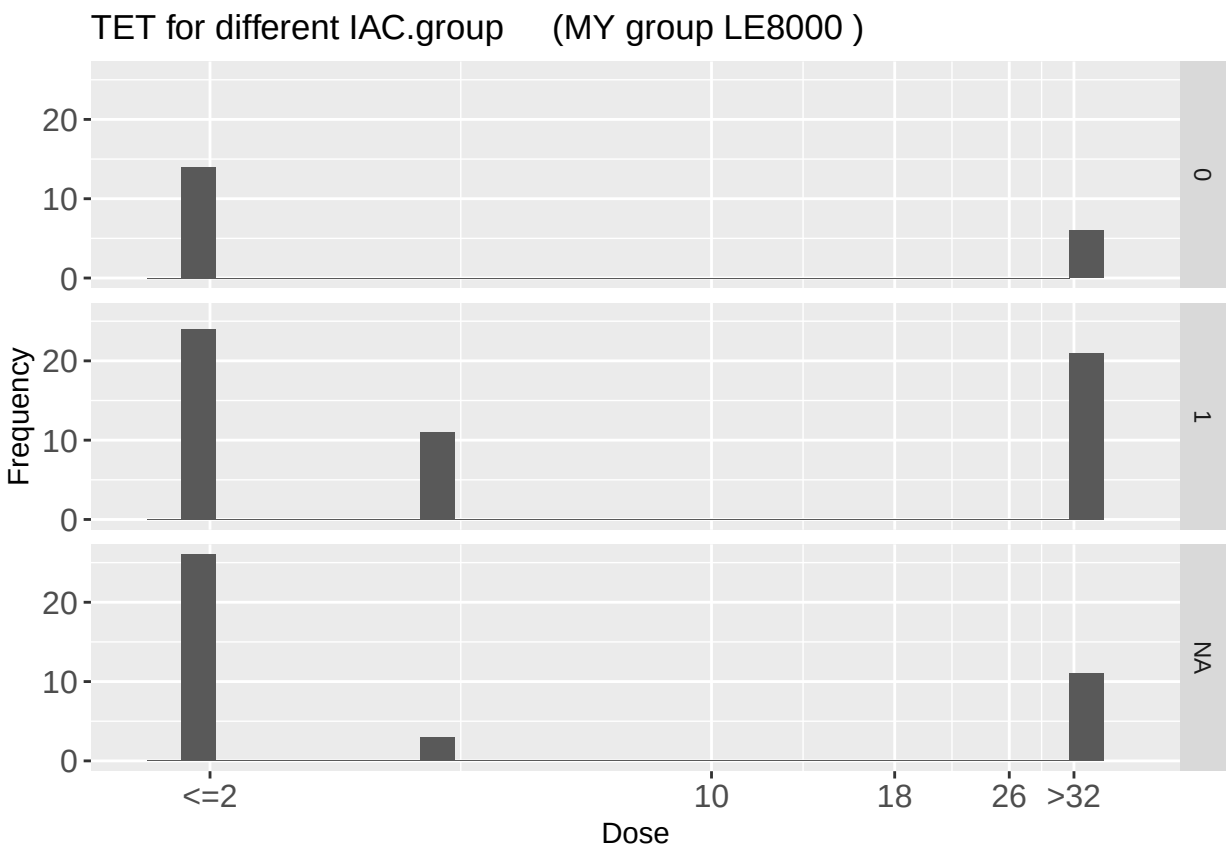

```
graphisch("IAC.group", "NAL" , 4,64,   4,16    )
```

```
## [1] "NAL - Resistance, IAC            :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  1.714 ... 5.357"
## [1] ""
## [1] "NAL - Resistance, no IAC       :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  3.200 ... 7.000"
## [1] ""
```



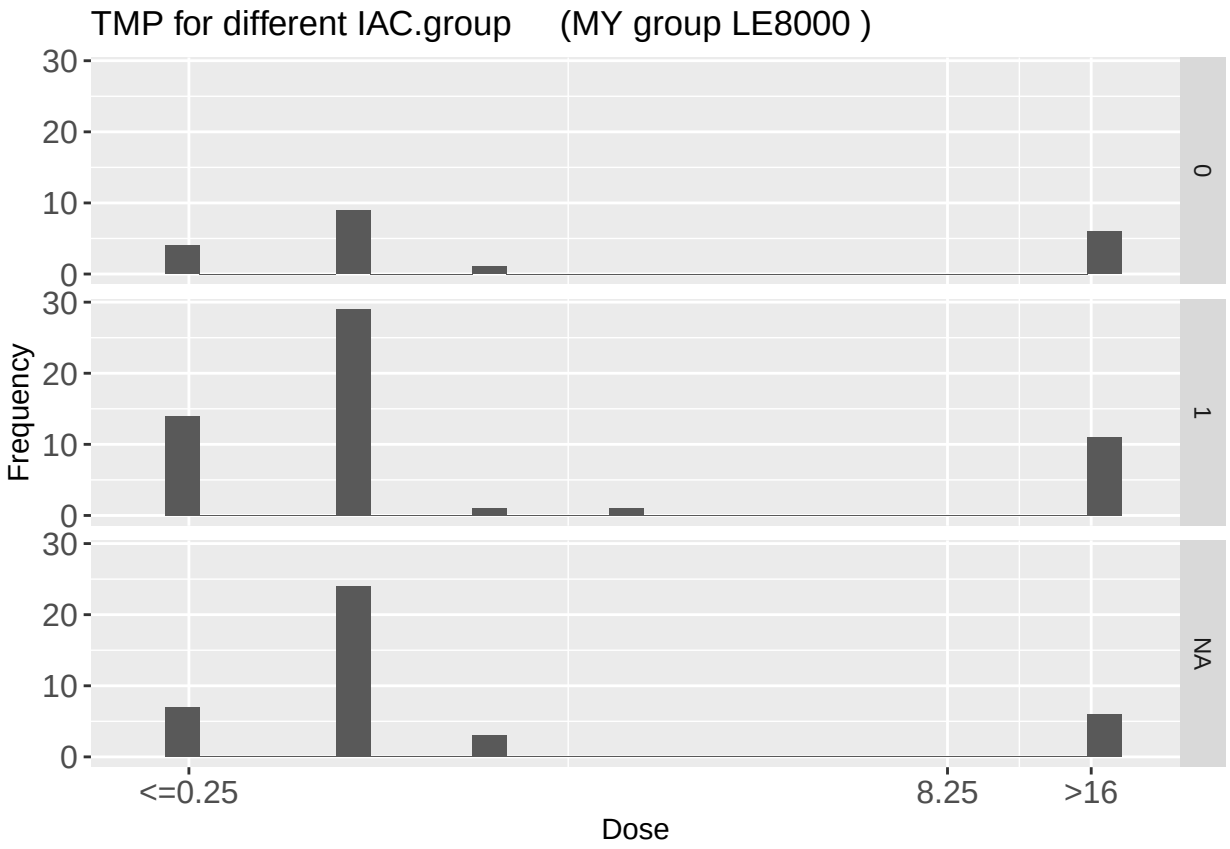

```
graphisch("IAC.group", "TET" , 2,32,   2,8    )
```

```
## [1] "TET - Resistance, IAC            :"
## [1] "  Median             = 4"
## [1] "  Mean   in  12.786 ... 13.643"
## [1] ""
## [1] "TET - Resistance, no IAC       :"
## [1] "  Median             <= 2"
## [1] "  Mean   in  9.600 ... 11.000"
## [1] ""
```



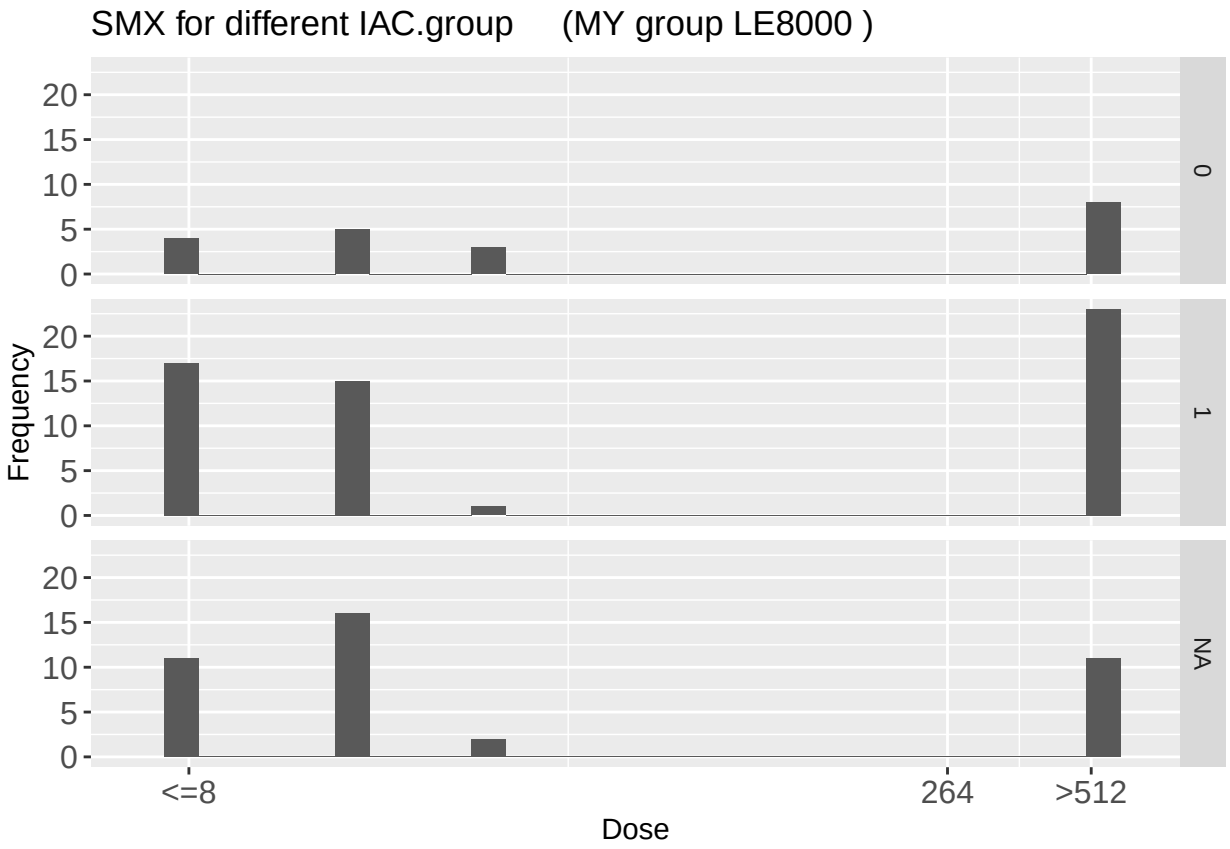

```
graphisch("IAC.group", "TMP" , 0.25 ,  16   ,   0.25,8    )
```

```
## [1] "TMP - Resistance, IAC           :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  3.455 ... 3.518"
## [1] ""
## [1] "TMP - Resistance, no IAC       :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  5.075 ... 5.125"
## [1] ""
```




```
graphisch("IAC.group", "SMX" , 8    , 512   ,   8,256    )
```

```
## [1] "SMX - Resistance, IAC            :"
## [1] "  Median             = 16"
## [1] "  Mean   in  215.143 ... 217.571"
## [1] ""
## [1] "SMX - Resistance, no IAC       :"
## [1] "  Median             = 32"
## [1] "  Mean   in  213.600 ... 215.200"
## [1] ""
```




```
#stop the script - by error
```

Die Mittelwerte der Resistenz sind für 5 Antibiotika vergleichbar (AMP, MERO, TGC, TAZ, CHL), für GEN tendenziell grösser im Fall *Ill Animals in Calving box*, für 3 Antibiotika tendenziell kleiner in diesem Fall (ZIP, AZI, NAL), für TET definitv grösser in diesem Fall und für 3 Antibiotika definitiv kleiner in diesem Fall (FOT, TMP, SMX). Diese Relationen sind im wesentlichen gleich gerichtet wie in WM - keine WM.

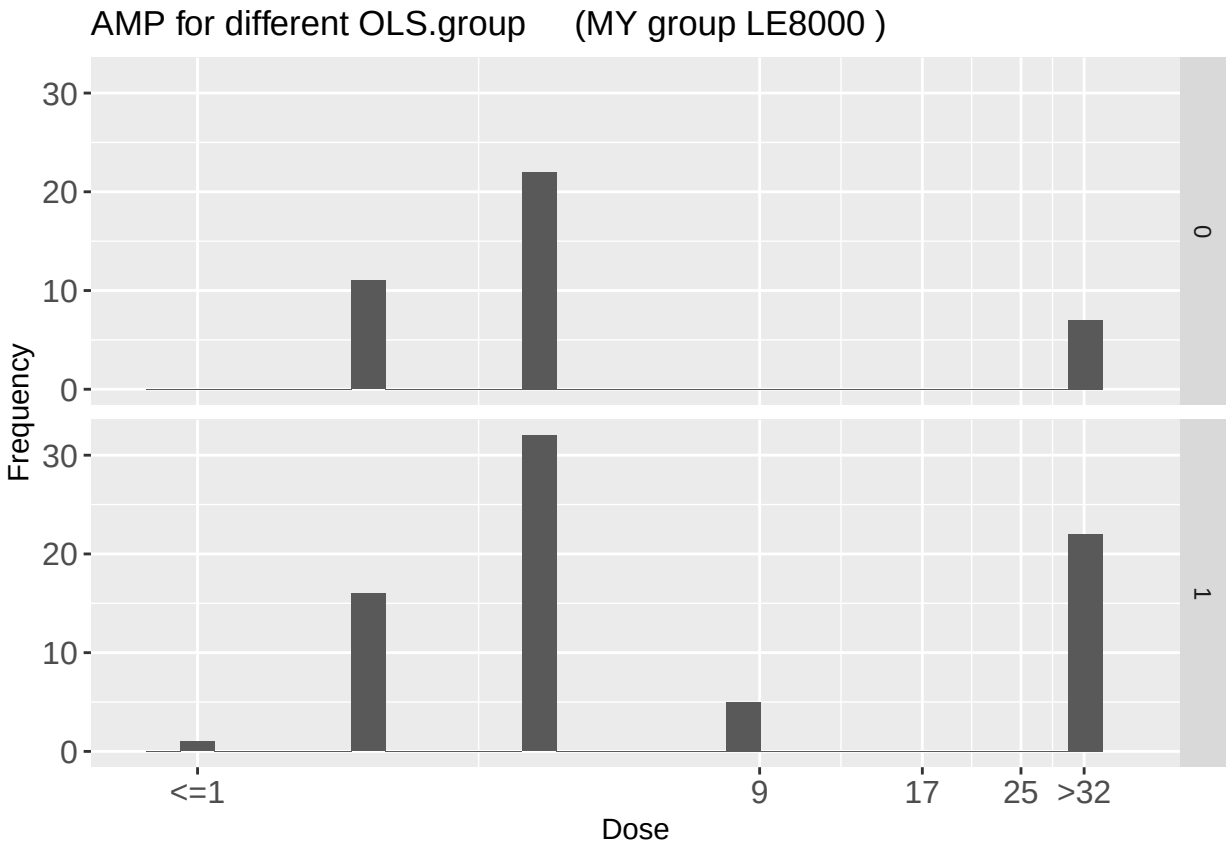
Der Vergleich des Medians der 2 Gruppen zeigt Unterschiede nur für TET und SMX, in der gleichen Richtung wie der Mittelwert. Deshalb diskutiere ich den Median nicht weiter.

Other Live Stock - Gruppen

Mit “OLS” abgekürzt.

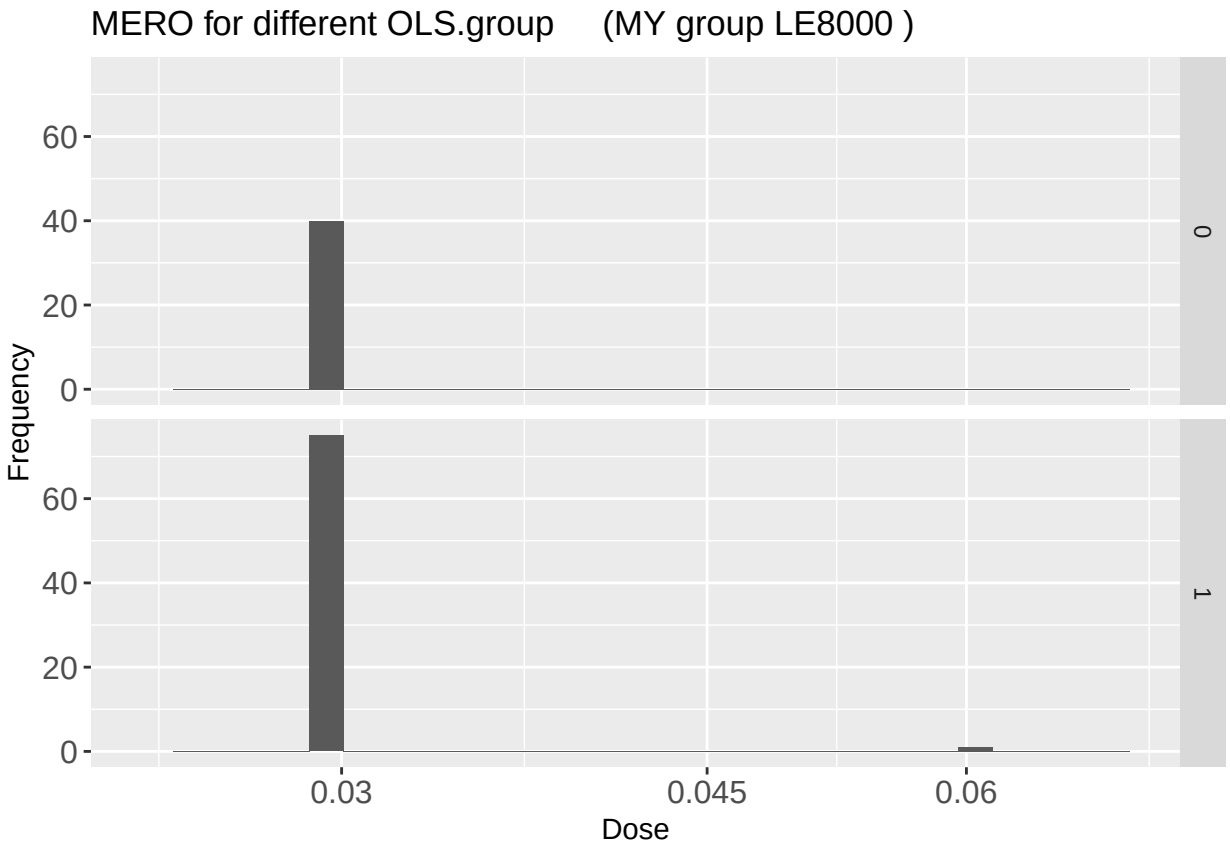
```
graphisch("OLS.group", "AMP", 1,32, 1,8)
```

```
## [1] "AMP - Resistance, OLS            :"
## [1] "  Median             = 4"
## [1] "  Mean   in  11.895 ... 11.908"
## [1] ""
## [1] "AMP - Resistance, no OLS       :"
## [1] "  Median             = 4"
## [1] "  Mean   =  8.350"
## [1] ""
```



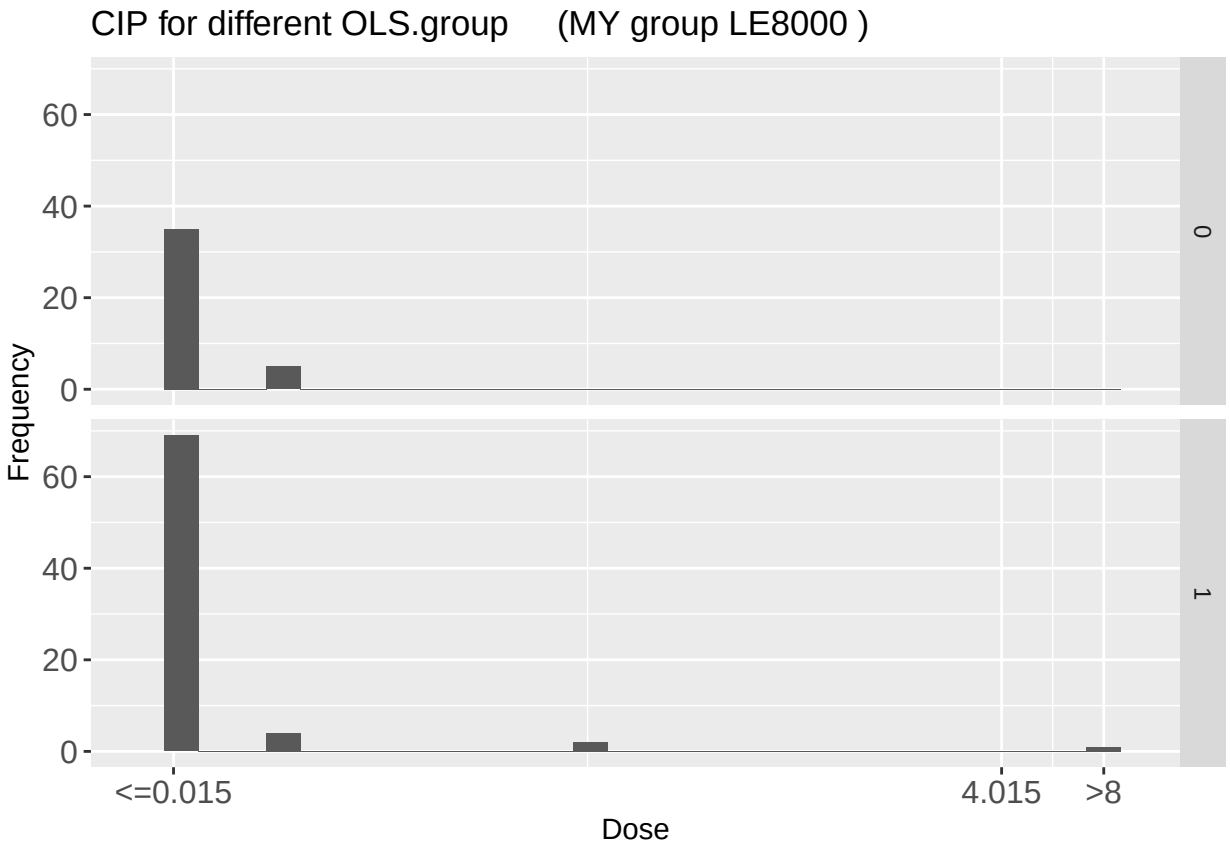

```
graphisch("OLS.group", "MERO", 0.03 ,  -0.06,   0.015,   0.015 )
```

```
## [1] "MERO - Resistance, OLS           :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.001 ... 0.030"
## [1] ""
## [1] "MERO - Resistance, no OLS       :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.000 ... 0.030"
## [1] ""
```



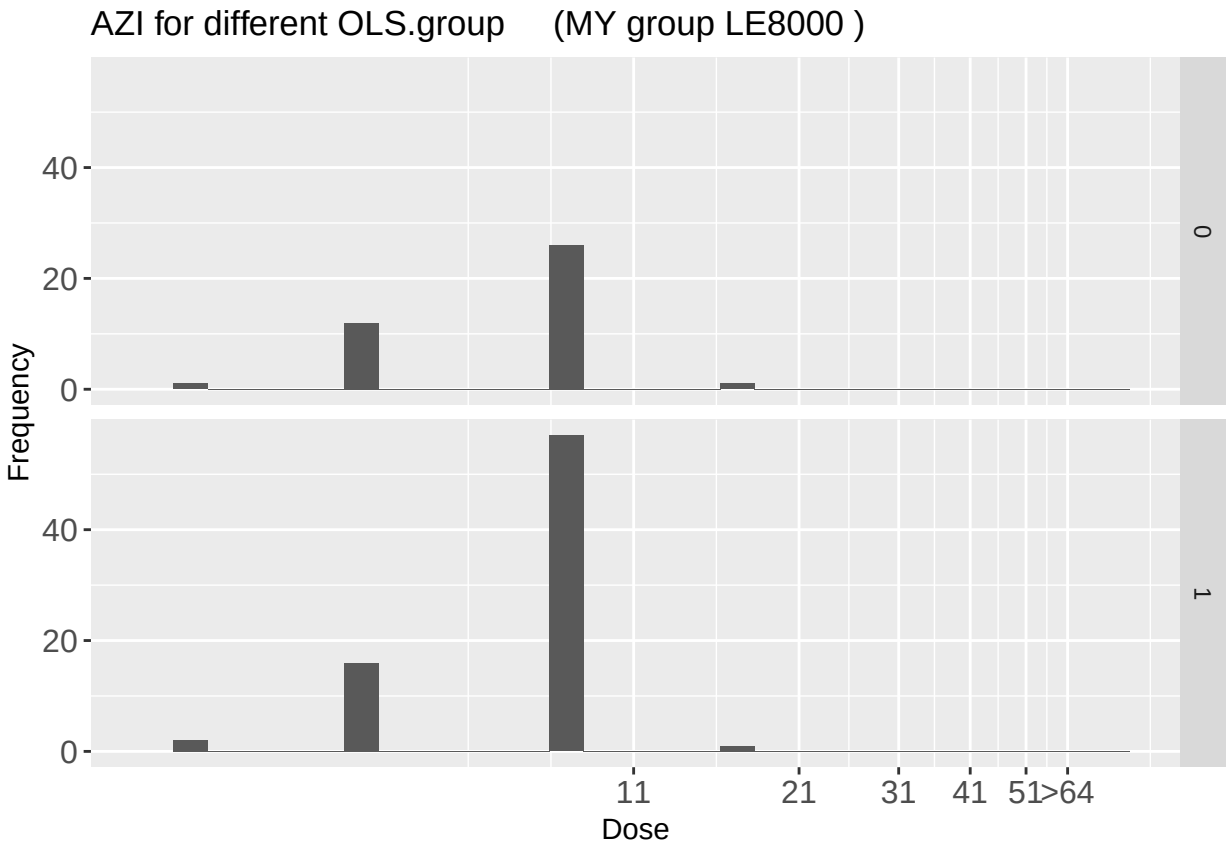

```
graphisch("OLS.group", "CIP" , 0.015,   8   ,   0.015,   4     )
```

```
## [1] "CIP - Resistance, OLS            :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.113 ... 0.127"
## [1] ""
## [1] "CIP - Resistance, no OLS       :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.004 ... 0.017"
## [1] ""
```



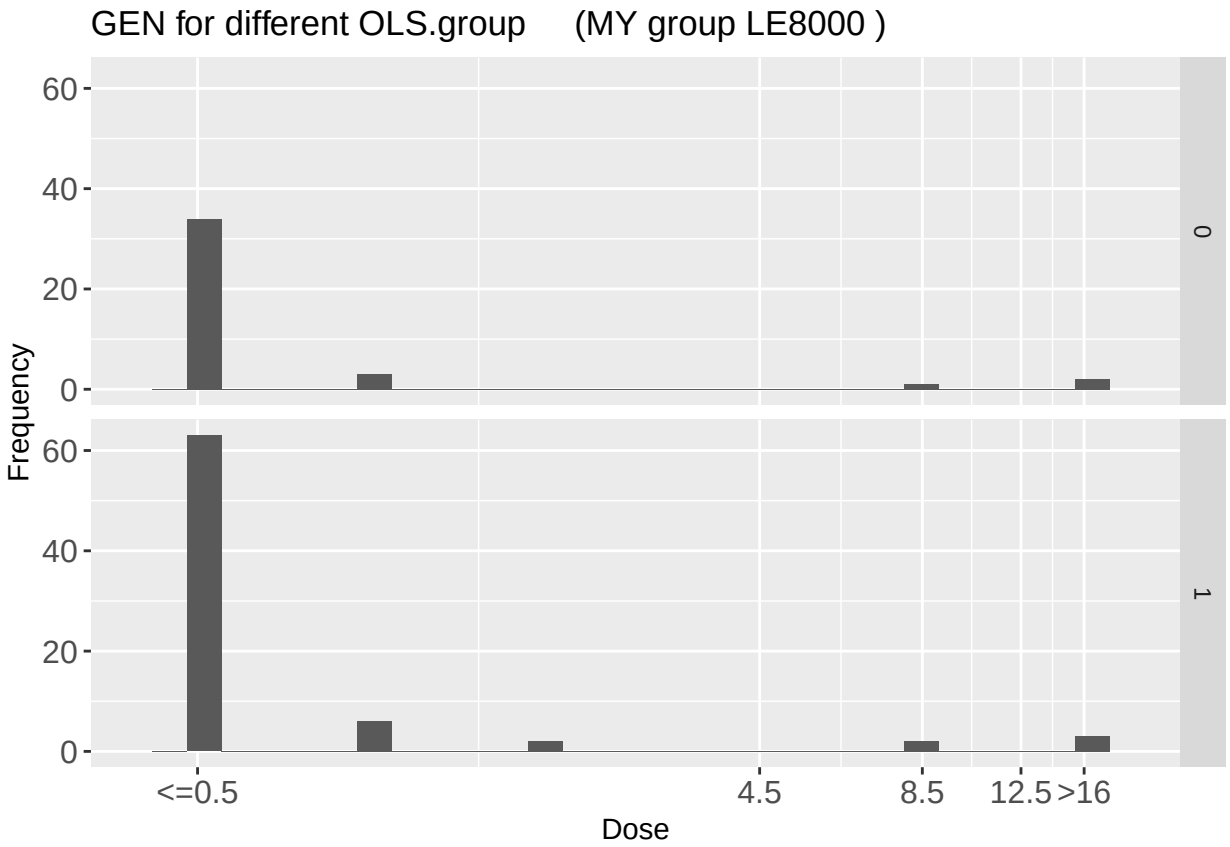

```
graphisch("OLS.group","AZI", 2,64, 1,10    )
```

```
## [1] "AZI - Resistance, OLS            :"
## [1] "  Median             = 8"
## [1] "  Mean   in  7.053 ... 7.105"
## [1] ""
## [1] "AZI - Resistance, no OLS       :"
## [1] "  Median             = 8"
## [1] "  Mean   in  6.800 ... 6.850"
## [1] ""
```



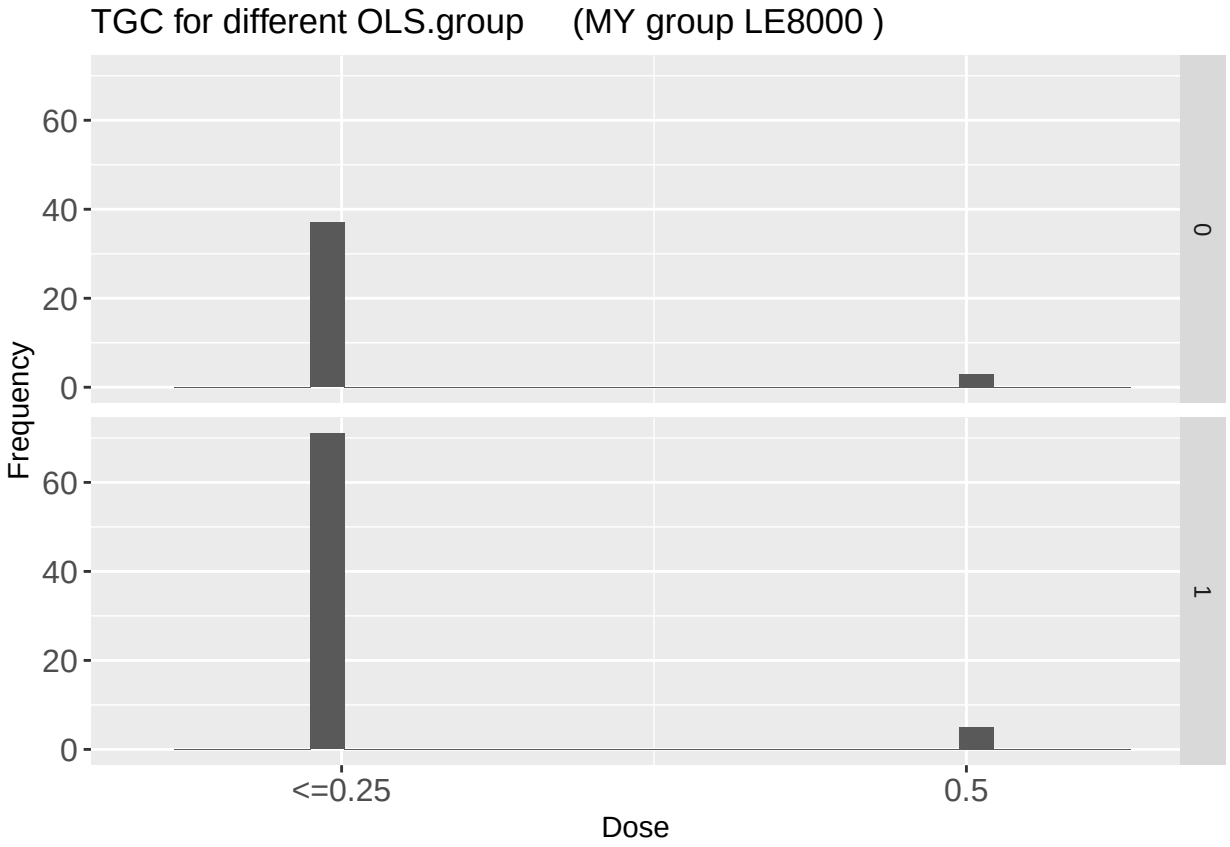

```
graphisch("OLS.group", "GEN" , 0.5  ,  16   ,   0.5  ,   4    )
```

```
## [1] "GEN - Resistance, OLS           :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  0.974 ... 1.388"
## [1] ""
## [1] "GEN - Resistance, no OLS       :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  1.075 ... 1.500"
## [1] ""
```



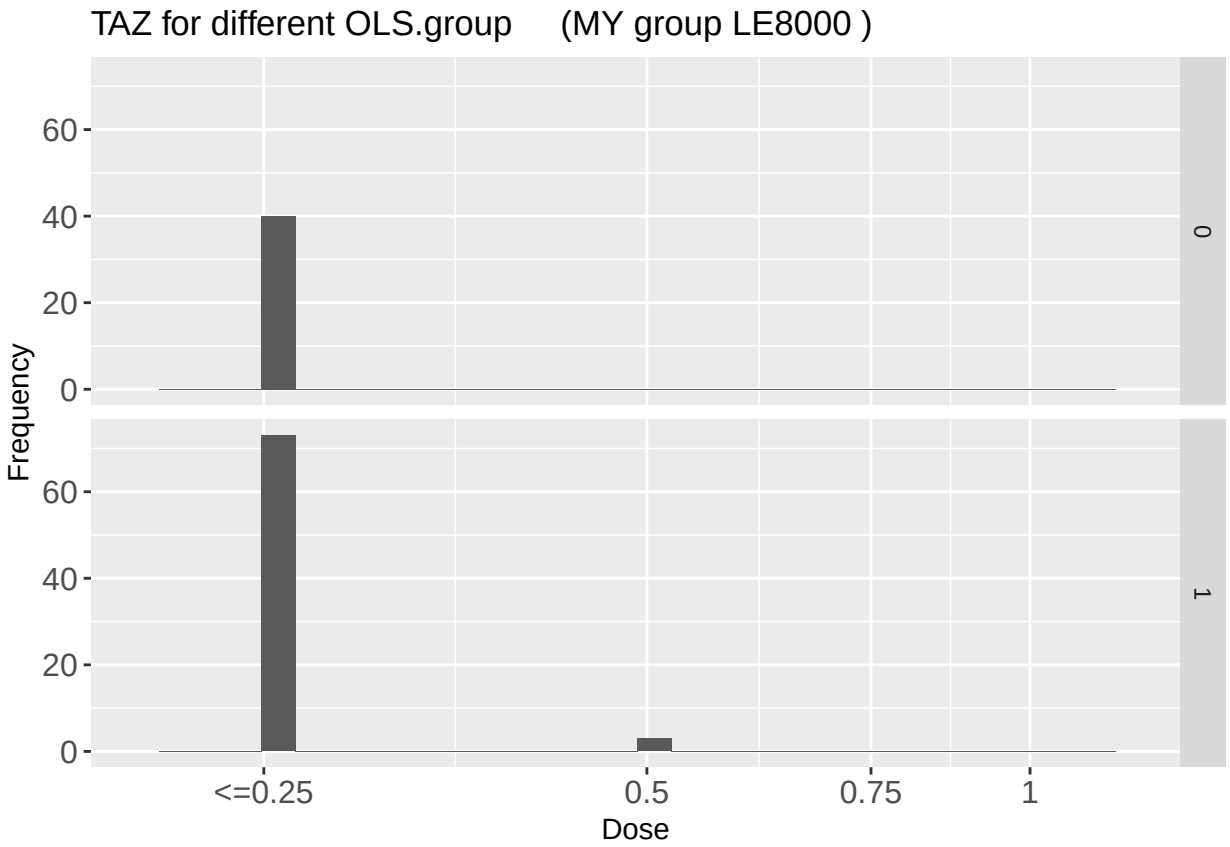

```
graphisch("OLS.group", "TGC" , 0.25 ,  -0.5 ,   0.25 ,   0.25 )
```

```
## [1] "TGC - Resistance, OLS            :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.033 ... 0.266"
## [1] ""
## [1] "TGC - Resistance, no OLS       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.037 ... 0.269"
## [1] ""
```



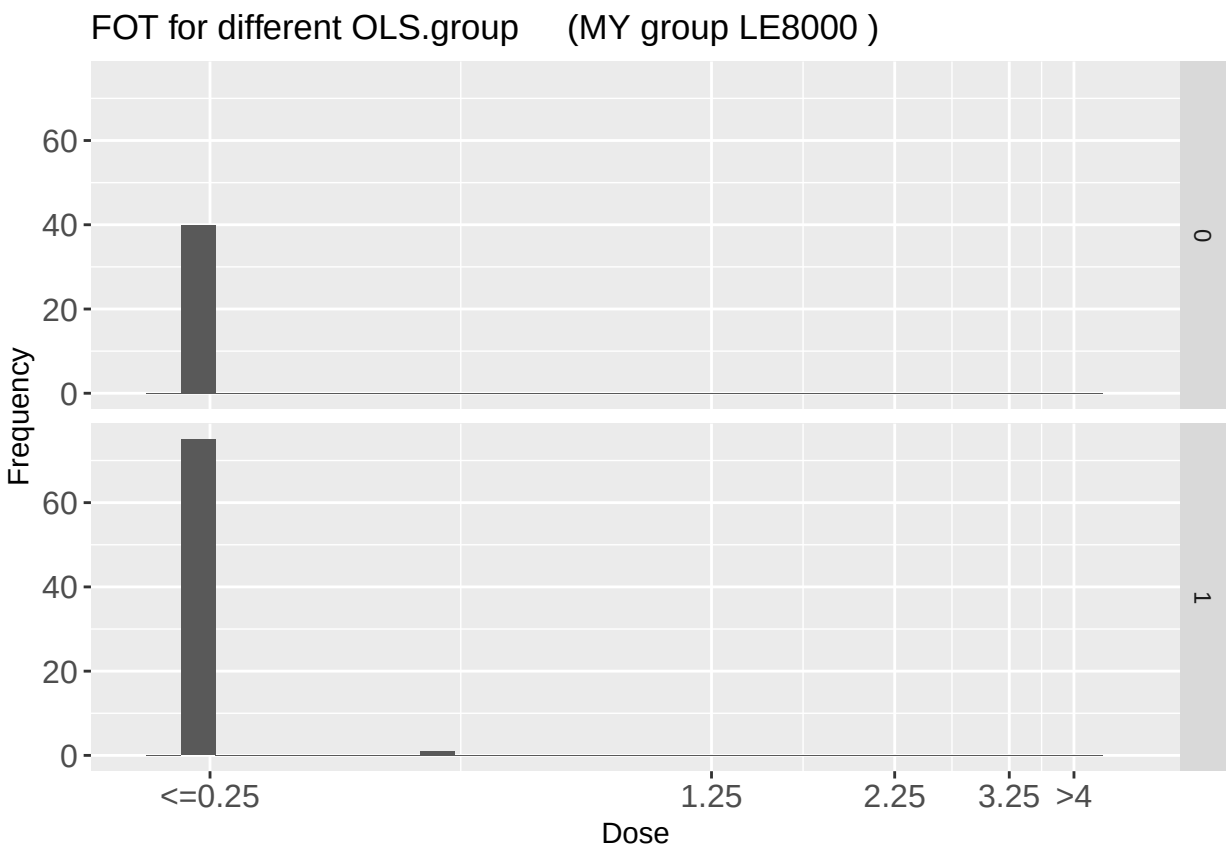

```
graphisch("OLS.group", "TAZ" , 0.25,-1   ,   0.25,0.25 )
```

```
## [1] "TAZ - Resistance, OLS            :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.020 ... 0.260"
## [1] ""
## [1] "TAZ - Resistance, no OLS       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
```



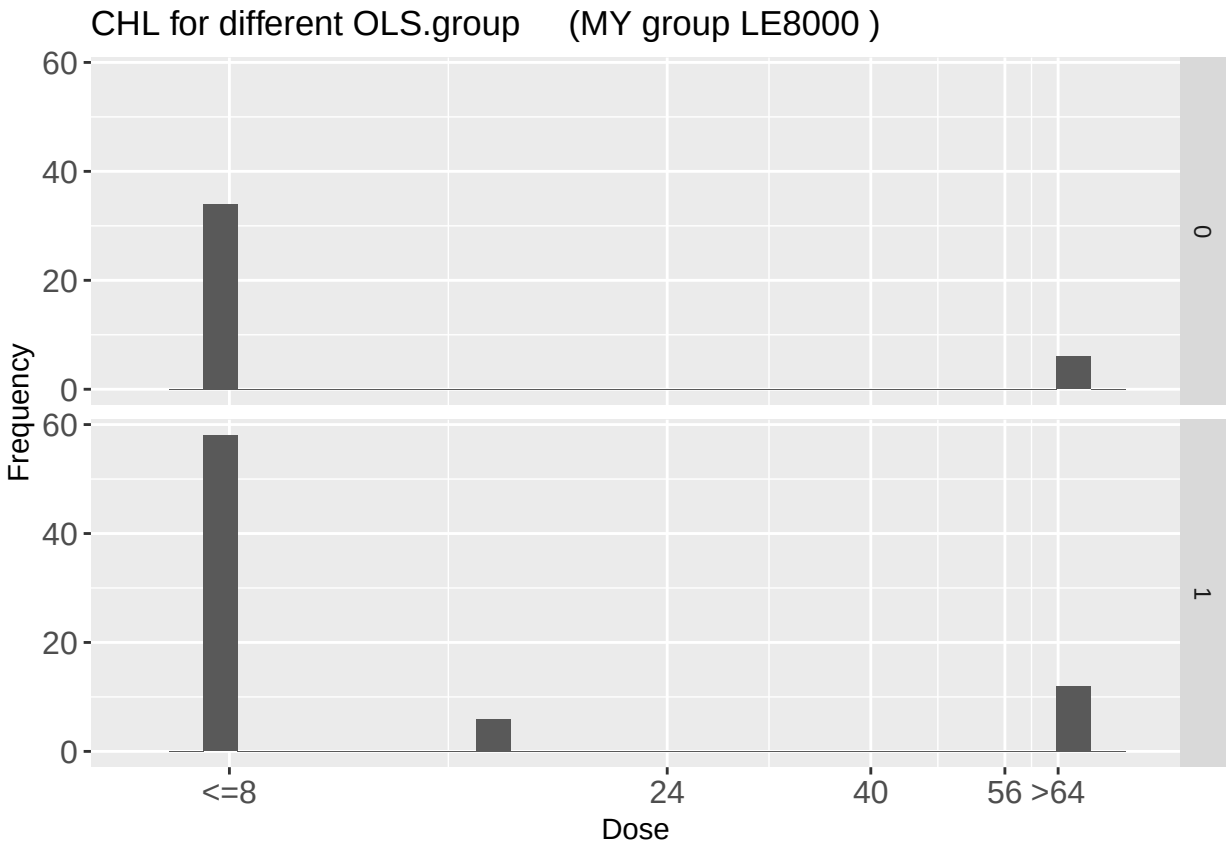

```
graphisch("OLS.group", "FOT" , 0.25 ,   4   ,   0.25 ,   1     )
```

```
## [1] "FOT - Resistance, OLS            :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.007 ... 0.253"
## [1] ""
## [1] "FOT - Resistance, no OLS       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
```



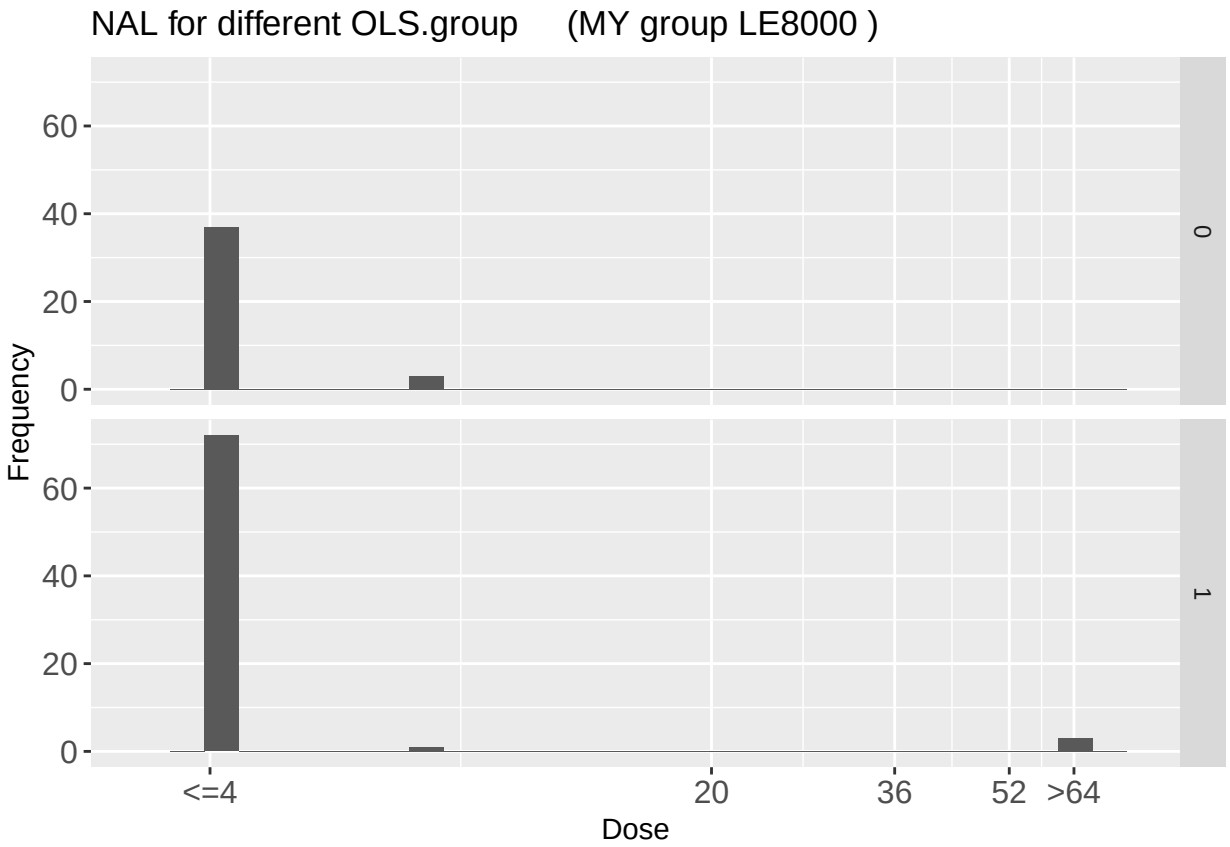

```
graphisch("OLS.group", "CHL" , 8    ,  64   ,   8,16    )
```

```
## [1] "CHL - Resistance, OLS            :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  11.368 ... 17.474"
## [1] ""
## [1] "CHL - Resistance, no OLS       :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  9.600 ... 16.400"
## [1] ""
```



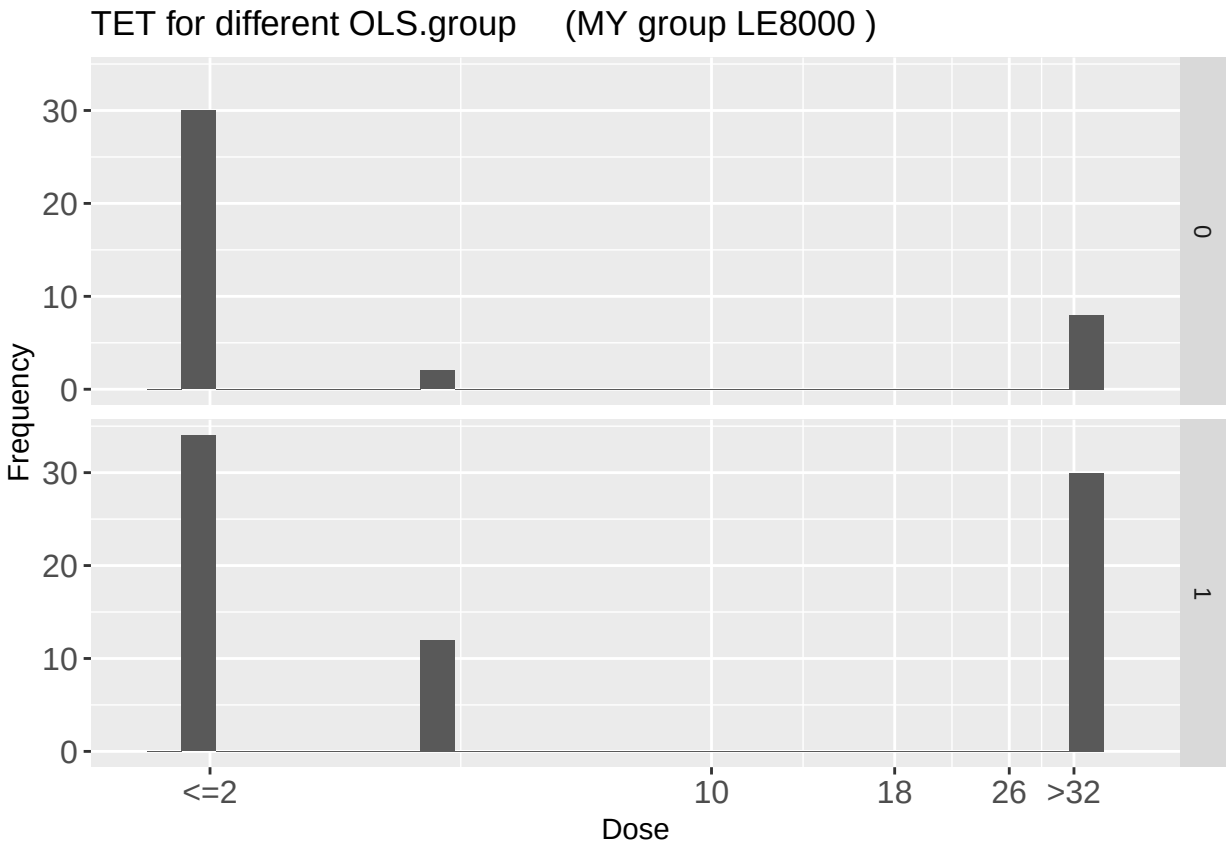

```
graphisch("OLS.group", "NAL" , 4    ,  64   ,   4,16    )
```

```
## [1] "NAL - Resistance, OLS            :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  2.632 ... 6.421"
## [1] ""
## [1] "NAL - Resistance, no OLS       :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  0.600 ... 4.300"
## [1] ""
```



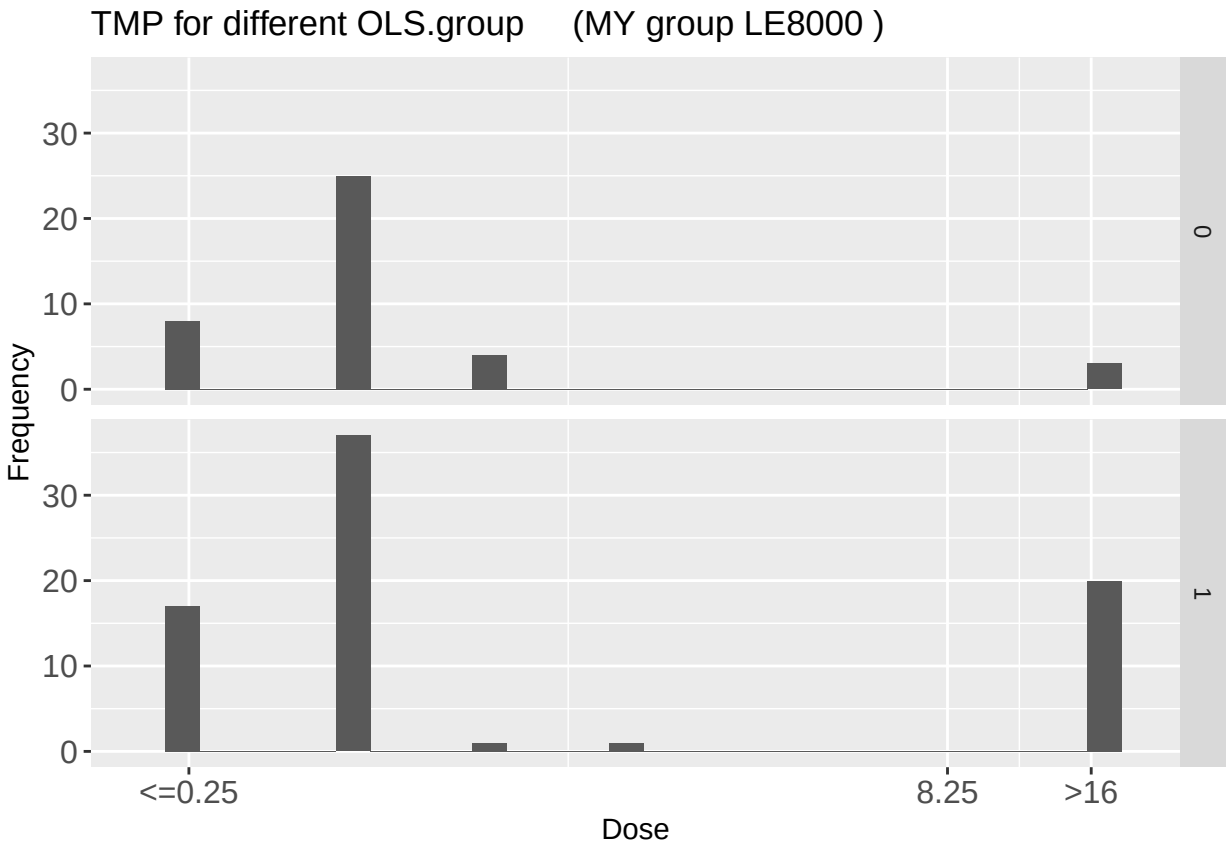

```
graphisch("OLS.group", "TET" , 2    ,  32   ,   2,8    )
```

```
## [1] "TET - Resistance, OLS            :"
## [1] "  Median             = 4"
## [1] "  Mean   in  13.263 ... 14.158"
## [1] ""
## [1] "TET - Resistance, no OLS       :"
## [1] "  Median             <= 2"
## [1] "  Mean   in  6.600 ... 8.100"
## [1] ""
```



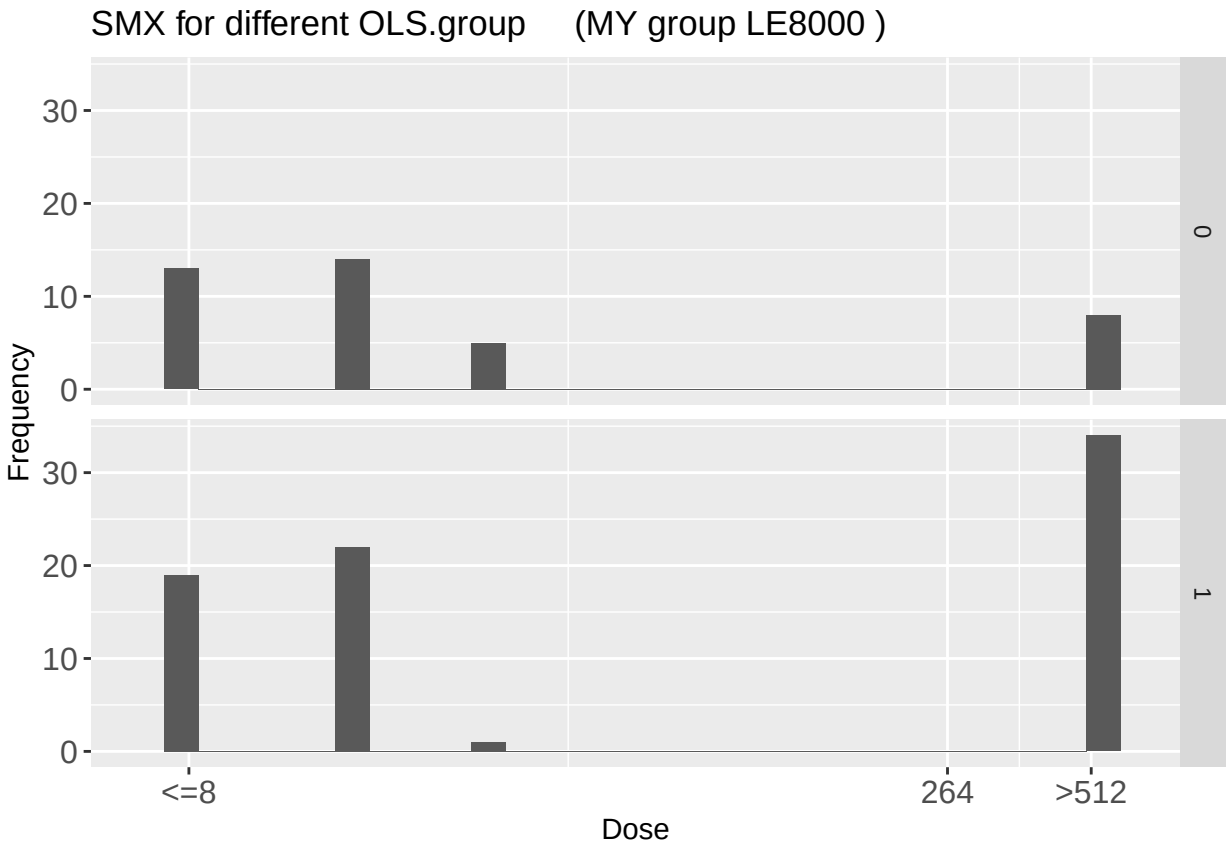

```
graphisch("OLS.group", "TMP" , 0.25 ,  16   ,   0.25,8    )
```

```
## [1] "TMP - Resistance, OLS           :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  4.493 ... 4.549"
## [1] ""
## [1] "TMP - Resistance, no OLS       :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  1.613 ... 1.663"
## [1] ""
```




```
graphisch("OLS.group", "SMX" , 8    , 512   ,   8,256   )
```

```
## [1] "SMX - Resistance, OLS            :"
## [1] "  Median             = 16"
## [1] "  Mean   in  234.105 ... 236.105"
## [1] ""
## [1] "SMX - Resistance, no OLS       :"
## [1] "  Median             = 16"
## [1] "  Mean   in  112.000 ... 114.600"
## [1] ""
```



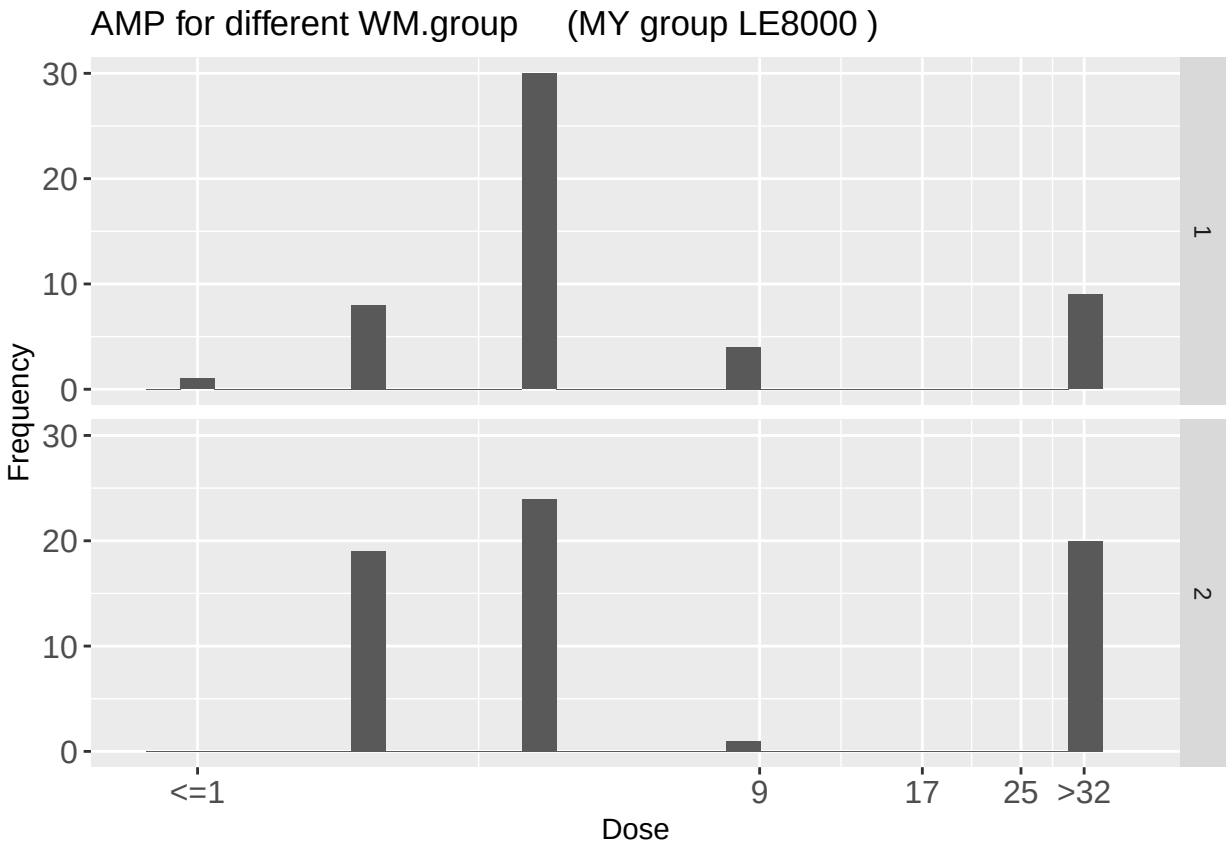

```
#stop the script
```

Die Mittelwerte der Resistenz sind für MERO, GEN und TAZ vergleichbar, für 5 Antibiotika tendenziell grösser im Fall *Other Livestock* (CIP, FOT, CHL, NAL, SMX), für TGC tendenziell kleiner in diesem Fall und für 4 Antibiotika definitiv kleiner in diesem Fall (AMP, AZI, TET, TMP). Diese Relationen sind im wesentlichen entgegengesetzt zu WM - keine WM!

Waste Milk - Gruppen

```
graphisch("WM.group", "AMP", 1,32, 1,8)
```

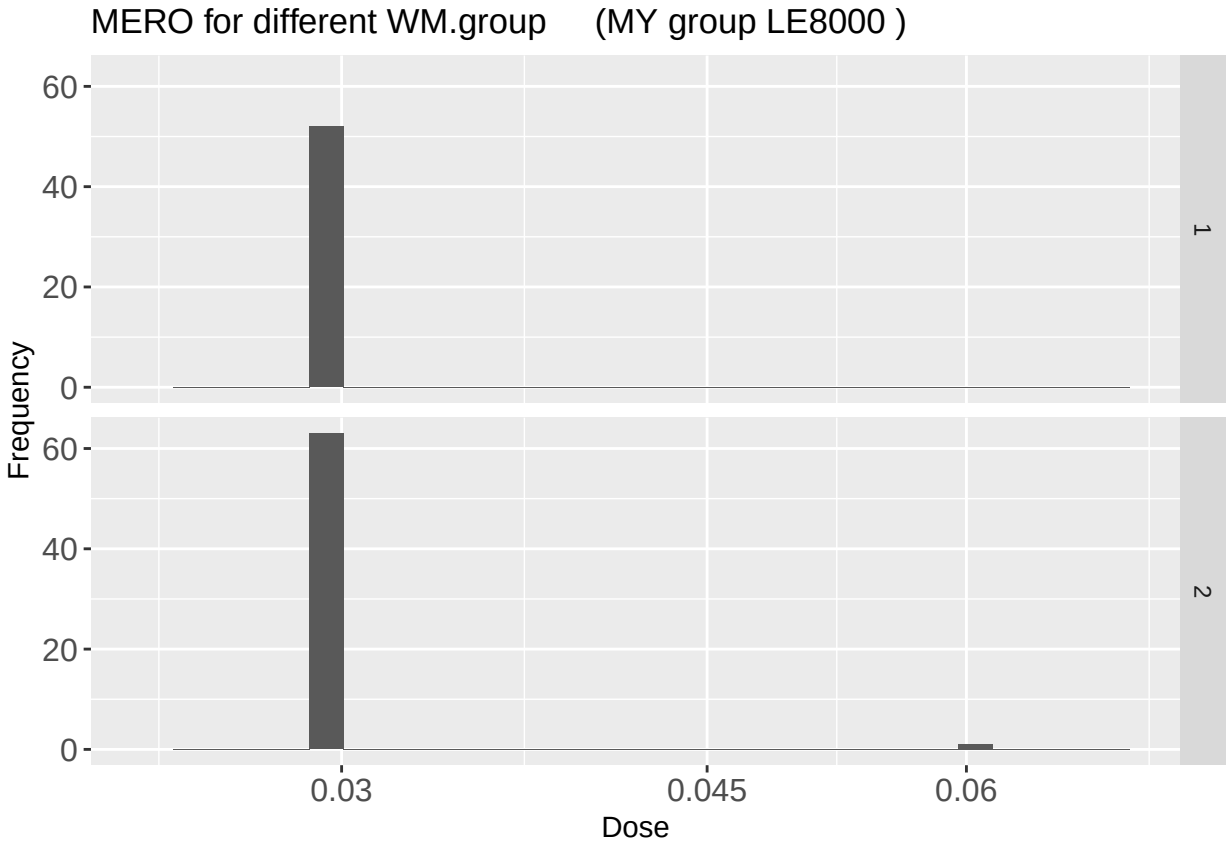
```
## [1] "AMP - Resistance, WM            :"
## [1] "  Median             = 4"
## [1] "  Mean   in  8.769 ... 8.788"
## [1] ""
## [1] "AMP - Resistance, no WM      :"
## [1] "  Median             = 4"
## [1] "  Mean   =  12.219"
## [1] ""
```



Der Mittelwert ist höher ohne WM.

```
  graphisch("WM.group", "MERO", .03,-0.06, .015,.015)
```

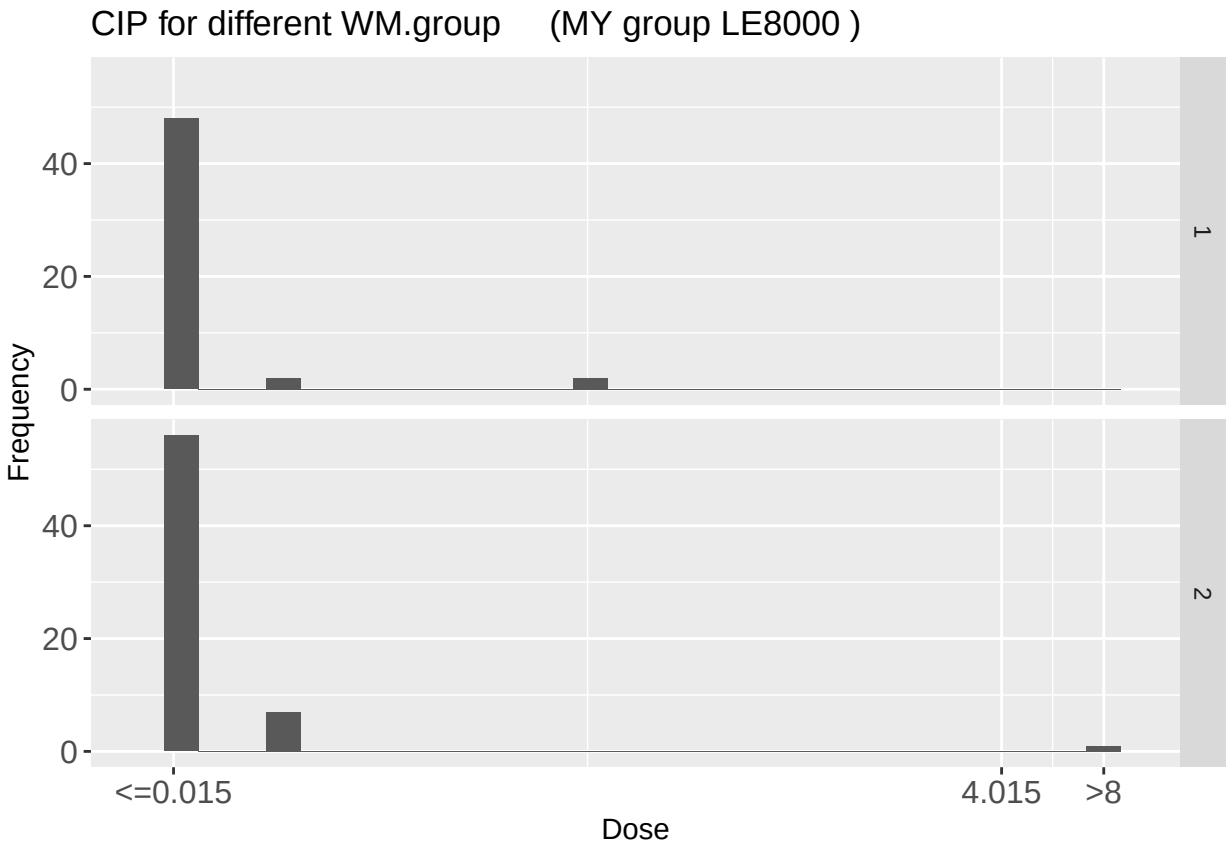
```
## [1] "MERO - Resistance, WM            :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.000 ... 0.030"
## [1] ""
## [1] "MERO - Resistance, no WM      :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.001 ... 0.030"
## [1] ""
```



Der Mittelwert ist vergleichbar ohne WM (tatsächlich tendenziell minimal höher - das ist leicht zu kontrollieren: MERO ist immer <=3 - ausser einmal 0.06 für Betrieb 4 und der ist WM group 2).

```
  graphisch("WM.group", "CIP", 0.015,8, .015,4)
```

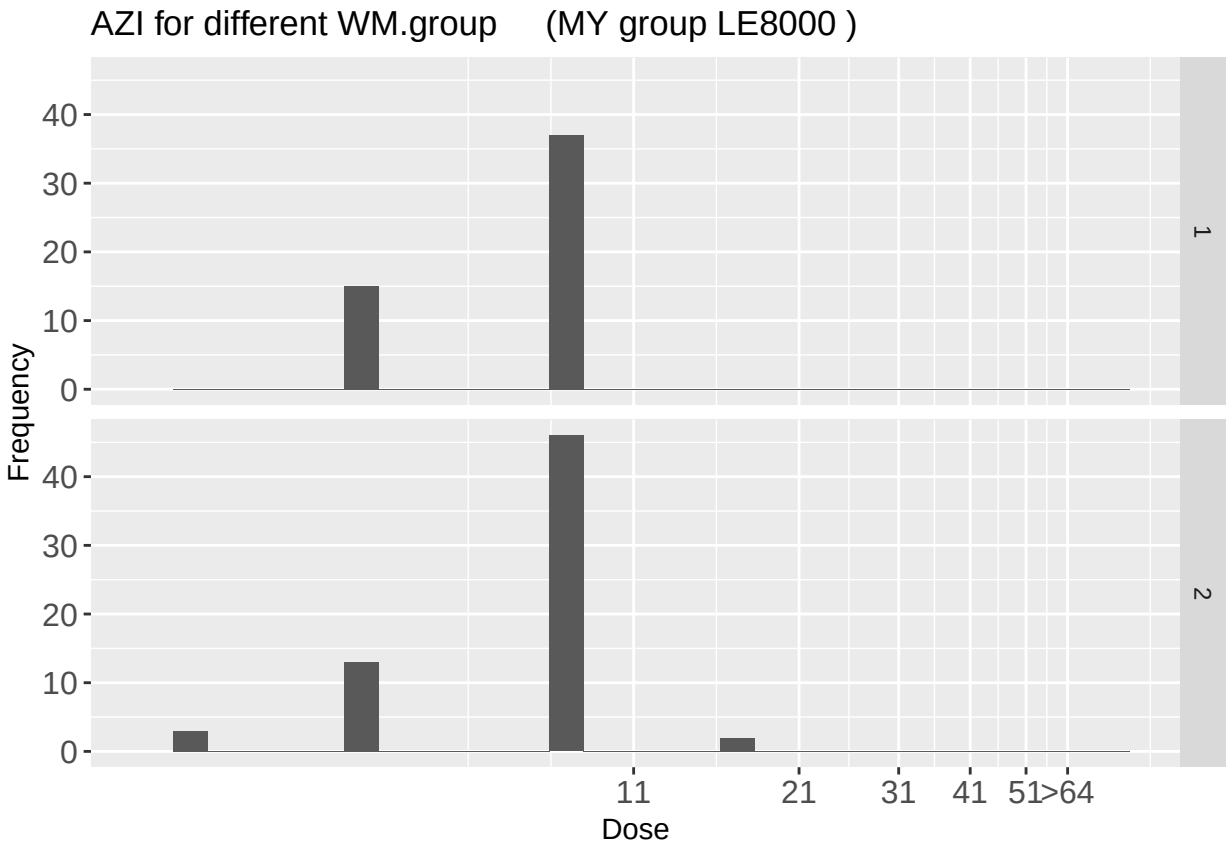
```
## [1] "CIP - Resistance, WM           :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.011 ... 0.025"
## [1] ""
## [1] "CIP - Resistance, no WM      :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.128 ... 0.141"
## [1] ""
```



Der Mittelwert ist tendenziell höher ohne WM.

```
  graphisch("WM.group", "AZI", 2,64, 1,10)
```

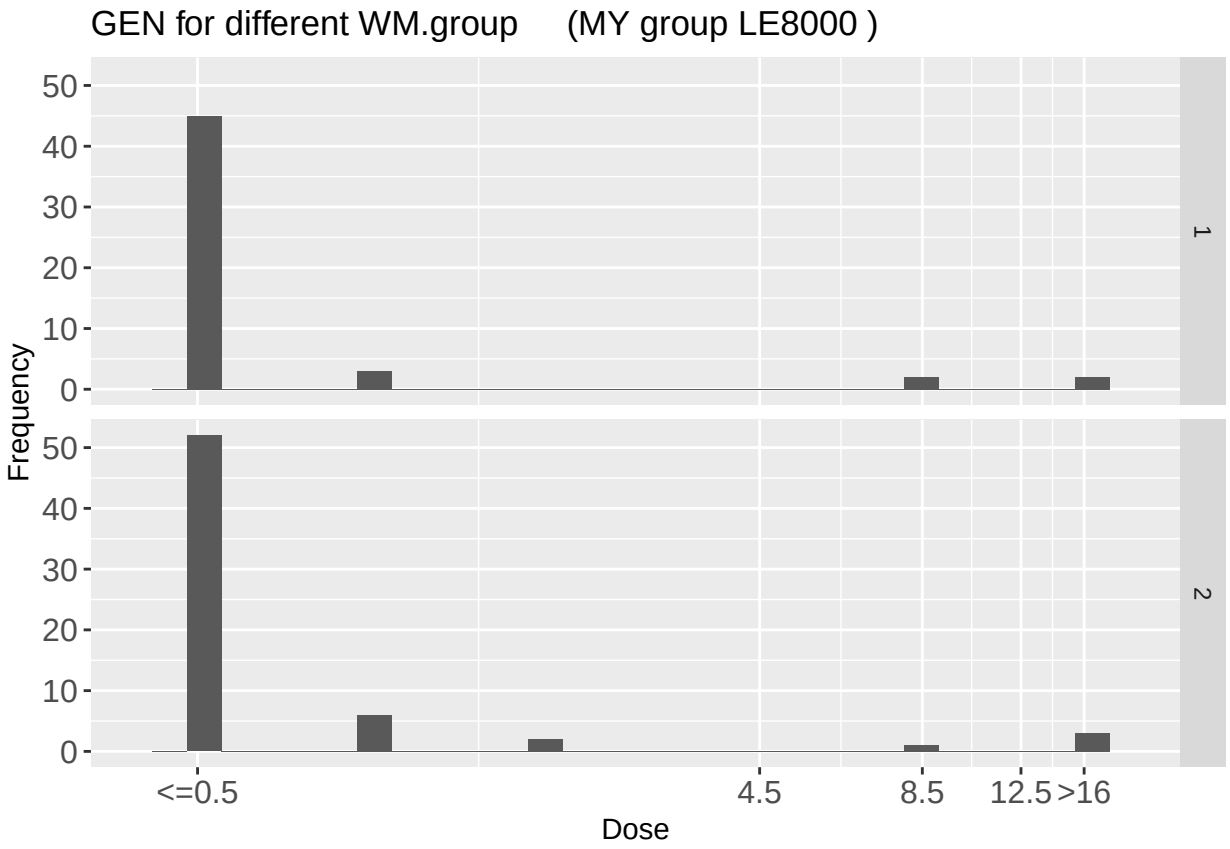
```
## [1] "AZI - Resistance, WM            :"
## [1] "  Median             = 8"
## [1] "  Mean   =  6.846"
## [1] ""
## [1] "AZI - Resistance, no WM      :"
## [1] "  Median             = 8"
## [1] "  Mean   in  7.062 ... 7.156"
## [1] ""
```



Der Mittelwert ist höher ohne WM.

```
  graphisch("WM.group", "GEN", 0.5,16, 0.5,4)
```

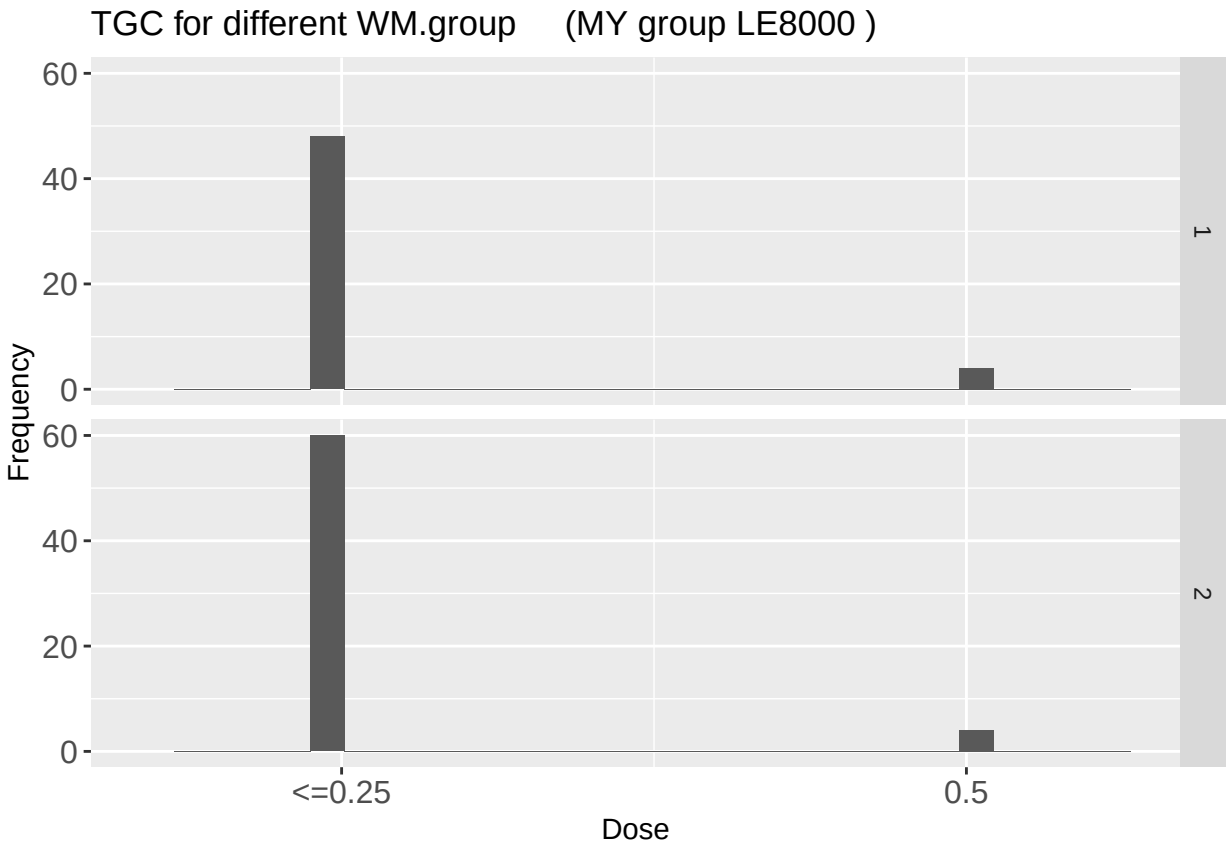
```
## [1] "GEN - Resistance, WM            :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  0.981 ... 1.413"
## [1] ""
## [1] "GEN - Resistance, no WM      :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  1.031 ... 1.438"
## [1] ""
```



Der Mittelwert ist vergleichbar ohne WM.

```
  graphisch("WM.group", "TGC", 0.25,-0.5, 0.25,0.25)
```

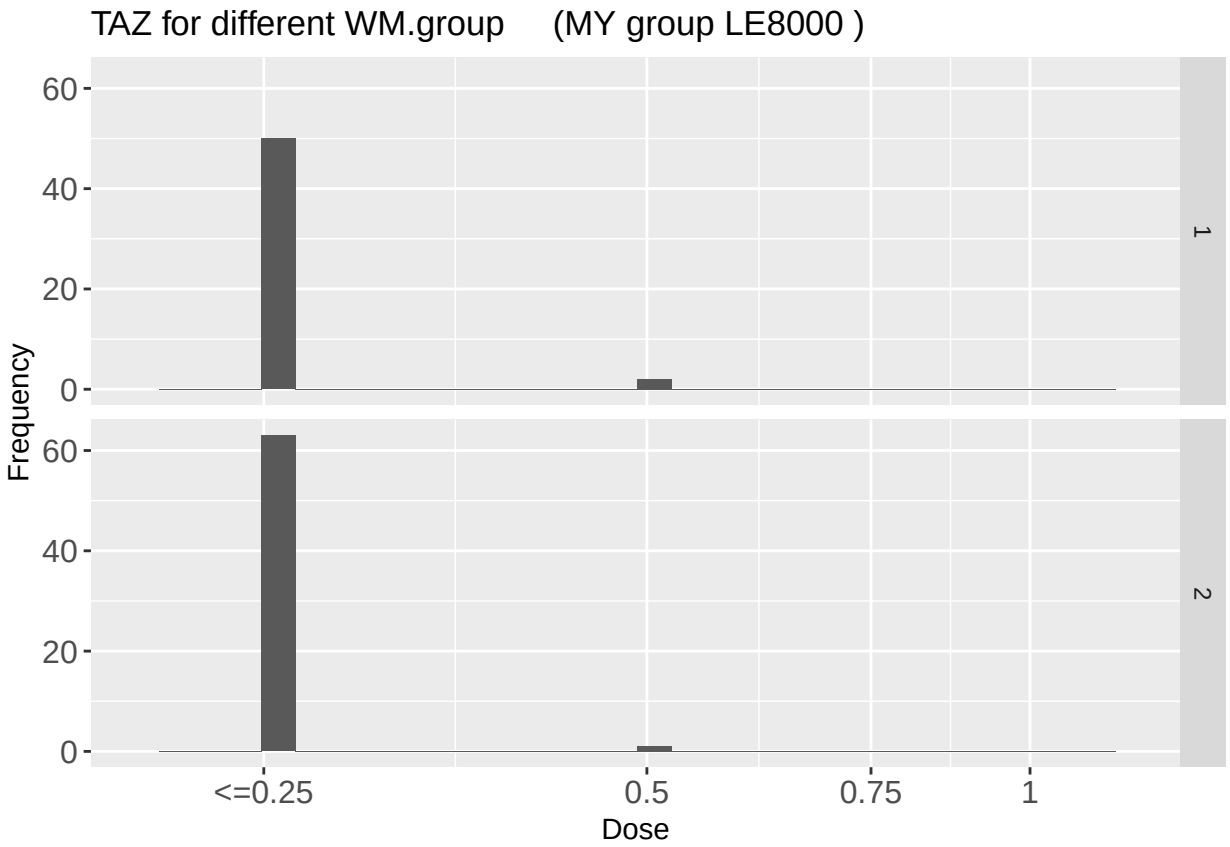
```
## [1] "TGC - Resistance, WM            :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.038 ... 0.269"
## [1] ""
## [1] "TGC - Resistance, no WM      :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.031 ... 0.266"
## [1] ""
```



Der Mittelwert ist vergleichbar ohne WM.

```
  graphisch("WM.group", "TAZ", 0.25, -1, .25,.25)
```

```
## [1] "TAZ - Resistance, WM            :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.019 ... 0.260"
## [1] ""
## [1] "TAZ - Resistance, no WM      :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.008 ... 0.254"
## [1] ""
```



Der Mittelwert ist vergleichbar ohne WM. Genauer: tendenziell höher - das kann man auch noch per Hand kontrollieren: TAZ ist immer <= 0.25 ausser für:

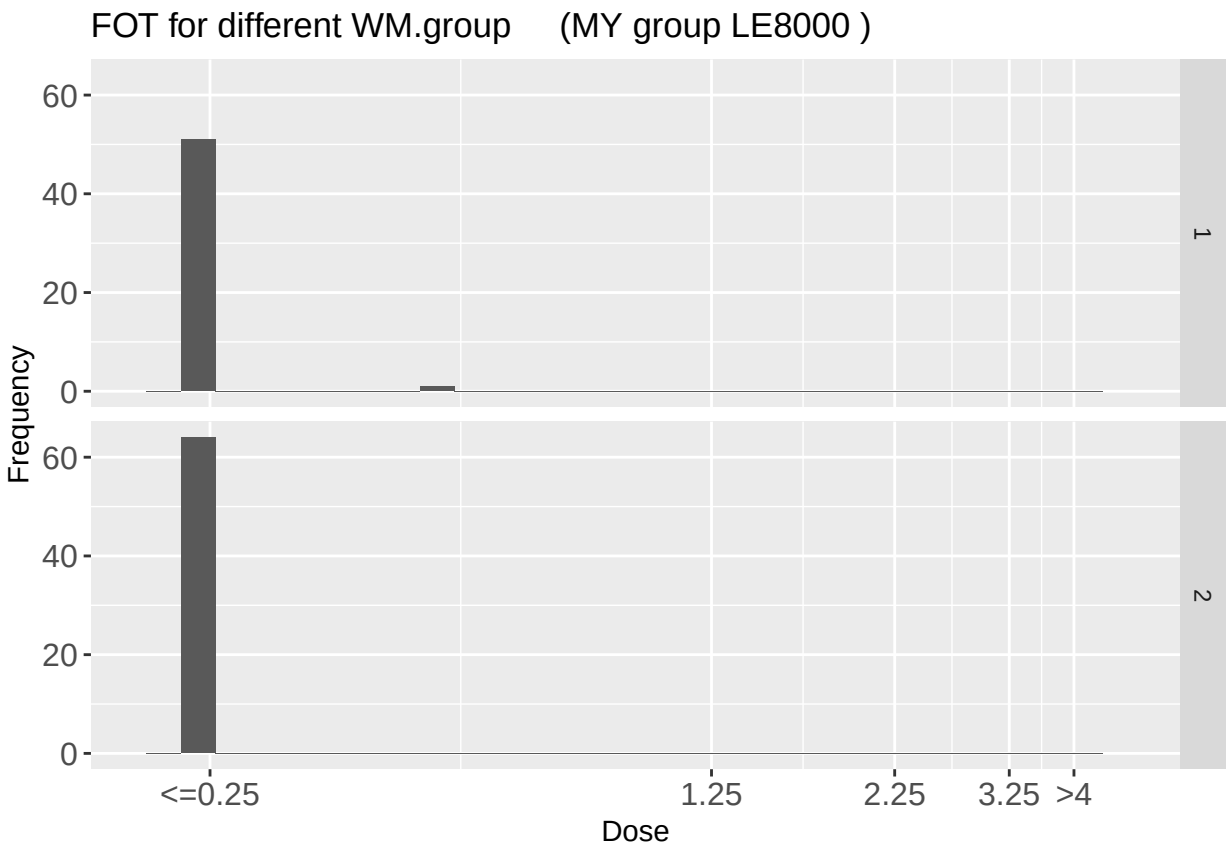
- Waste Milk: 0.5 für Betriebe 11 und 15
- Keine Waste Milk: 0.5 für Betriebe 12, 59 und 3*1 für Betrieb 52

(Betrieb 30 wurde ganz am Anfang schon gelöscht)

Die Werte 0.5 balanzieren sich also aus für Waste Milk oder nicht, und der Unterschied kommt von den 3 Werten 1: Ohne WM ist resistenter.

```
  graphisch("WM.group", "FOT", 0.25,  4, .25, 1)
```

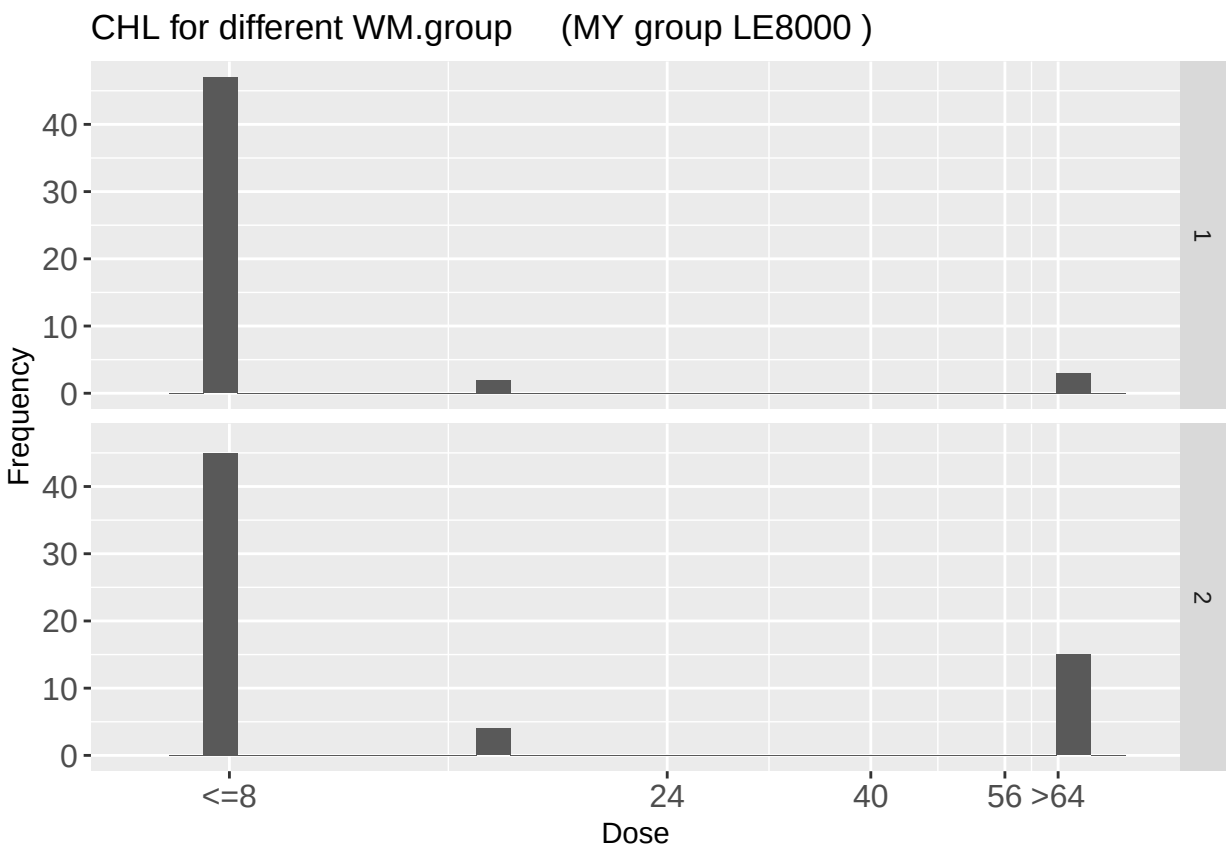
```
## [1] "FOT - Resistance, WM           :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.010 ... 0.255"
## [1] ""
## [1] "FOT - Resistance, no WM      :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
```



Der Mittelwert ist tendenziell höher ohne WM.

```
  graphisch("WM.group", "CHL", 8,64, 8,16)
```

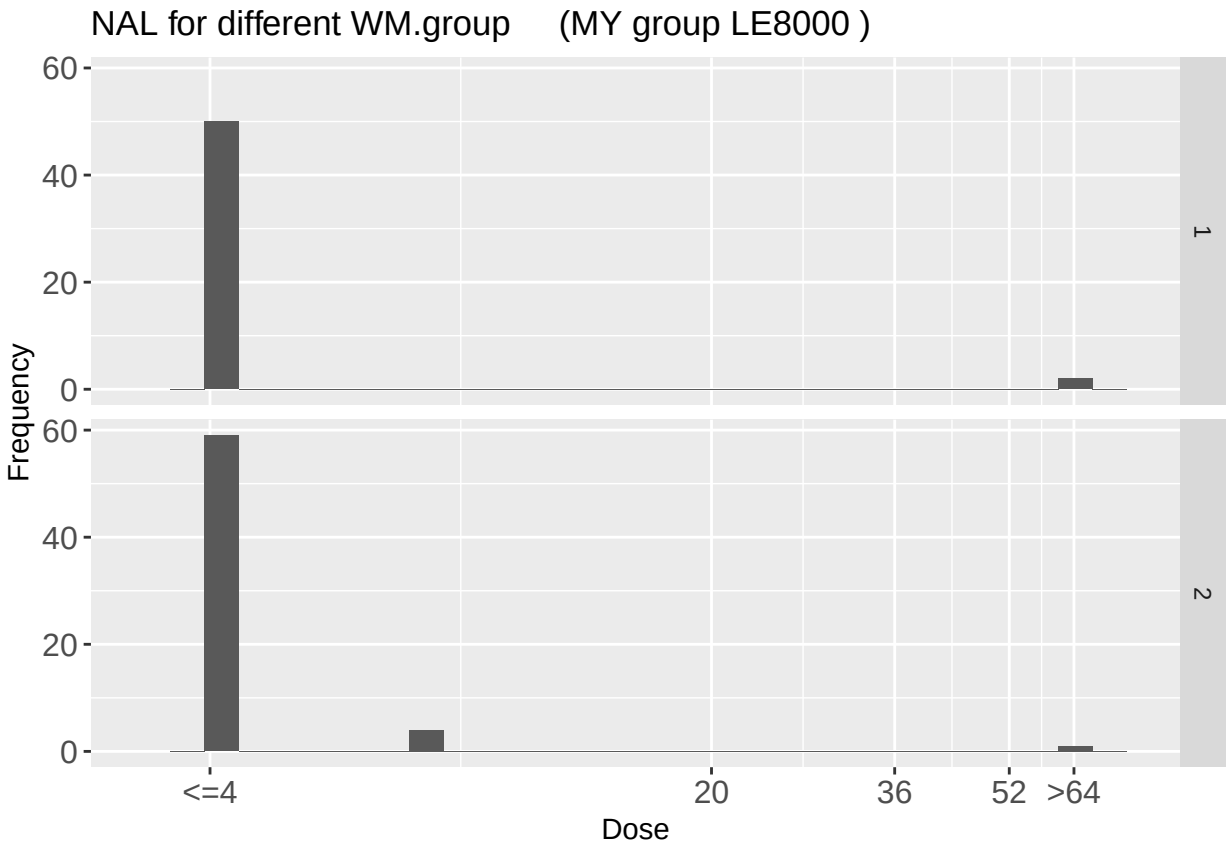
```
## [1] "CHL - Resistance, WM            :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  4.308 ... 11.538"
## [1] ""
## [1] "CHL - Resistance, no WM      :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  16.000 ... 21.625"
## [1] ""
```



Der Mittelwert ist tendenziell höher ohne WM.

```
  graphisch("WM.group", "NAL", 4,64, 4,16)
```

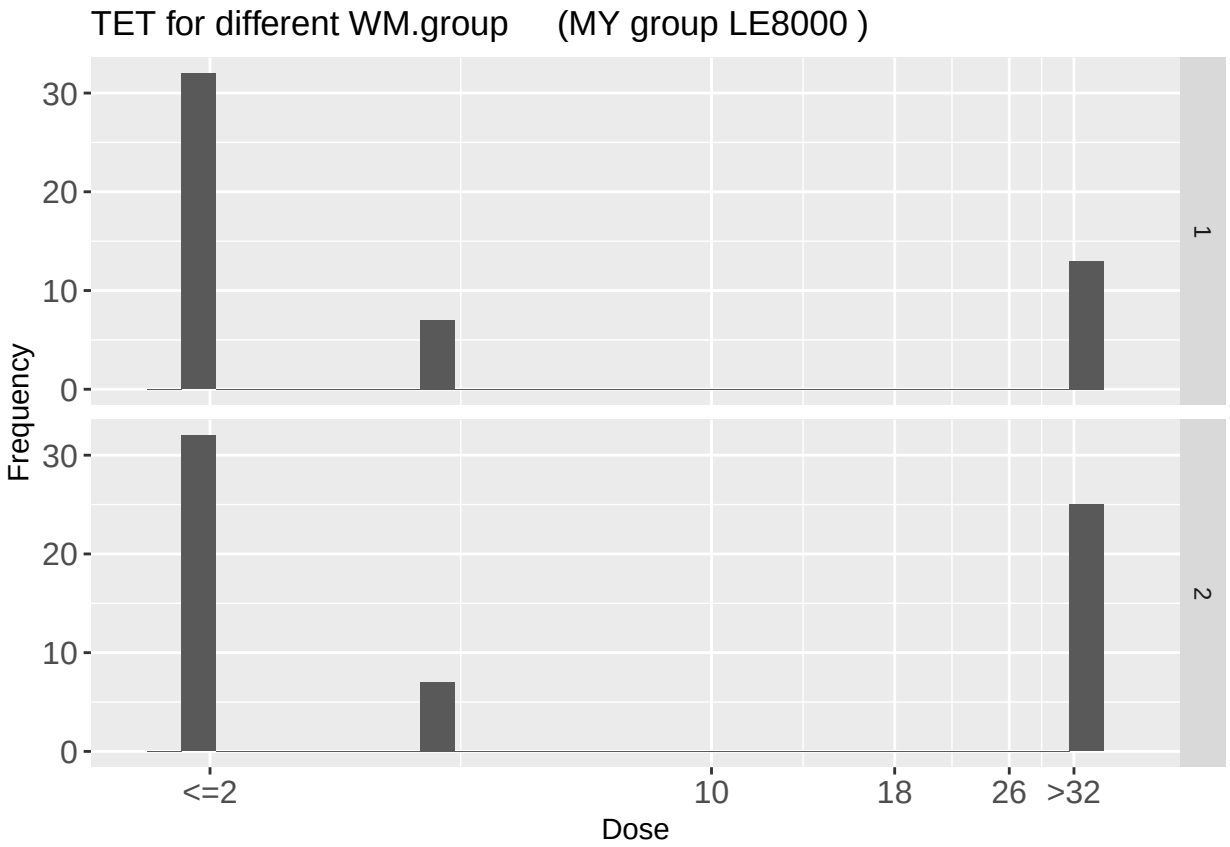
```
## [1] "NAL - Resistance, WM            :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  2.462 ... 6.308"
## [1] ""
## [1] "NAL - Resistance, no WM      :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  1.500 ... 5.188"
## [1] ""
```



Der Mittelwert ist tendenziell höher ohne WM.

```
  graphisch("WM.group", "TET", 2,32, 2,8)
```

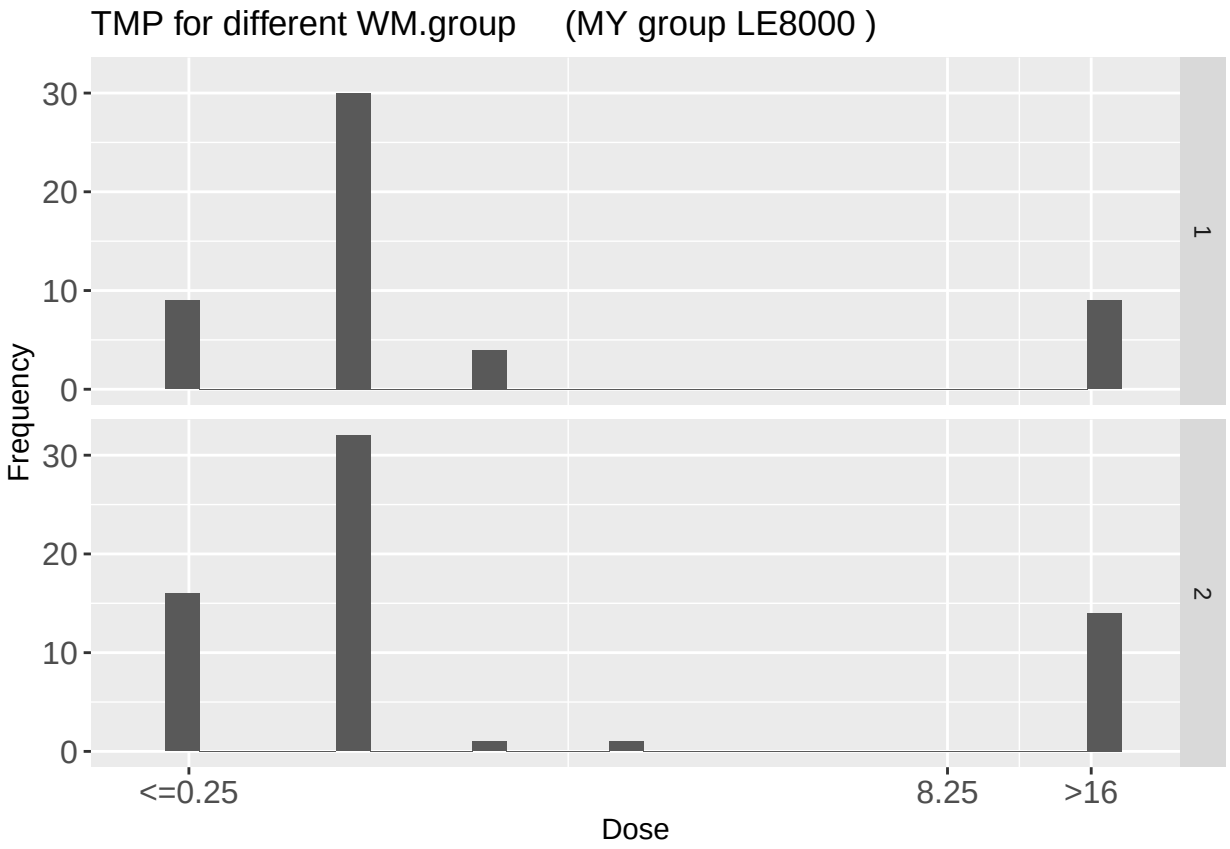
```
## [1] "TET - Resistance, WM            :"
## [1] "  Median             <= 2"
## [1] "  Mean   in  8.538 ... 9.769"
## [1] ""
## [1] "TET - Resistance, no WM      :"
## [1] "  Median             = 3"
## [1] "  Mean   in  12.938 ... 13.938"
## [1] ""
```



Der Mittelwert ist tendenziell höher ohne WM.

```
  graphisch("WM.group", "TMP", 0.25,16, .25,8)
```

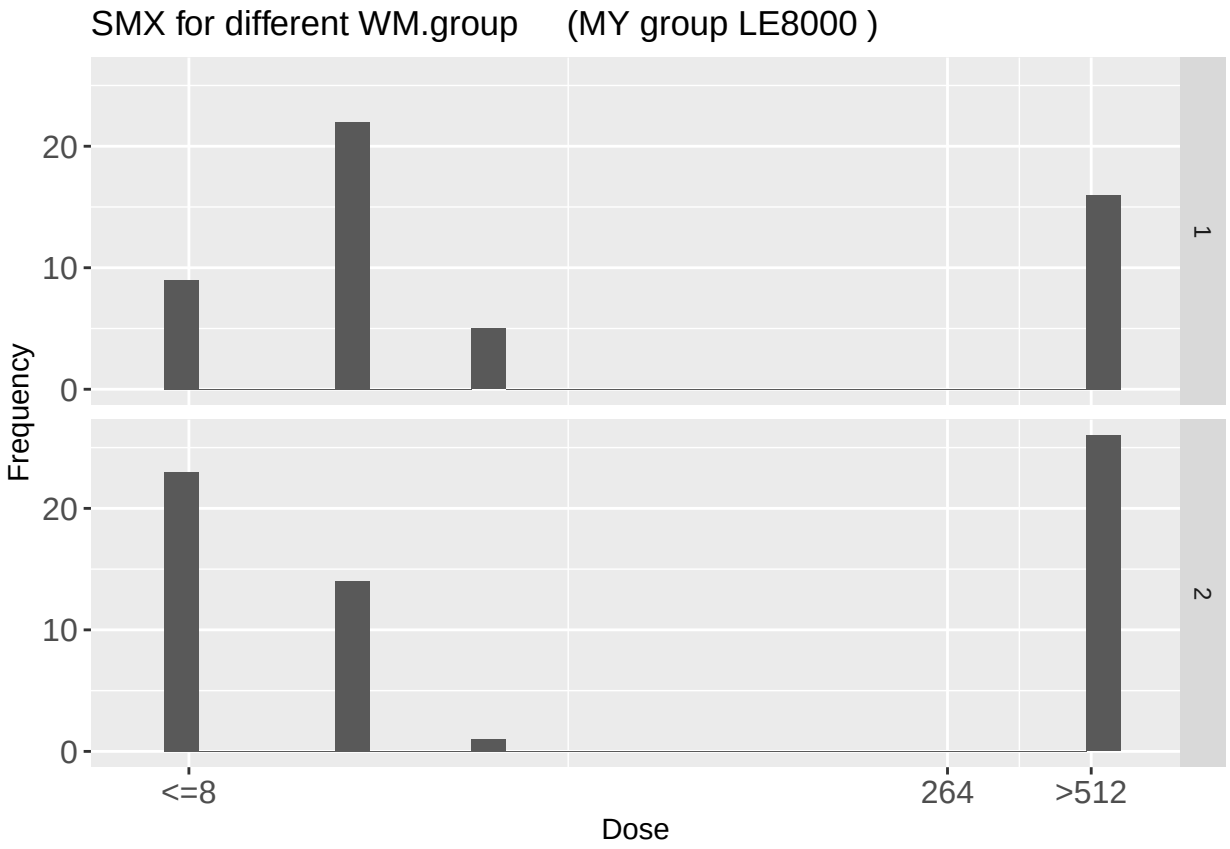
```
## [1] "TMP - Resistance, WM            :"
## [1] "  Median              = 0.5"
## [1] "  Mean   in  3.135 ... 3.178"
## [1] ""
## [1] "TMP - Resistance, no WM      :"
## [1] "  Median              = 0.5"
## [1] "  Mean   in  3.797 ... 3.859"
## [1] ""
```



Der Mittelwert ist höher ohne WM.

```
  graphisch("WM.group", "SMX", 8,512, 8,256)
```

```
## [1] "SMX - Resistance, WM            :"
## [1] "  Median              = 16"
## [1] "  Mean   in  167.385 ... 168.769"
## [1] ""
## [1] "SMX - Resistance, no WM      :"
## [1] "  Median              = 16"
## [1] "  Mean   in  212.000 ... 214.875"
## [1] ""
```



Der Mittelwert ist vergleichbar ohne WM.

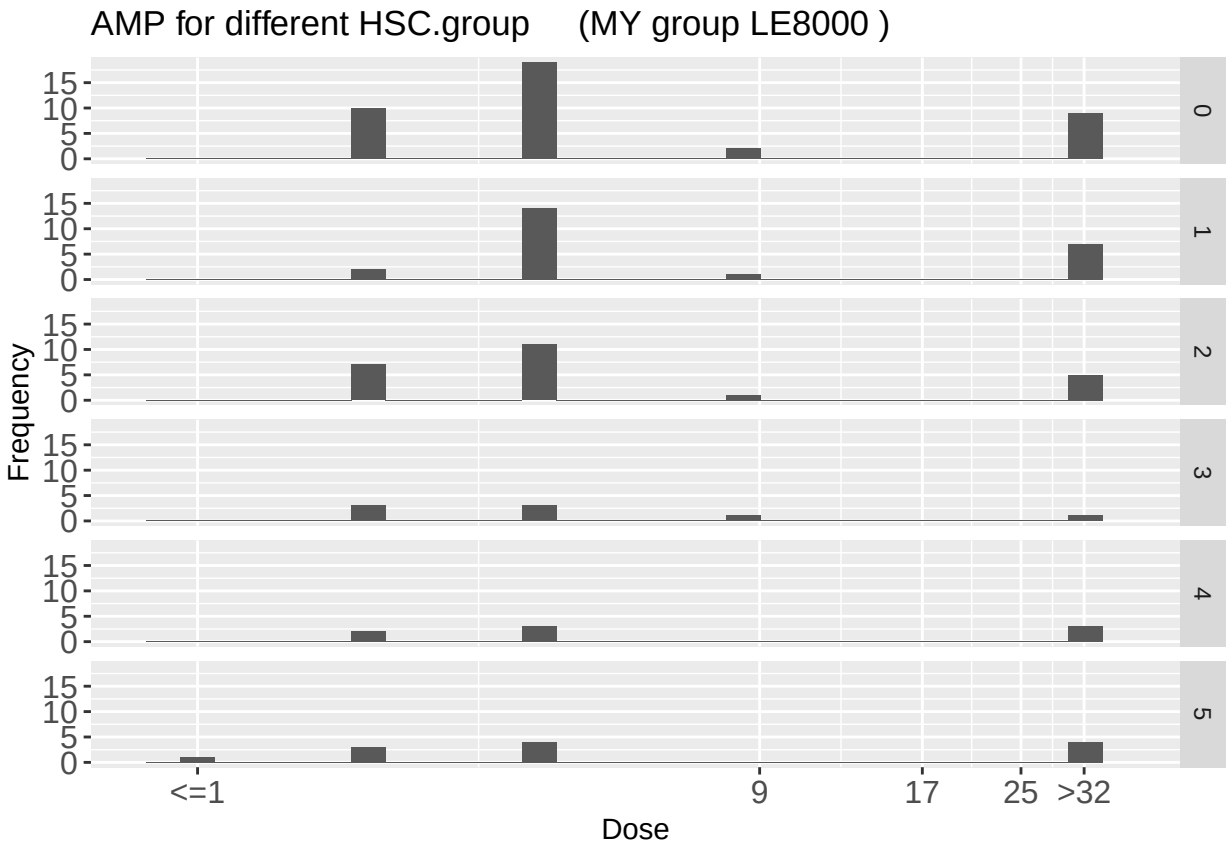
Die Mittelwerte der Resistenz sind für 5 Antibiotika vergleichbar (MERO, GEN, TGC, TAZ, SMX), für 3 Antibiotika tendenziell grösser im Fall *WM* (CIP, FOT, NAL) und für 5 Antibiotika definitiv grösser in diesem Fall (AMP, AZI, HCL, TET, TMP).

Husbandry System Calves - Gruppen

Mit “HSC” abgekürzt.

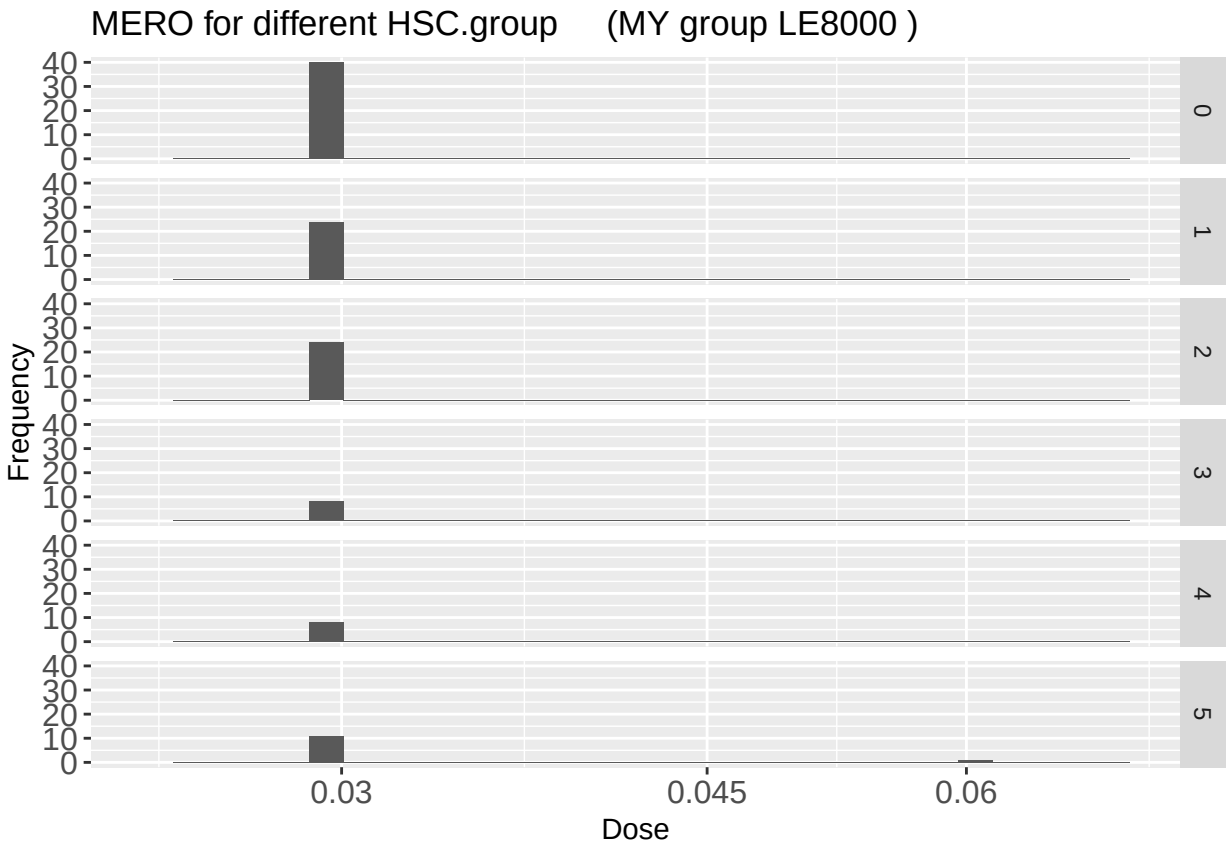
```
  graphisch("HSC.group", "AMP", 1,32, 1,8)
```

```
## [1] "AMP - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             = 4"
## [1] "  Mean   =  10.000"
## [1] ""
## [1] "AMP - Resistance, 1: stable with outlet :"
## [1] "  Median             = 4"
## [1] "  Mean   =  12.167"
## [1] ""
## [1] "AMP - Resistance, 2: outdoors           :"
## [1] "  Median             = 4"
## [1] "  Mean   =  9.417"
## [1] ""
## [1] "AMP - Resistance, 3 = 0 + 1       :"
## [1] "  Median             = 4"
## [1] "  Mean   =  7.250"
## [1] ""
## [1] "AMP - Resistance, 4 = 1 + 2       :"
## [1] "  Median             = 4"
## [1] "  Mean   =  14.000"
## [1] ""
## [1] "AMP - Resistance, 5 = 0 + 2        :"
## [1] "  Median             = 4"
## [1] "  Mean   in  12.500 ... 12.583"
## [1] ""
```



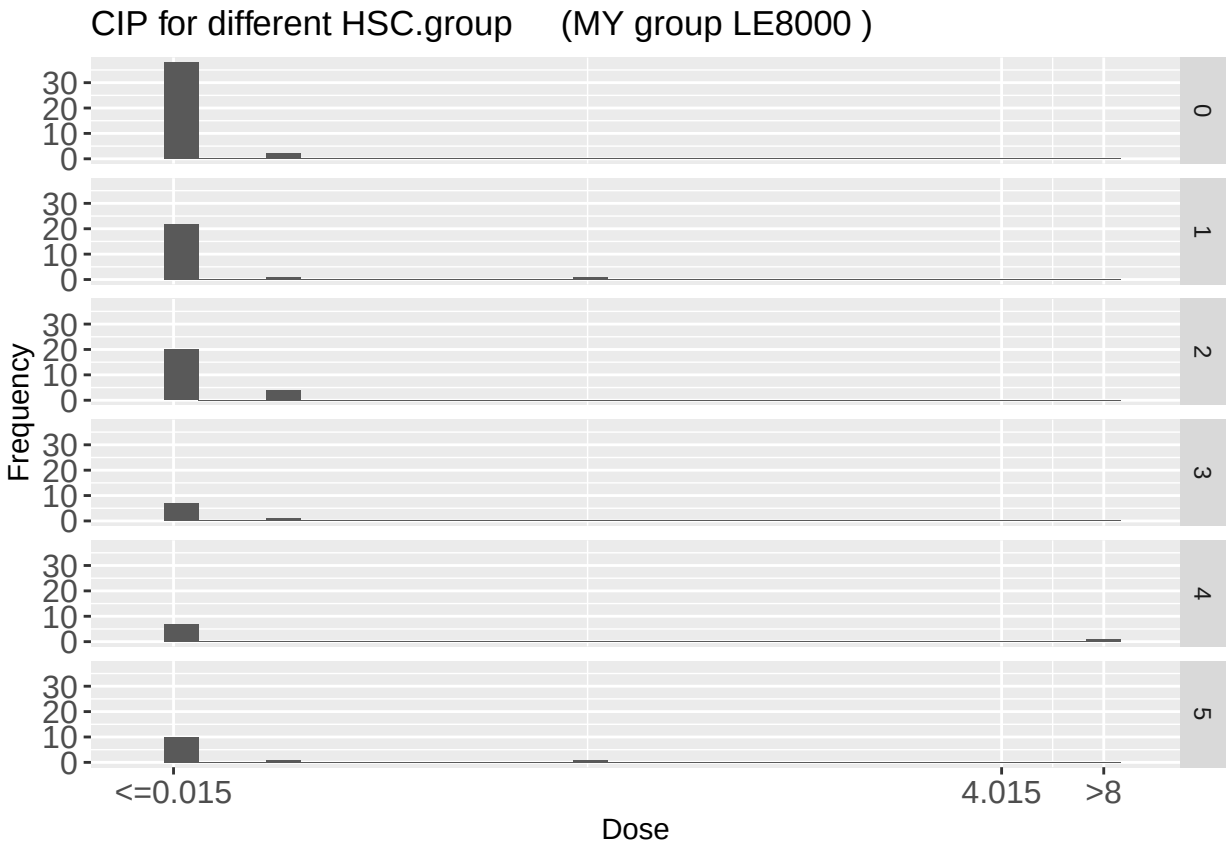

```
graphisch("HSC.group", "MERO", 0.03 ,  -0.06,   0.015,0.015)
```

```
## [1] "MERO - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.000 ... 0.030"
## [1] ""
## [1] "MERO - Resistance, 1: stable with outlet :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.000 ... 0.030"
## [1] ""
## [1] "MERO - Resistance, 2: outdoors           :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.000 ... 0.030"
## [1] ""
## [1] "MERO - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.000 ... 0.030"
## [1] ""
## [1] "MERO - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.000 ... 0.030"
## [1] ""
## [1] "MERO - Resistance, 5 = 0 + 2        :"
## [1] "  Median             <= 0.03"
## [1] "  Mean   in  0.005 ... 0.033"
## [1] ""
```



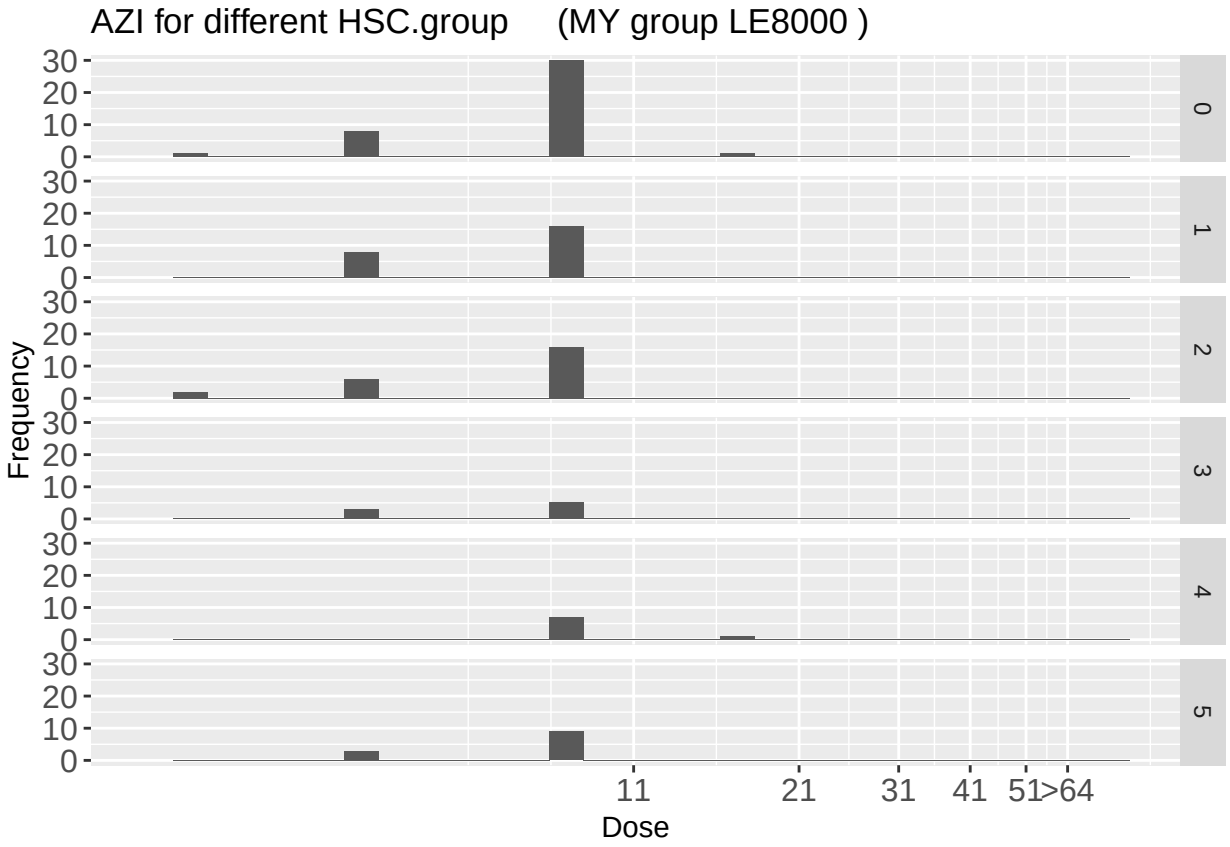

```
graphisch("HSC.group", "CIP" , 0.015,   8   ,   0.015,   4    )
```

```
## [1] "CIP - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.002 ... 0.016"
## [1] ""
## [1] "CIP - Resistance, 1: stable with outlet :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.012 ... 0.025"
## [1] ""
## [1] "CIP - Resistance, 2: outdoors           :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.005 ... 0.017"
## [1] ""
## [1] "CIP - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.004 ... 0.017"
## [1] ""
## [1] "CIP - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  1.000 ... 1.013"
## [1] ""
## [1] "CIP - Resistance, 5 = 0 + 2        :"
## [1] "  Median             <= 0.015"
## [1] "  Mean   in  0.023 ... 0.036"
## [1] ""
```



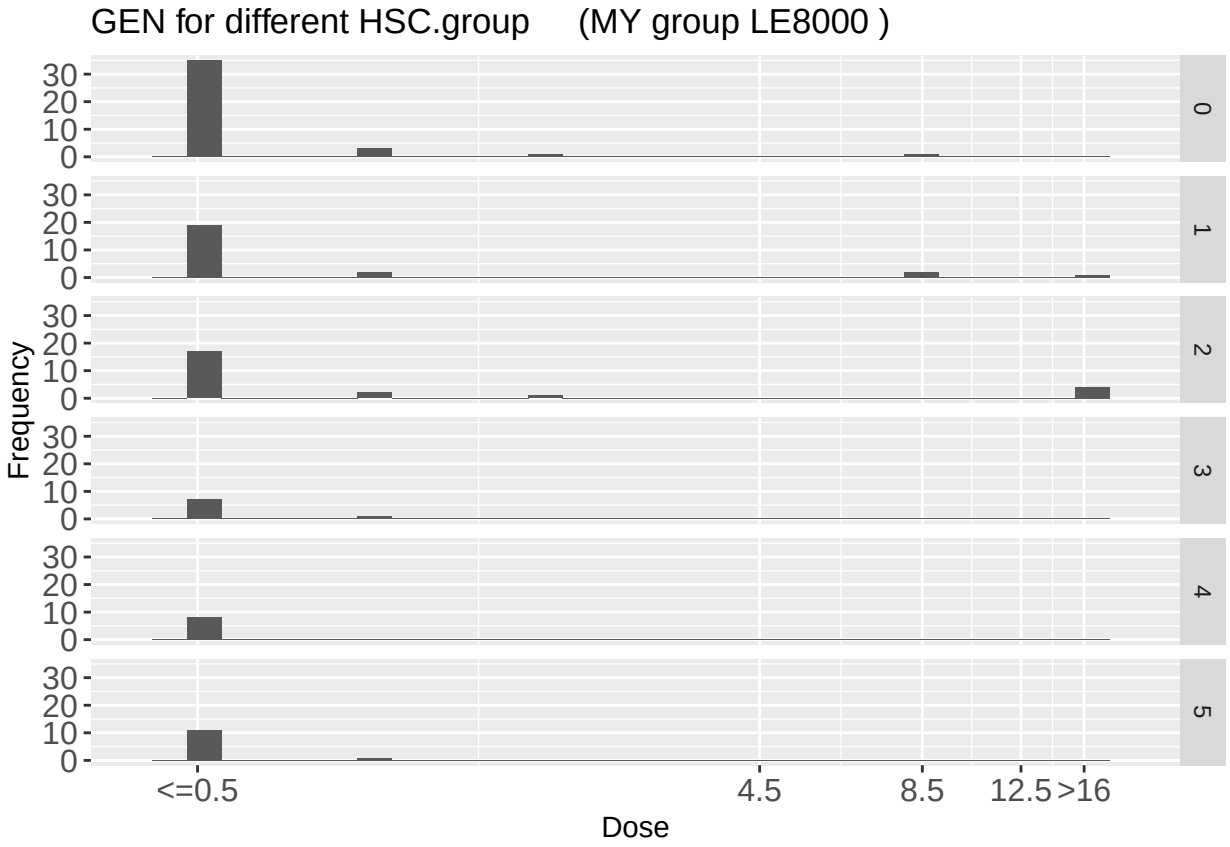

```
graphisch("HSC.group", "AZI" , 2    ,  64   ,   1    ,   10    )
```

```
## [1] "AZI - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             = 8"
## [1] "  Mean   in  7.200 ... 7.250"
## [1] ""
## [1] "AZI - Resistance, 1: stable with outlet :"
## [1] "  Median             = 8"
## [1] "  Mean   =  6.667"
## [1] ""
## [1] "AZI - Resistance, 2: outdoors           :"
## [1] "  Median             = 8"
## [1] "  Mean   in  6.333 ... 6.500"
## [1] ""
## [1] "AZI - Resistance, 3 = 0 + 1       :"
## [1] "  Median             = 8"
## [1] "  Mean   =  6.500"
## [1] ""
## [1] "AZI - Resistance, 4 = 1 + 2       :"
## [1] "  Median             = 8"
## [1] "  Mean   =  9.000"
## [1] ""
## [1] "AZI - Resistance, 5 = 0 + 2        :"
## [1] "  Median             = 8"
## [1] "  Mean   =  7.000"
## [1] ""
```



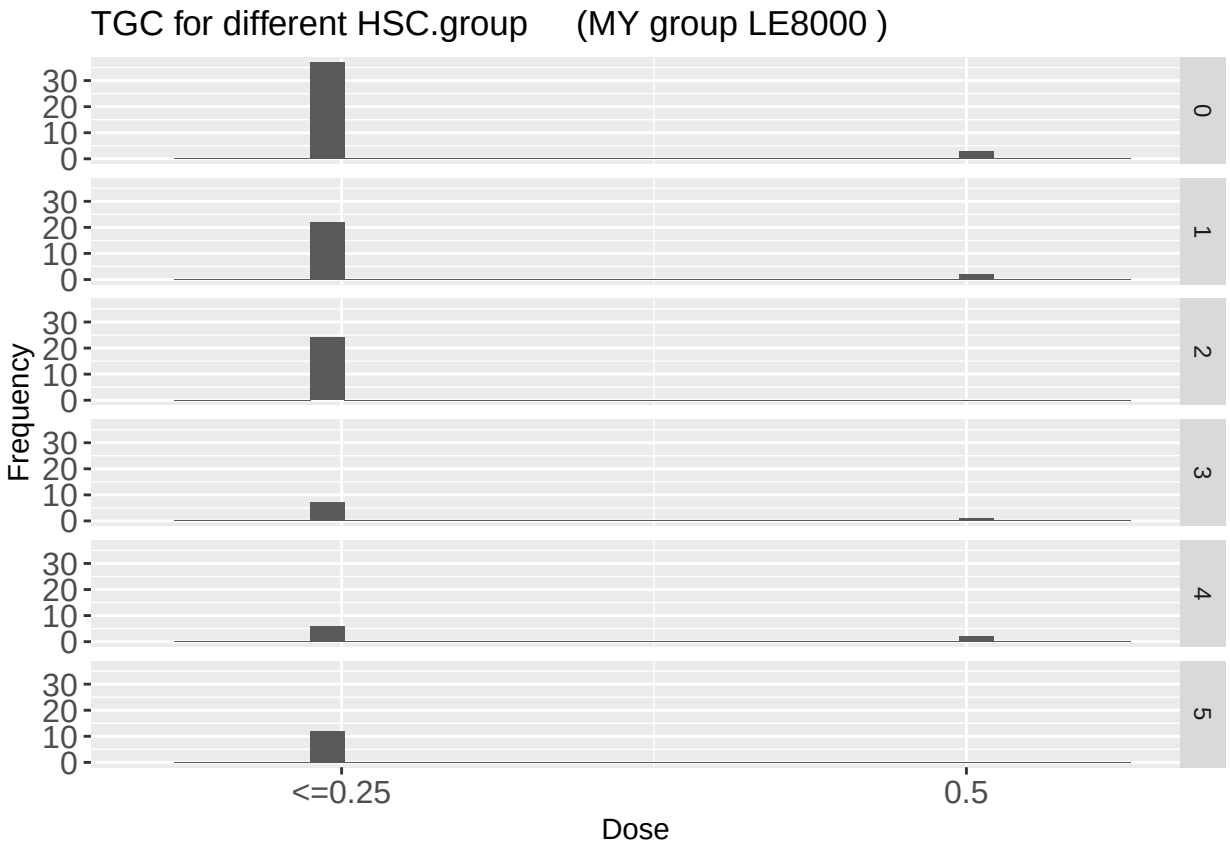

```
graphisch("HSC.group", "GEN" , 0.5  ,  16   ,   0.5  ,   4    )
```

```
## [1] "GEN - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  0.325 ... 0.762"
## [1] ""
## [1] "GEN - Resistance, 1: stable with outlet :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  1.417 ... 1.812"
## [1] ""
## [1] "GEN - Resistance, 2: outdoors           :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  2.833 ... 3.188"
## [1] ""
## [1] "GEN - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  0.125 ... 0.562"
## [1] ""
## [1] "GEN - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  0.000 ... 0.500"
## [1] ""
## [1] "GEN - Resistance, 5 = 0 + 2        :"
## [1] "  Median             <= 0.5"
## [1] "  Mean   in  0.083 ... 0.542"
## [1] ""
```



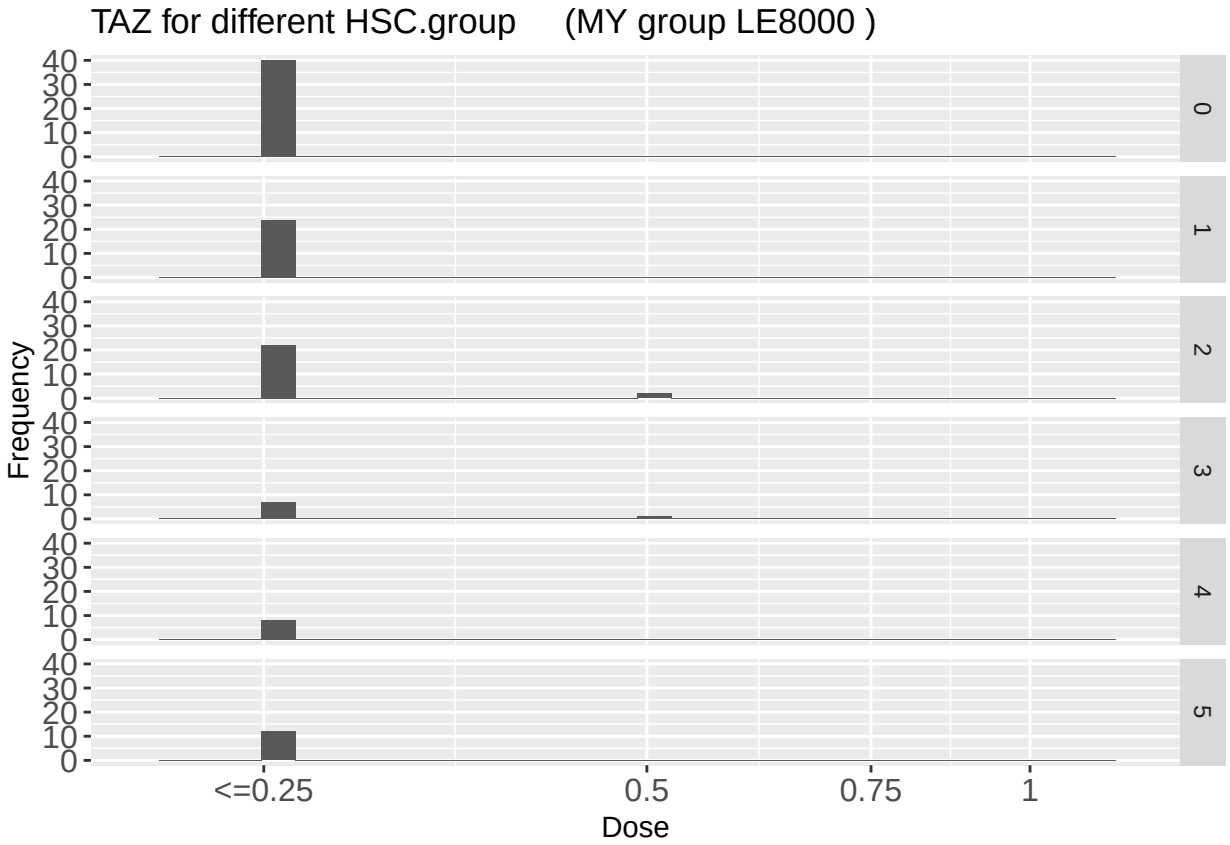

```
graphisch("HSC.group", "TGC" , 0.25 ,  -0.5 ,   0.25 ,   0.25 )
```

```
## [1] "TGC - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.037 ... 0.269"
## [1] ""
## [1] "TGC - Resistance, 1: stable with outlet :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.042 ... 0.271"
## [1] ""
## [1] "TGC - Resistance, 2: outdoors           :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
## [1] "TGC - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.062 ... 0.281"
## [1] ""
## [1] "TGC - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.125 ... 0.312"
## [1] ""
## [1] "TGC - Resistance, 5 = 0 + 2        :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
```



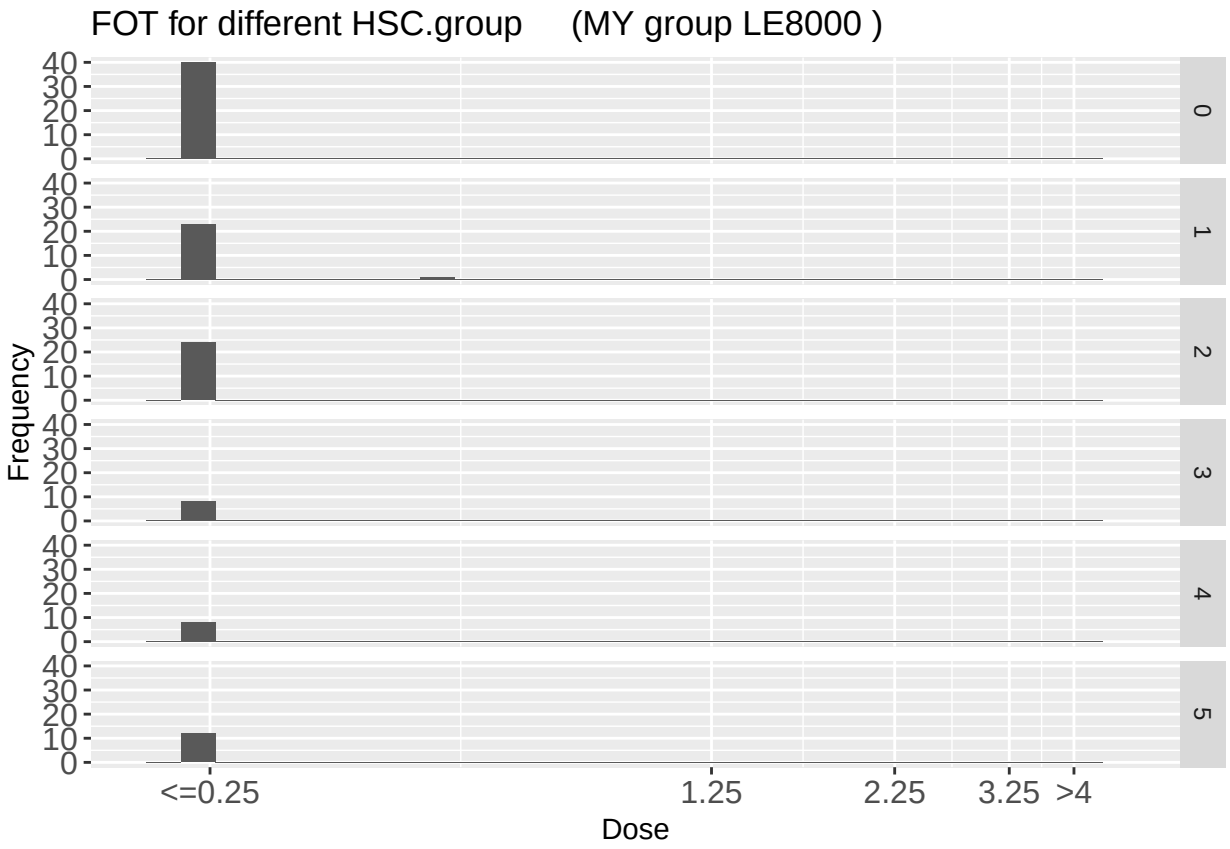

```
graphisch("HSC.group", "TAZ" , 0.25 ,  -1   ,   0.25 ,   0.25 )
```

```
## [1] "TAZ - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
## [1] "TAZ - Resistance, 1: stable with outlet :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
## [1] "TAZ - Resistance, 2: outdoors           :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.042 ... 0.271"
## [1] ""
## [1] "TAZ - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.062 ... 0.281"
## [1] ""
## [1] "TAZ - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
## [1] "TAZ - Resistance, 5 = 0 + 2        :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
```



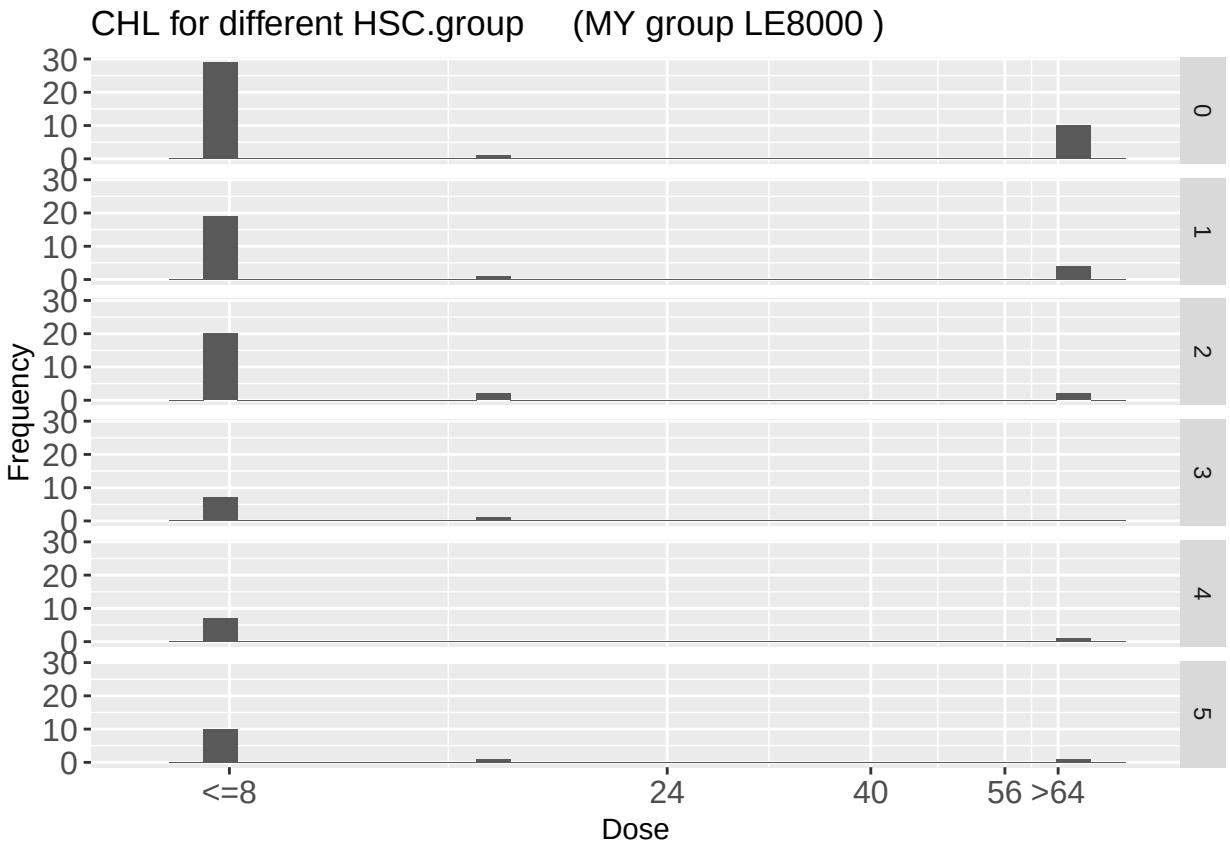

```
graphisch("HSC.group", "FOT" , 0.25 ,   4   ,   0.25 ,   1    )
```

```
## [1] "FOT - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
## [1] "FOT - Resistance, 1: stable with outlet :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.021 ... 0.260"
## [1] ""
## [1] "FOT - Resistance, 2: outdoors           :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
## [1] "FOT - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
## [1] "FOT - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
## [1] "FOT - Resistance, 5 = 0 + 2        :"
## [1] "  Median             <= 0.25"
## [1] "  Mean   in  0.000 ... 0.250"
## [1] ""
```



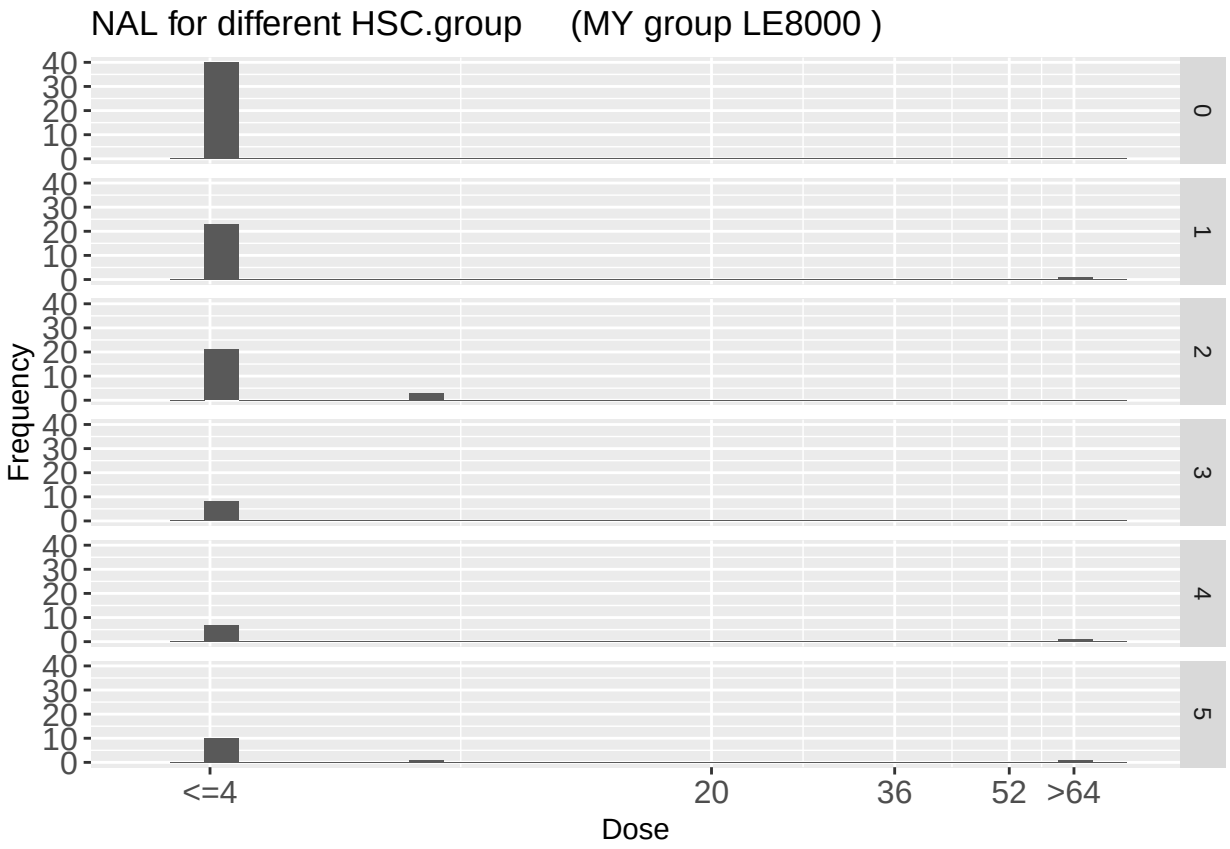

```
graphisch("HSC.group", "CHL" , 8    ,  64   ,   8,16   )
```

```
## [1] "CHL - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  16.400 ... 22.200"
## [1] ""
## [1] "CHL - Resistance, 1: stable with outlet :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  11.333 ... 17.667"
## [1] ""
## [1] "CHL - Resistance, 2: outdoors           :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  6.667 ... 13.333"
## [1] ""
## [1] "CHL - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  2.000 ... 9.000"
## [1] ""
## [1] "CHL - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  8.000 ... 15.000"
## [1] ""
## [1] "CHL - Resistance, 5 = 0 + 2        :"
## [1] "  Median             <= 8"
## [1] "  Mean   in  6.667 ... 13.333"
## [1] ""
```



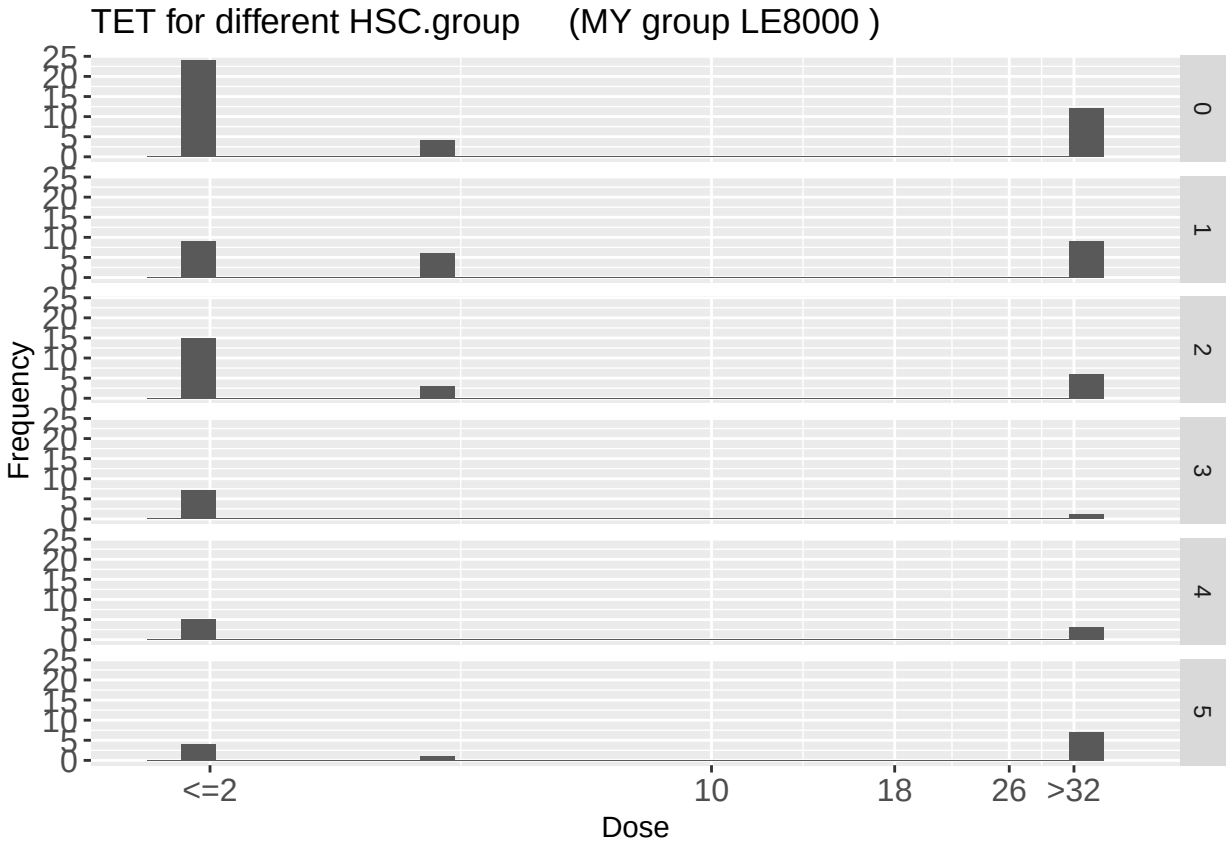

```
graphisch("HSC.group", "NAL" , 4    ,  64   ,   4,16   )
```

```
## [1] "NAL - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  0.000 ... 4.000"
## [1] ""
## [1] "NAL - Resistance, 1: stable with outlet :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  2.667 ... 6.500"
## [1] ""
## [1] "NAL - Resistance, 2: outdoors           :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  1.000 ... 4.500"
## [1] ""
## [1] "NAL - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  0.000 ... 4.000"
## [1] ""
## [1] "NAL - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  8.000 ... 11.500"
## [1] ""
## [1] "NAL - Resistance, 5 = 0 + 2        :"
## [1] "  Median             <= 4"
## [1] "  Mean   in  6.000 ... 9.333"
## [1] ""
```



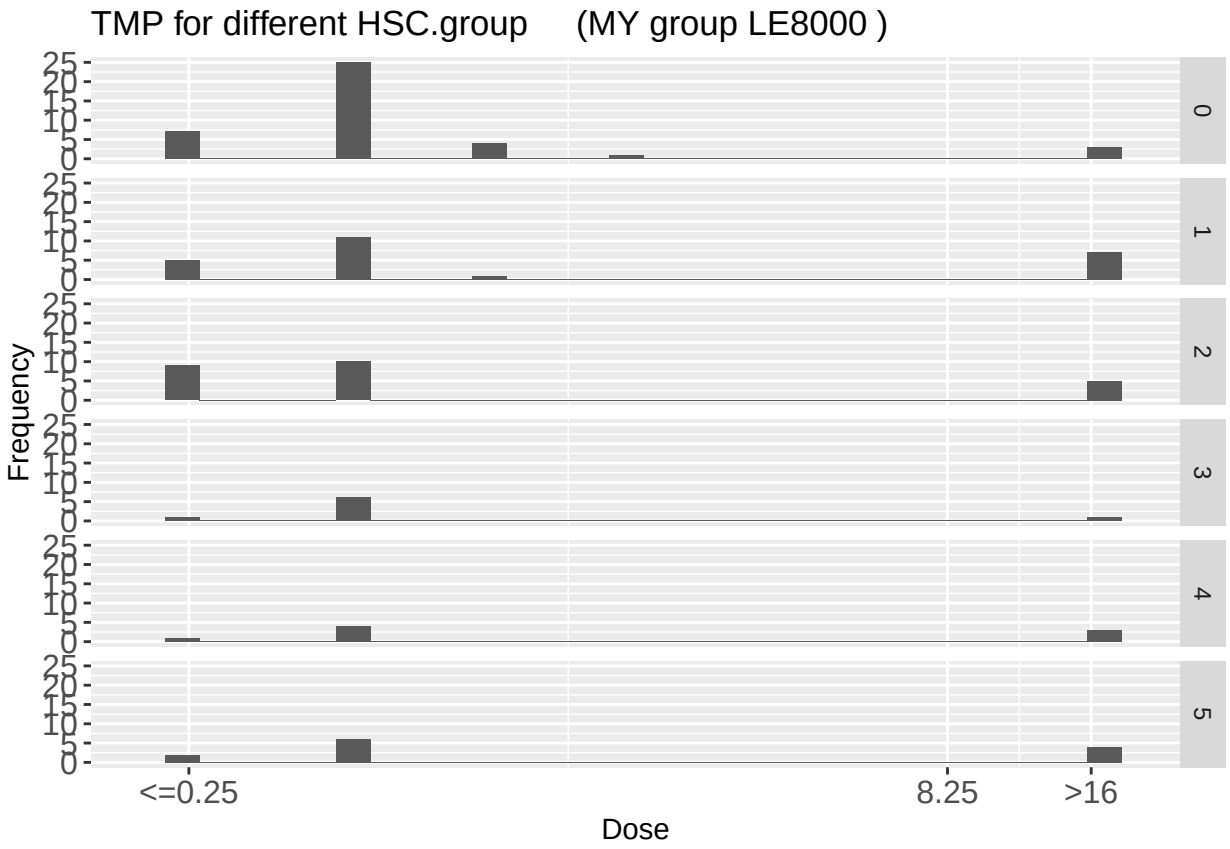

```
graphisch("HSC.group", "TET" , 2    ,  32   ,   2,8    )
```

```
## [1] "TET - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             <= 2"
## [1] "  Mean   in  10.000 ... 11.200"
## [1] ""
## [1] "TET - Resistance, 1: stable with outlet :"
## [1] "  Median             = 4"
## [1] "  Mean   in  13.000 ... 13.750"
## [1] ""
## [1] "TET - Resistance, 2: outdoors           :"
## [1] "  Median             <= 2"
## [1] "  Mean   in  8.500 ... 9.750"
## [1] ""
## [1] "TET - Resistance, 3 = 0 + 1       :"
## [1] "  Median             <= 2"
## [1] "  Mean   in  4.000 ... 5.750"
## [1] ""
## [1] "TET - Resistance, 4 = 1 + 2       :"
## [1] "  Median             <= 2"
## [1] "  Mean   in  12.000 ... 13.250"
## [1] ""
## [1] "TET - Resistance, 5 = 0 + 2        :"
## [1] "  Median             > 32"
## [1] "  Mean   in  19.000 ... 19.667"
## [1] ""
```



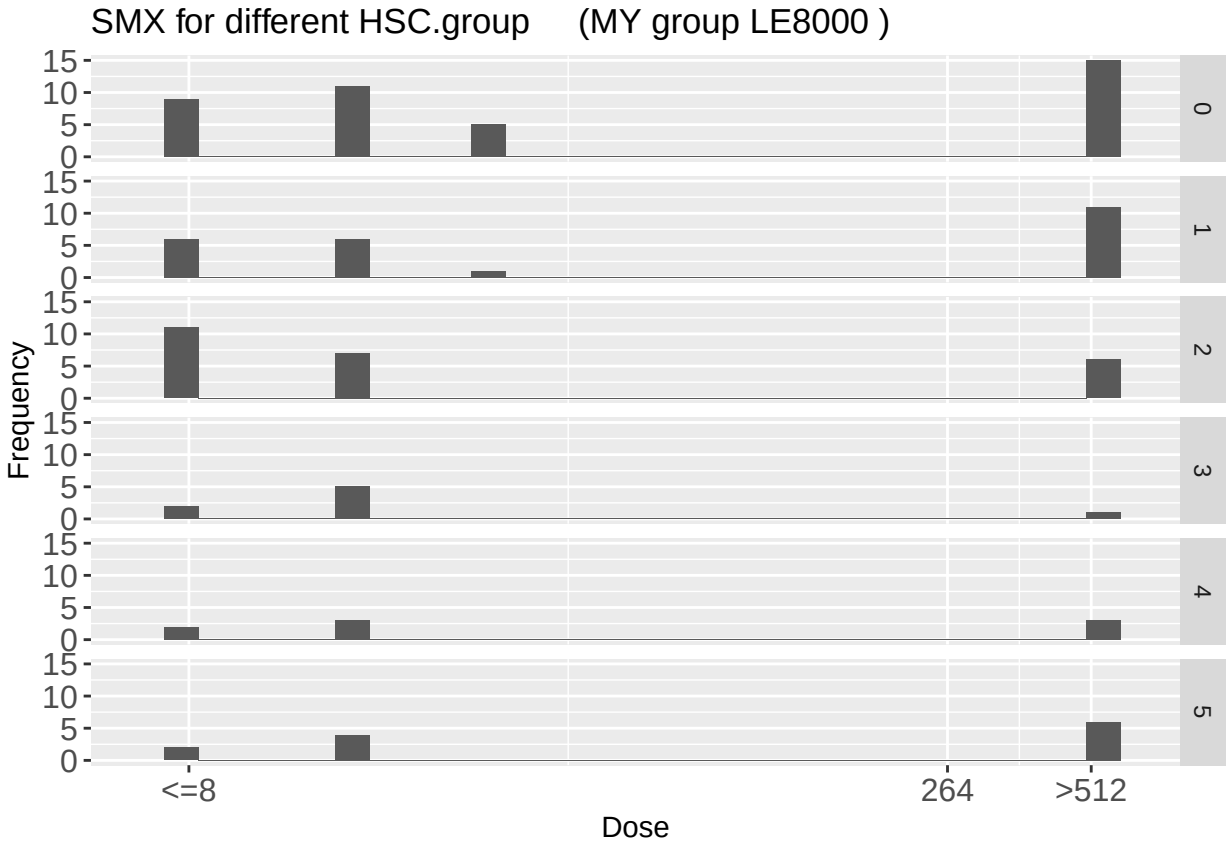

```
graphisch("HSC.group", "TMP" , 0.25 ,  16   ,   0.25,8    )
```

```
## [1] "TMP - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  1.663 ... 1.706"
## [1] ""
## [1] "TMP - Resistance, 1: stable with outlet :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  4.938 ... 4.990"
## [1] ""
## [1] "TMP - Resistance, 2: outdoors           :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  3.542 ... 3.635"
## [1] ""
## [1] "TMP - Resistance, 3 = 0 + 1       :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  2.375 ... 2.406"
## [1] ""
## [1] "TMP - Resistance, 4 = 1 + 2       :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  6.250 ... 6.281"
## [1] ""
## [1] "TMP - Resistance, 5 = 0 + 2        :"
## [1] "  Median             = 0.5"
## [1] "  Mean   in  5.583 ... 5.625"
## [1] ""
```




```
graphisch("HSC.group", "SMX" , 8    , 512   ,   8,256    )
```

```
## [1] "SMX - Resistance, 0: stable w\\o  outlet :"
## [1] "  Median             = 24"
## [1] "  Mean   in  200.400 ... 202.200"
## [1] ""
## [1] "SMX - Resistance, 1: stable with outlet :"
## [1] "  Median             = 24"
## [1] "  Mean   in  240.000 ... 242.000"
## [1] ""
## [1] "SMX - Resistance, 2: outdoors           :"
## [1] "  Median             = 16"
## [1] "  Mean   in  132.667 ... 136.333"
## [1] ""
## [1] "SMX - Resistance, 3 = 0 + 1       :"
## [1] "  Median             = 16"
## [1] "  Mean   in  74.000 ... 76.000"
## [1] ""
## [1] "SMX - Resistance, 4 = 1 + 2       :"
## [1] "  Median             = 16"
## [1] "  Mean   in  198.000 ... 200.000"
## [1] ""
## [1] "SMX - Resistance, 5 = 0 + 2        :"
## [1] "  Median             = 264"
## [1] "  Mean   in  261.333 ... 262.667"
## [1] ""
```



Es ist kein sehr ausgeprägtes Muster für grösste/kleinste Resistenzen zu erkennen. Tendenziell ergeben 1 und 1+2 die grössten Resistenzen, 2 und vor allem 0+1 die kleinsten.

Vollständigkeit

Jetzt sind alle Verteilungen geplotted und deskriptiv analysiert, ausser:

- AMI: alle Proben sensitiv <=4
- COL: alle Proben sensitiv <=1

Weitere Schritte

Technischer Natur

- noch minimale Verbesserungen Verteilungsplots?

Fundamentaler Natur

Kausalitäten studieren mittels Regressionen :

- Kausalitätsgraph
- Lineare Regressionen
- multivariable logistische Regression, mixed effects