Ácidos orgánicos

Contents

Acidos orgánicos en peso fresco

Concentración del perfíl de ácidos orgánicos a distintos estados de Madurez

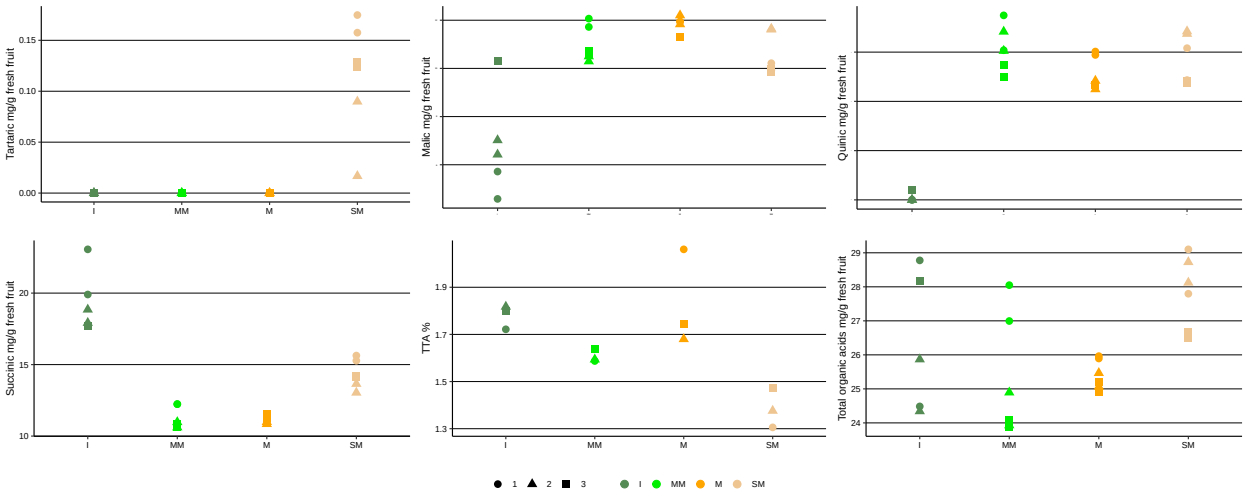


Tabla descriptiva

CAR	MAD	N	CONF	sd	se	ci
Tartárico	I	6	0.0000000	0.0000000	0.0000000	0.0000000
Tartárico	MM	6	0.0000000	0.0000000	0.0000000	0.0000000
Tartárico	M	6	0.0000000	0.0000000	0.0000000	0.0000000
Tartárico	SM	6	0.1152562	0.0564589	0.0230492	0.0592499
Málico	I	6	7.3874887	2.3903972	0.9758756	2.5085680
Málico	MM	6	10.9755462	0.7328273	0.2991755	0.7690551
Málico	M	6	11.7595387	0.3620525	0.1478073	0.3799508
Málico	SM	6	10.5368668	0.8561249	0.3495115	0.8984480
Quínico	I	6	0.0665693	0.1031288	0.0421021	0.1082270
Quínico	MM	6	3.0760242	0.4524811	0.1847246	0.4748497
Quínico	M	6	2.5455362	0.3395038	0.1386018	0.3562873
Quínico	SM	6	2.8491493	0.4983371	0.2034453	0.5229727
Succínico	I	6	19.1837748	2.0849133	0.8511623	2.1879823
Succínico	MM	6	11.2524155	0.7742892	0.3161022	0.8125667
Succínico	M	6	11.1127248	0.2554297	0.1042787	0.2680570
Succínico	SM	6	14.3175103	0.9775555	0.3990853	1.0258815
ATT	I	3	1.7792000	0.0507984	0.0293285	0.1261903
ATT	MM	3	1.6064000	0.0278970	0.0161063	0.0692999
ATT	M	3	1.8282667	0.2039064	0.1177254	0.5065315
ATT	SM	3	1.3845333	0.0835276	0.0482247	0.2074940
TOTALac	I	6	26.6378330	1.9904222	0.8125865	2.0888200
TOTALac	MM	6	25.3039856	1.7882993	0.7300701	1.8767050
TOTALac	M	6	25.4177997	0.4341469	0.1772397	0.4556092
TOTALac	SM	6	27.8187827	1.0618127	0.4334832	1.1143041
NA	I	6	45.6298478	4.8115370	1.9643018	5.0493984
NA	MM	6	36.7682227	5.1410360	2.0988191	5.3951864
NA	M	6	39.1592535	2.5994180	1.0612080	2.7279219
NA	SM	6	53.1196428	1.8422847	0.7521096	1.9333593

Evolución del perfíl de ácidos orgánicos

```
## Error in `palette()`:
## ! Insufficient values in manual scale. 6 needed but only 4 provided.
```

Acidos orgánicos Totales

Concentración de ácidos orgánicos totales

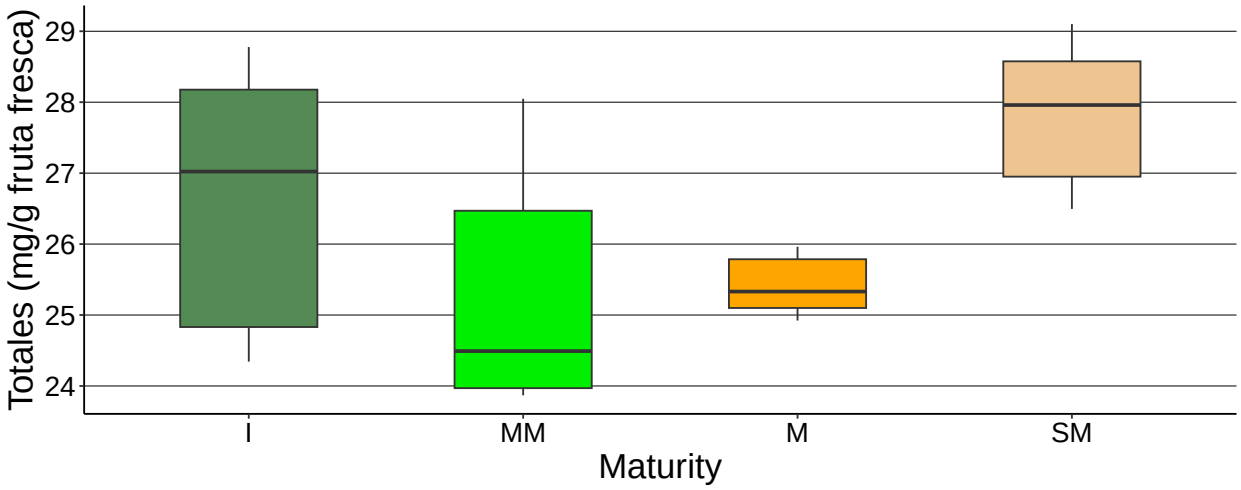
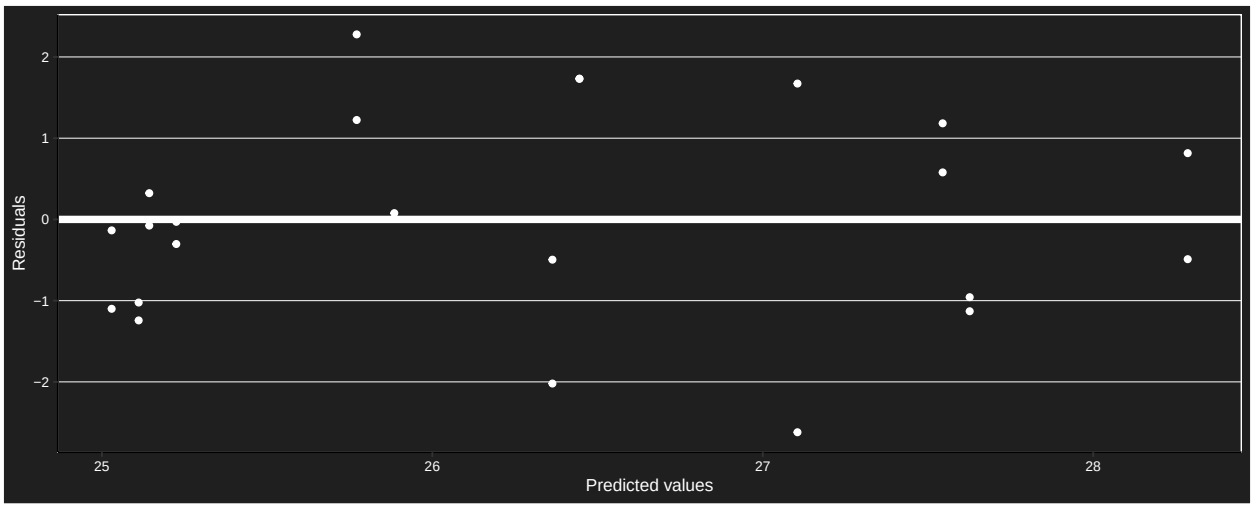
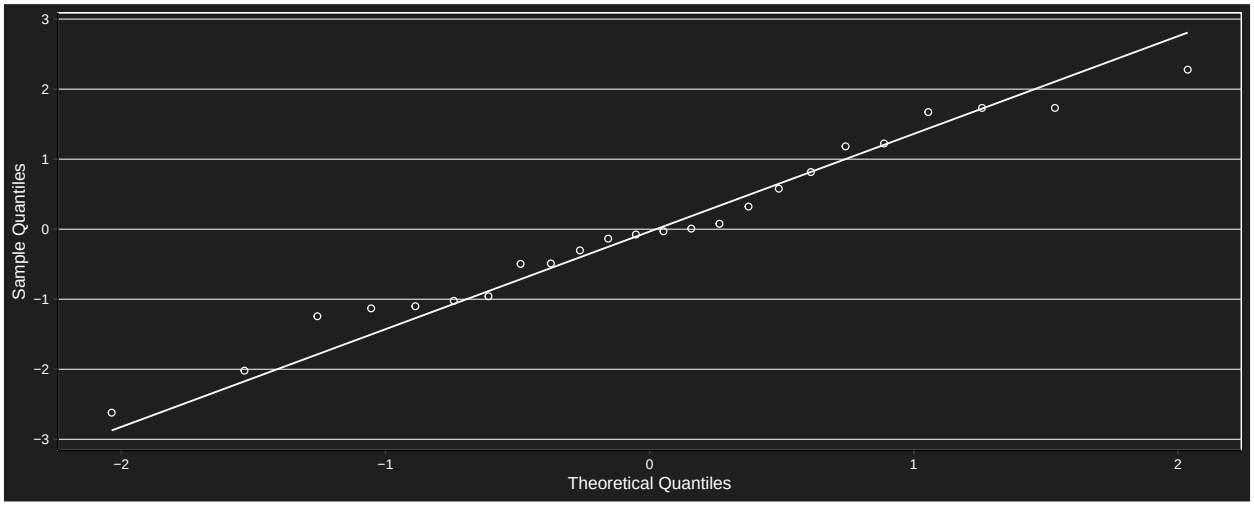


Tabla descriptiva totales

CAR	MAD	N	TOTALF	sd	se	ci
ACIDS	I	6	26.637833	1.9904221	0.8125864	2.0888199
ACIDS	MM	6	25.303985	1.7882992	0.7300701	1.8767049
ACIDS	M	6	25.417800	0.4341472	0.1772399	0.4556096
ACIDS	SM	6	27.818783	1.0618125	0.4334832	1.1143039
CATIONS	I	3	3.590633	1.3255207	0.7652897	3.2927760
CATIONS	MM	3	2.560667	0.3135370	0.1810207	0.7788691
CATIONS	M	3	2.603833	0.3089976	0.1783999	0.7675927
CATIONS	SM	3	2.214367	0.3945083	0.2277695	0.9800130
STAT	I	3	1.721123	0.2633318	0.1520347	0.6541524
STAT	MM	3	1.447652	0.1162909	0.0671406	0.2888827
STAT	M	3	1.541716	0.1326913	0.0766094	0.3296235
STAT	SM	3	1.909504	0.0077334	0.0044649	0.0192107
SUGARS	I	6	45.629848	4.8115374	1.9643019	5.0493989
SUGARS	MM	6	36.768222	5.1410362	2.0988192	5.3951866
SUGARS	M	6	39.159254	2.5994183	1.0612081	2.7279222
SUGARS	SM	6	53.119643	1.8422850	0.7521097	1.9333595

```
## Linear mixed-effects model fit by REML
##   Data: dataAT
##   Log-restricted-likelihood: -39.09968
##   Fixed: TOTALF ~ MAD
## (Intercept)       MADMM        MADM       MADSM
##   26.637833   -1.333847   -1.220033    1.180950
##
## Random effects:
##  Formula: ~1 | REP
##         (Intercept) Residual
## StdDev:   0.5444281 1.371765
##
## Number of Observations: 24
## Number of Groups: 3
```






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.97767, p-value = 0.8493
```

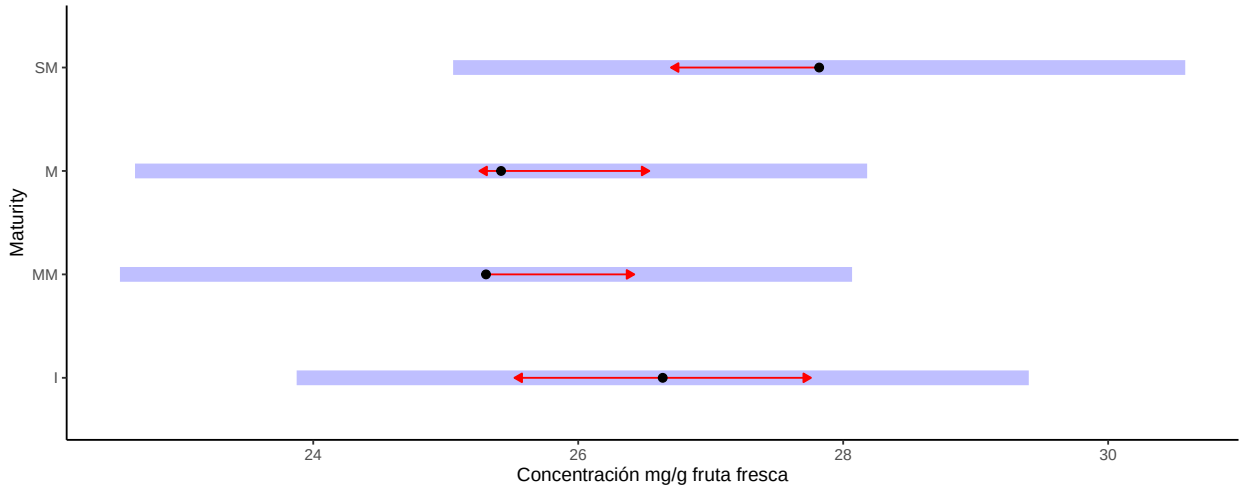
Anova

```
##             numDF denDF  F-value p-value
## (Intercept)     1    18 3901.697  <.0001
## MAD             3    18    4.454  0.0165
```

Test de Tukey

```
## $emmeans
##  MAD   emmean        SE df lower.CL upper.CL
##  I   26.63783 0.6422025  2 23.87466 29.40101
##  MM  25.30399 0.6422025  2 22.54081 28.06716
```

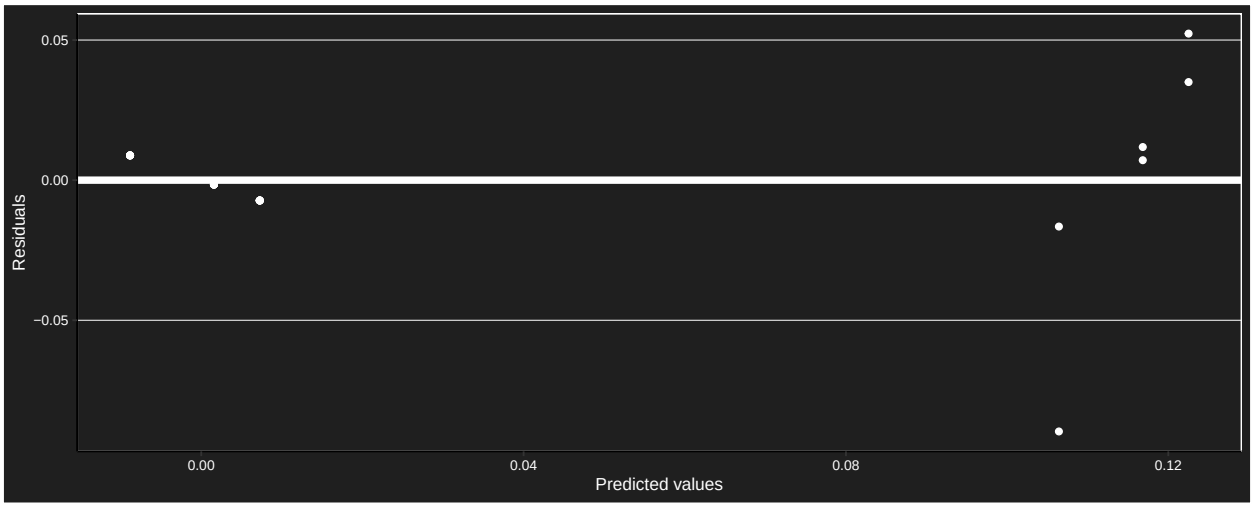
```
##  M   25.41780 0.6422025  2 22.65463 28.18097
##  SM  27.81878 0.6422025  2 25.05561 30.58196
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate        SE df t.ratio p.value
##  I - MM    1.3338475 0.7919891 18   1.684  0.3602
##  I - M     1.2200332 0.7919891 18   1.540  0.4354
##  I - SM   -1.1809497 0.7919891 18  -1.491  0.4629
##  MM - M   -0.1138143 0.7919891 18  -0.144  0.9989
##  MM - SM  -2.5147972 0.7919891 18  -3.175  0.0246
##  M - SM   -2.4009828 0.7919891 18  -3.032  0.0331
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```

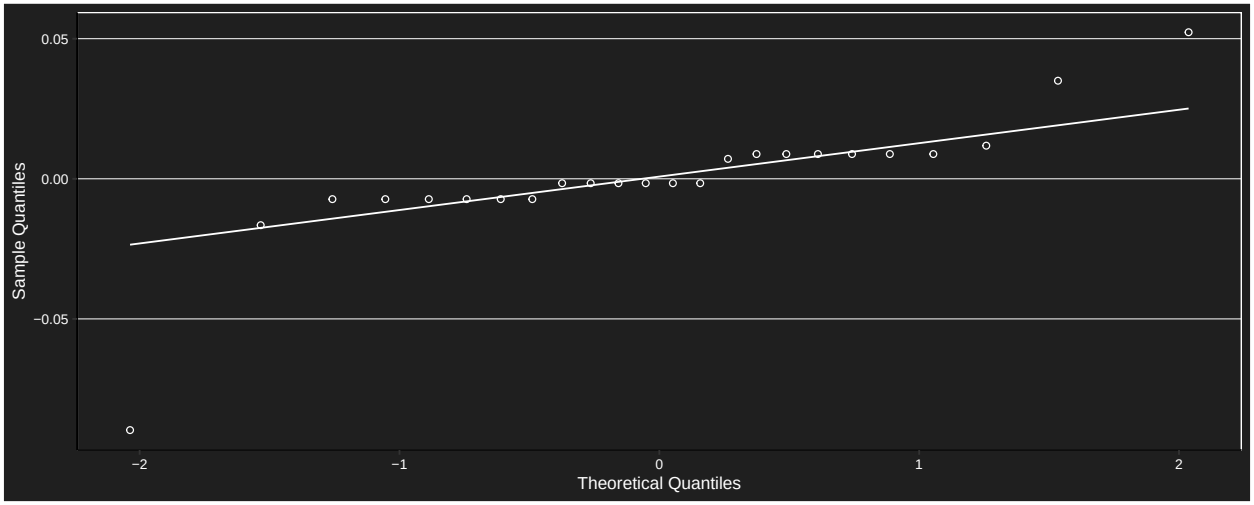


Ácido Tartárico

Modelo y supuestos

```
## Linear mixed-effects model fit by REML
##   Data: tar
##   Log-restricted-likelihood: 39.7876
##   Fixed: CONF ~ MAD
##   (Intercept)         MADMM          MADM         MADSM
## -1.163400e-17 -1.916123e-18  1.387779e-17  1.152562e-01
##
## Random effects:
##  Formula: ~1 | REP
##         (Intercept)  Residual
## StdDev:  0.01080452 0.0265232
##
## Number of Observations: 24
## Number of Groups: 3
```






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.72687, p-value = 2.331e-05
```

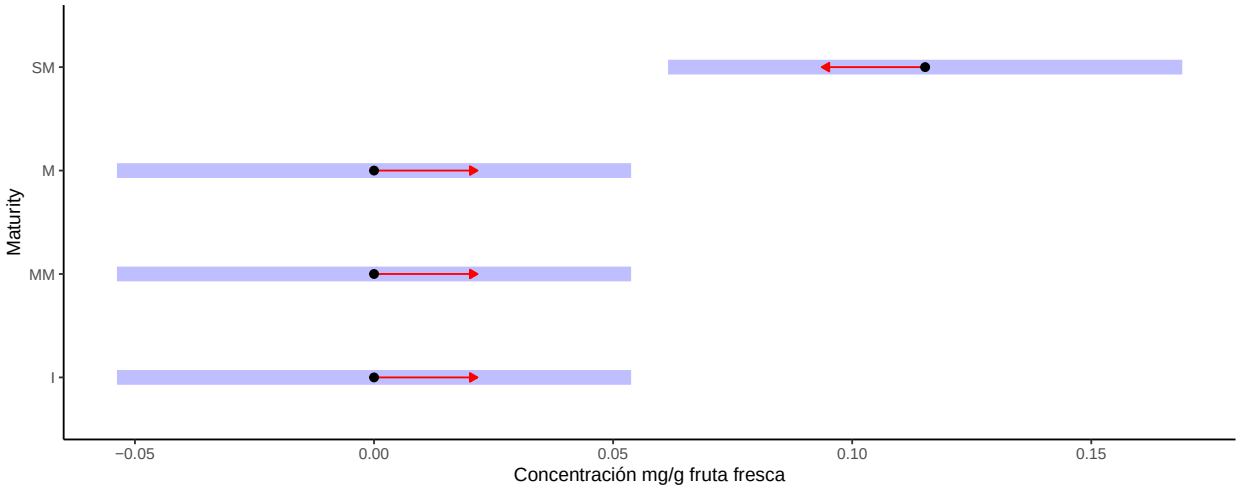
Anova

```
##             numDF denDF  F-value p-value
## (Intercept)     1    18 12.16941  0.0026
## MAD             3    18 28.32485  <.0001
```

Test de Tukey

```
## $emmeans
##  MAD    emmean         SE df    lower.CL   upper.CL
##  I   0.0000000 0.01249637  2 -0.05376754 0.05376754
```

```
##  MM  0.0000000 0.01249637  2 -0.05376754 0.05376754
##  M   0.0000000 0.01249637  2 -0.05376754 0.05376754
##  SM  0.1152562 0.01249637  2  0.06148862 0.16902371
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate         SE df t.ratio p.value
##  I - MM    0.0000000 0.01531318 18   0.000  1.0000
##  I - M     0.0000000 0.01531318 18   0.000  1.0000
##  I - SM   -0.1152562 0.01531318 18  -7.527  <.0001
##  MM - M    0.0000000 0.01531318 18   0.000  1.0000
##  MM - SM  -0.1152562 0.01531318 18  -7.527  <.0001
##  M - SM   -0.1152562 0.01531318 18  -7.527  <.0001
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```

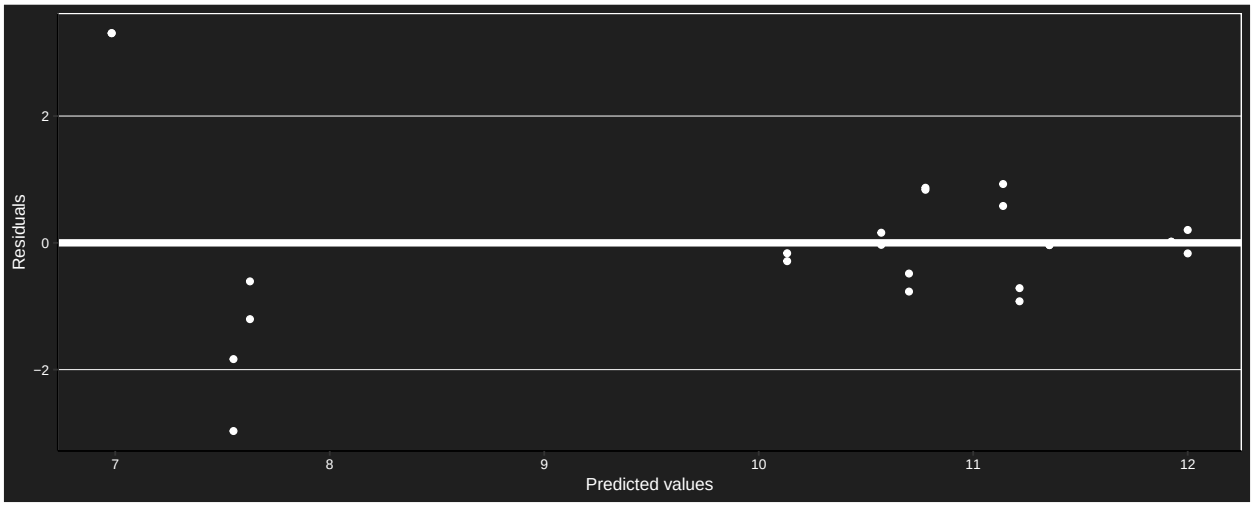


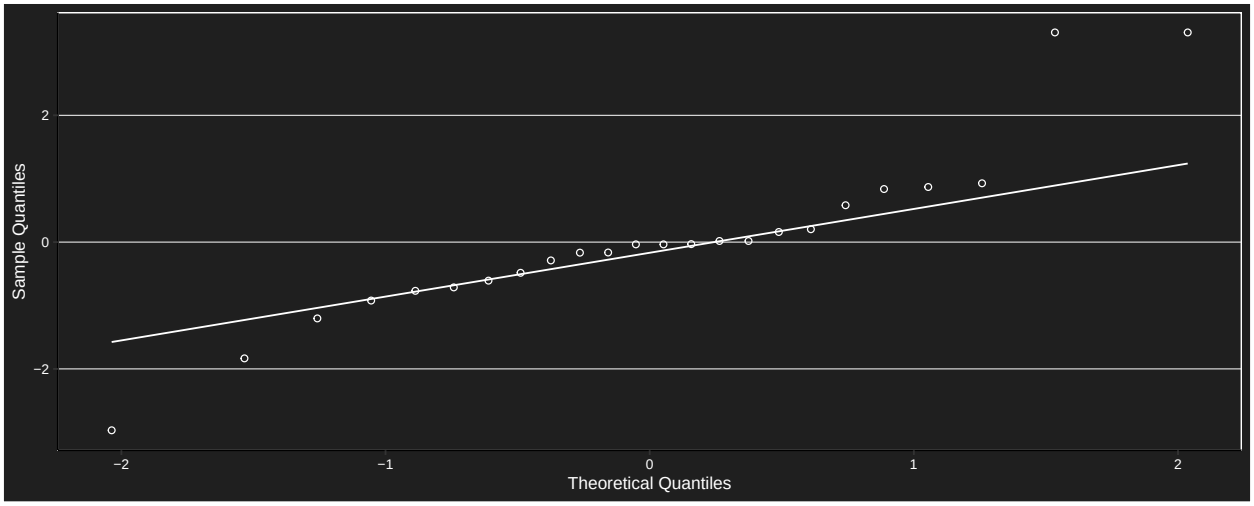
Ácido málico

Modelo y supuestos

```
## Linear mixed-effects model fit by REML
##   Data: mal
##   Log-restricted-likelihood: -26.58205
##   Fixed: CONF ~ MAD
## (Intercept)       MADMM        MADM       MADSM
##    7.387489    3.588057    4.372050    3.149378
##
## Random effects:
##  Formula: ~1 | REP
##         (Intercept) Residual
## StdDev:   0.3652165 2.680123
##
```

```
## Variance function:
##  Structure: Different standard deviations per stratum
##  Formula: ~1 | MAD
##  Parameter estimates:
##          I          M         MM         SM
## 1.00000000 0.05526687 0.27021057 0.26008009
## Number of Observations: 24
## Number of Groups: 3
```






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.88973, p-value = 0.01312
```

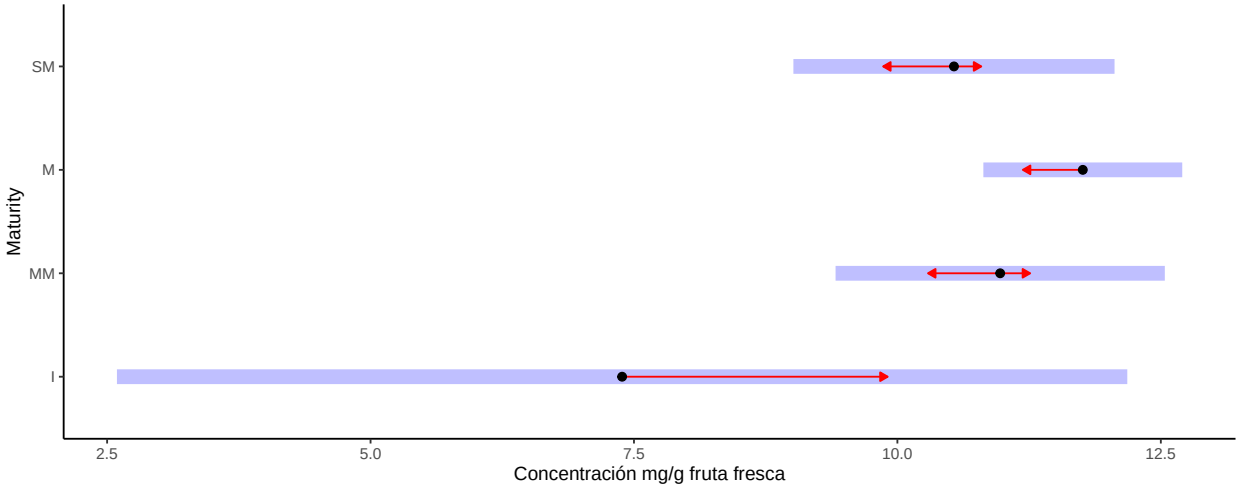
Anova

```
##             numDF denDF   F-value p-value
```

```
## (Intercept)     1    18 2846.5229  <.0001
## MAD             3    18   12.9604   1e-04
```

Test de Tukey

```
## $emmeans
##  MAD    emmean        SE df  lower.CL upper.CL
##  I    7.387489 1.1142881  2  2.593094 12.18188
##  MM  10.975546 0.3631410  2  9.413076 12.53802
##  M   11.759539 0.2193575  2 10.815719 12.70336
##  SM  10.536867 0.3541752  2  9.012974 12.06076
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast  estimate        SE df t.ratio p.value
##  I - MM   -3.588057 1.1333964 18  -3.166  0.0251
##  I - M    -4.372050 1.0958256 18  -3.990  0.0043
##  I - SM   -3.149378 1.1305556 18  -2.786  0.0542
##  MM - M   -0.783993 0.3017732 18  -2.598  0.0780
##  MM - SM   0.438679 0.4103528 18   1.069  0.7121
##  M - SM    1.222672 0.2909222 18   4.203  0.0027
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```

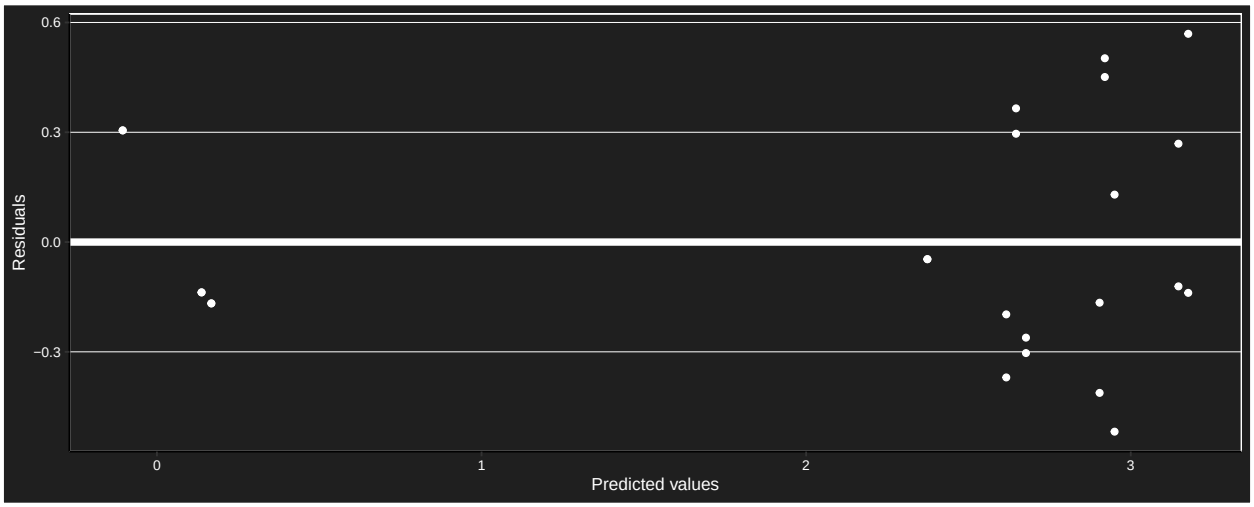


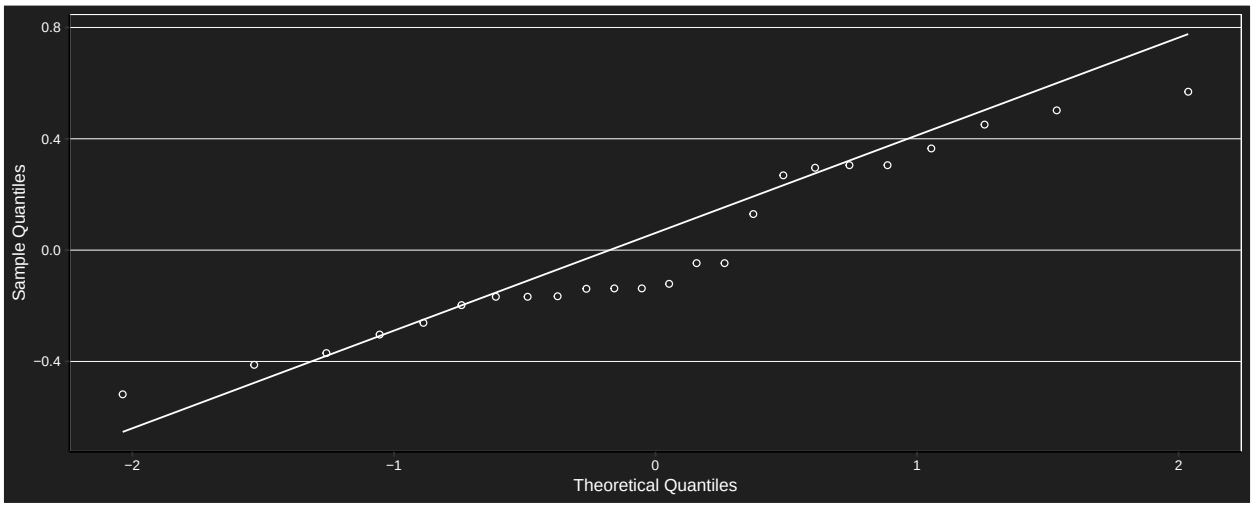
Ácido quínico

Modelo y supuestos

```
## Linear mixed-effects model fit by REML
##   Data: qui
##   Log-restricted-likelihood: -11.80976
```

```
##   Fixed: CONF ~ MAD
## (Intercept)       MADMM        MADM       MADSM
##  0.06656933  3.00945483  2.47896683  2.78258000
##
## Random effects:
##  Formula: ~1 | REP
##         (Intercept)  Residual
## StdDev:   0.1805716 0.3444666
##
## Number of Observations: 24
## Number of Groups: 3
```






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.93241, p-value = 0.1104
```

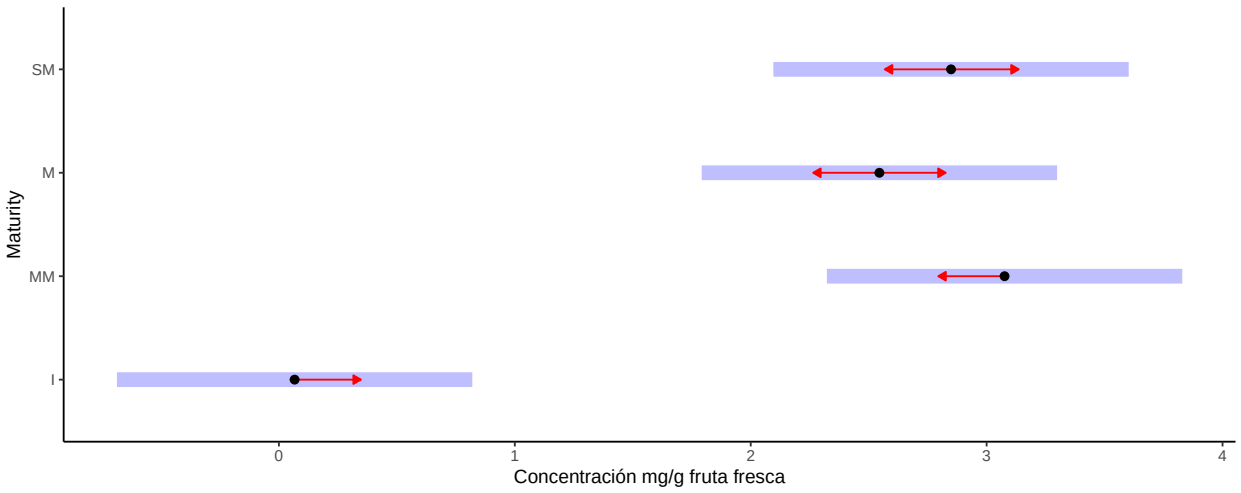
```
## Levene's Test for Homogeneity of Variance (center = median)
##       Df F value  Pr(>F)
## group  3  3.0561 0.05203 .
##       20
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Anova

```
##             numDF denDF   F-value p-value
## (Intercept)     1    18 288.07894  <.0001
## MAD             3    18  98.47655  <.0001
```

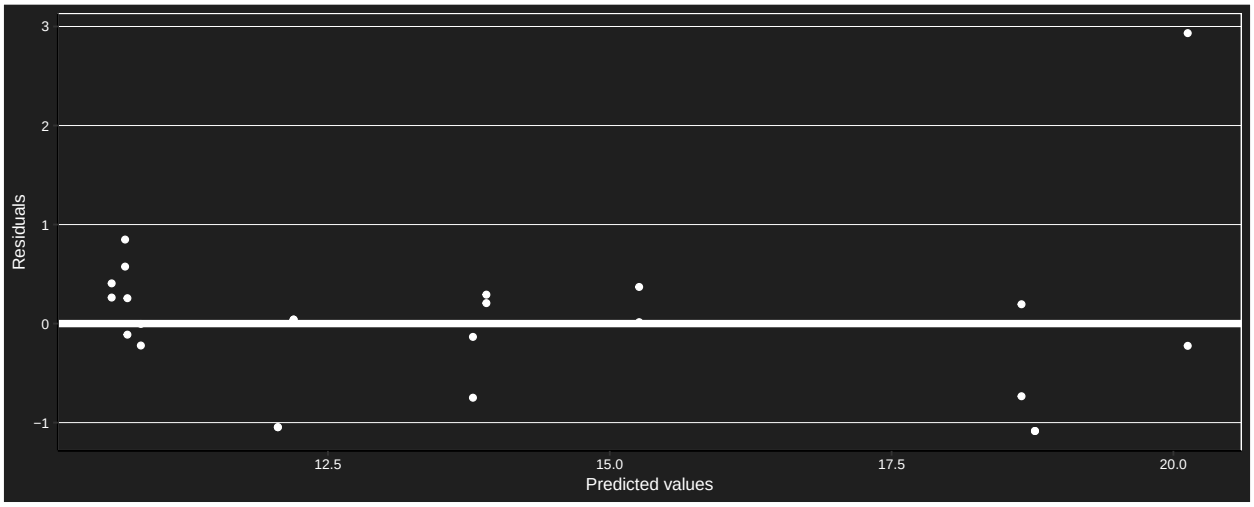
Test de Tukey

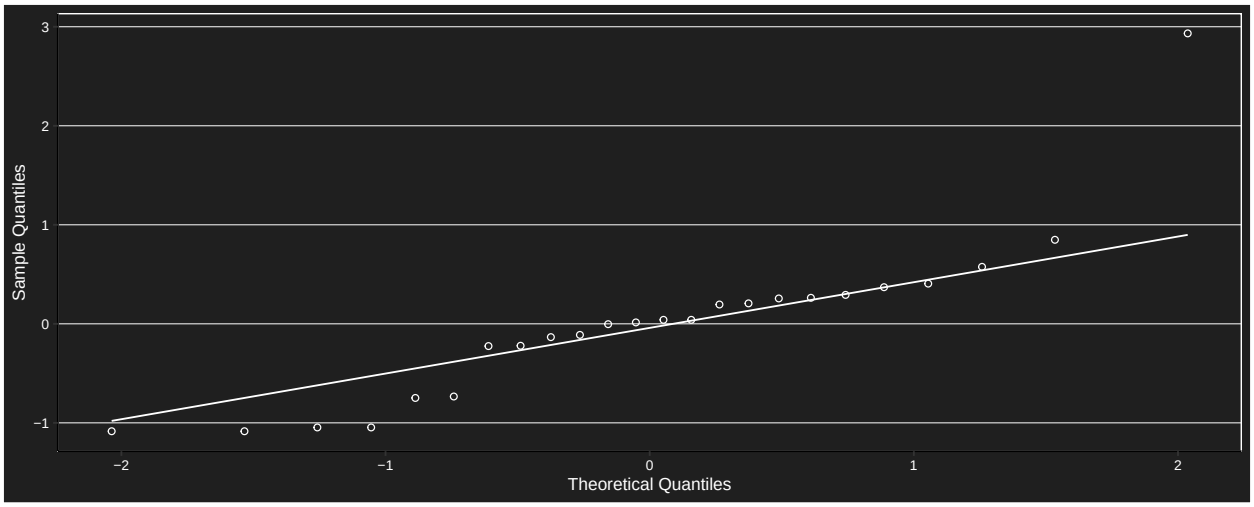
```
## $emmeans
##  MAD    emmean        SE df   lower.CL upper.CL
##  I   0.0665693 0.1750569  2 -0.6866396 0.819778
##  MM  3.0760242 0.1750569  2  2.3228152 3.829233
##  M   2.5455362 0.1750569  2  1.7923272 3.298745
##  SM  2.8491493 0.1750569  2  2.0959404 3.602358
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate        SE df t.ratio p.value
##  I - MM   -3.0094548 0.1988779 18 -15.132  <.0001
##  I - M    -2.4789668 0.1988779 18 -12.465  <.0001
##  I - SM   -2.7825800 0.1988779 18 -13.991  <.0001
##  MM - M    0.5304880 0.1988779 18   2.667  0.0683
##  MM - SM   0.2268748 0.1988779 18   1.141  0.6700
##  M - SM   -0.3036132 0.1988779 18  -1.527  0.4431
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```



Ácido succinico

Modelo y supuestos






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.8254, p-value = 0.0007898
```

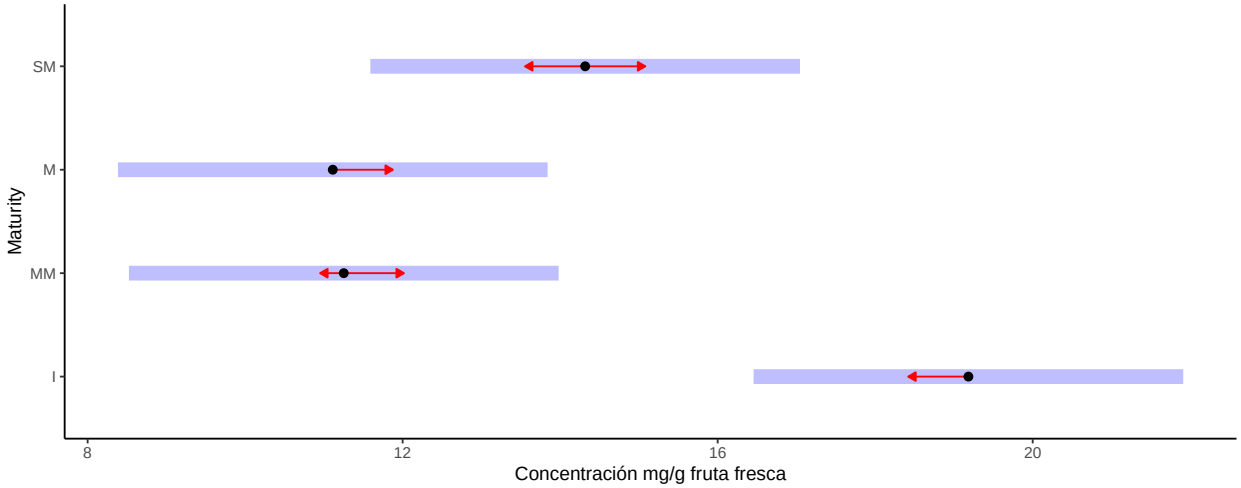
```
## Levene's Test for Homogeneity of Variance (center = median)
##       Df F value Pr(>F)
## group  3  1.8901 0.1638
##       20
```

Anova

```
##             numDF denDF  F-value p-value
## (Intercept)     1    18 667.5826  <.0001
## MAD             3    18  97.5744  <.0001
```

Test de Tukey

```
## $emmeans
##  MAD   emmean        SE df  lower.CL upper.CL
##  I   19.18378 0.6340304  2 16.455762 21.91179
##  MM  11.25241 0.6340304  2  8.524403 13.98043
##  M   11.11272 0.6340304  2  8.384712 13.84074
##  SM  14.31751 0.6340304  2 11.589498 17.04552
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast  estimate        SE df t.ratio p.value
##  I - MM    7.931359 0.5411022 18  14.658  <.0001
##  I - M     8.071050 0.5411022 18  14.916  <.0001
##  I - SM    4.866264 0.5411022 18   8.993  <.0001
##  MM - M    0.139691 0.5411022 18   0.258  0.9938
##  MM - SM  -3.065095 0.5411022 18  -5.665  0.0001
##  M - SM   -3.204786 0.5411022 18  -5.923  0.0001
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```



Acidos orgánicos en peso seco

Concentración del perfíl de ácidos orgánicos

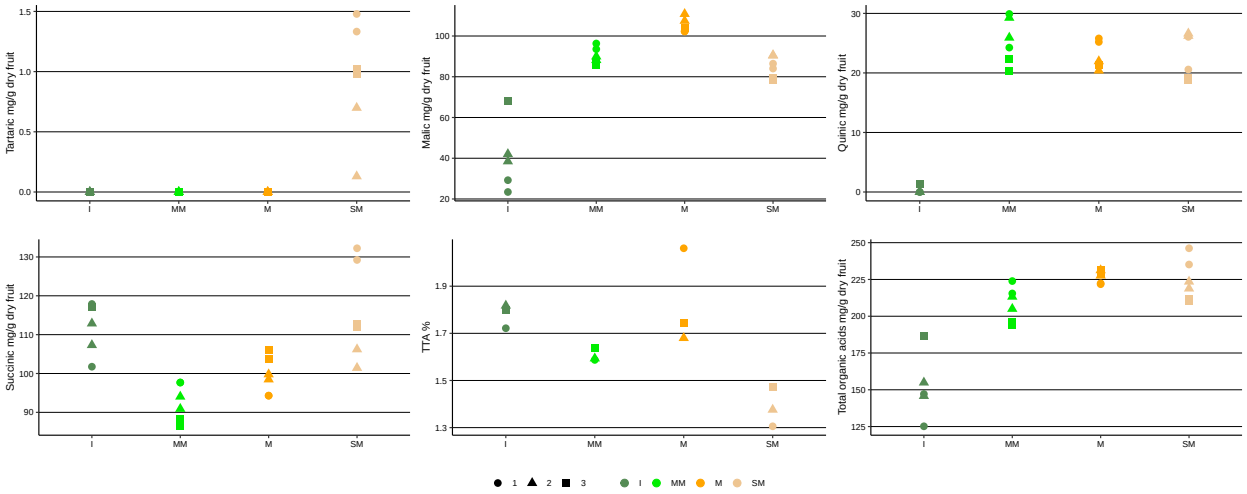


Tabla descriptiva

```
##          CAR MAD N        CONS          sd          se          ci
## 1  Tartárico   I 6   0.0000000  0.00000000  0.00000000  0.00000000
## 2  Tartárico  MM 6   0.0000000  0.00000000  0.00000000  0.00000000
## 3  Tartárico   M 6   0.0000000  0.00000000  0.00000000  0.00000000
## 4  Tartárico  SM 6   0.9411357  0.48306748  0.19721147  0.50694823
## 5     Málico   I 6  44.9021340 19.15238481  7.81892835 20.09919520
## 6     Málico  MM 6  90.1895317  4.02201511  1.64198079  4.22084600
## 7     Málico   M 6 105.1474897  3.36357515  1.37317381  3.52985564
## 8     Málico  SM 6  84.7945992  5.36803324  2.19149040  5.63340540
## 9    Quínico   I 6   0.4406633  0.68267270  0.27869996  0.71642106
## 10   Quínico  MM 6  25.3176063  3.81400139  1.55705955  4.00254899
## 11   Quínico   M 6  22.6888082  2.24262162  0.91554644  2.35348706
## 12   Quínico  SM 6  22.9204245  3.75680532  1.53370935  3.94252539
## 13 Succínico   I 6 112.3334865  6.53452657  2.66770930  6.85756508
## 14 Succínico  MM 6  92.4815923  4.78050904  1.95163464  5.01683657
## 15 Succínico   M 6  99.4372398  4.82401388  1.96939542  5.06249209
## 16 Succínico  SM 6 115.6551513 12.41879308  5.06995105 13.03272407
## 17       ATT   I 3   1.7792000  0.05079843  0.02932848  0.12619028
## 18       ATT  MM 3   1.6064000  0.02789695  0.01610631  0.06929987
## 19       ATT   M 3   1.8282667  0.20390638  0.11772541  0.50653154
## 20       ATT  SM 3   1.3845333  0.08352756  0.04822466  0.20749396
## 21   TOTALac   I 6 157.6762838 24.41479565  9.96729859 25.62175670
## 22   TOTALac  MM 6 207.9887303 11.65695743  4.75893294 12.23322658
## 23   TOTALac   M 6 227.2735377  4.28462553  1.74919105  4.49643873
## 24   TOTALac  SM 6 224.3113107 13.98740598  5.71033458 14.67888234
## 25      <NA>   I 6 266.8807917  8.48194315  3.46273879  8.90125343
## 26      <NA>  MM 6 301.6803547 34.61672247 14.13221777 36.32802229
## 27      <NA>   M 6 350.6257562 31.18238676 12.73015609 32.72390800
## 28      <NA>  SM 6 428.3680832 26.75277911 10.92177634 28.07531986
```

Evolución del perfíl de ácidos orgánicos

```
## Error in `palette()`:
## ! Insufficient values in manual scale. 6 needed but only 4 provided.
```

Ácidos orgánicos totales

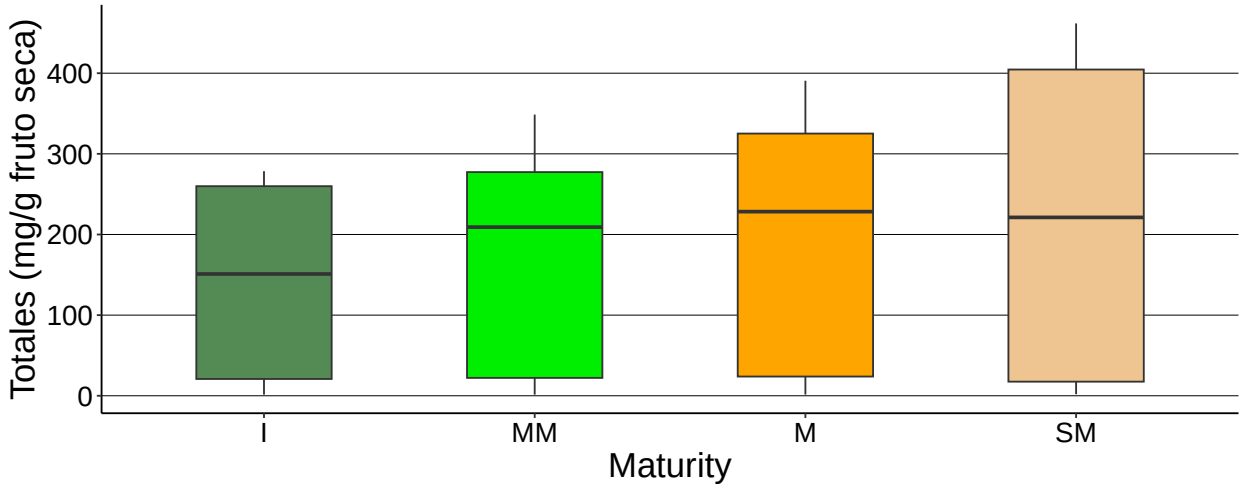


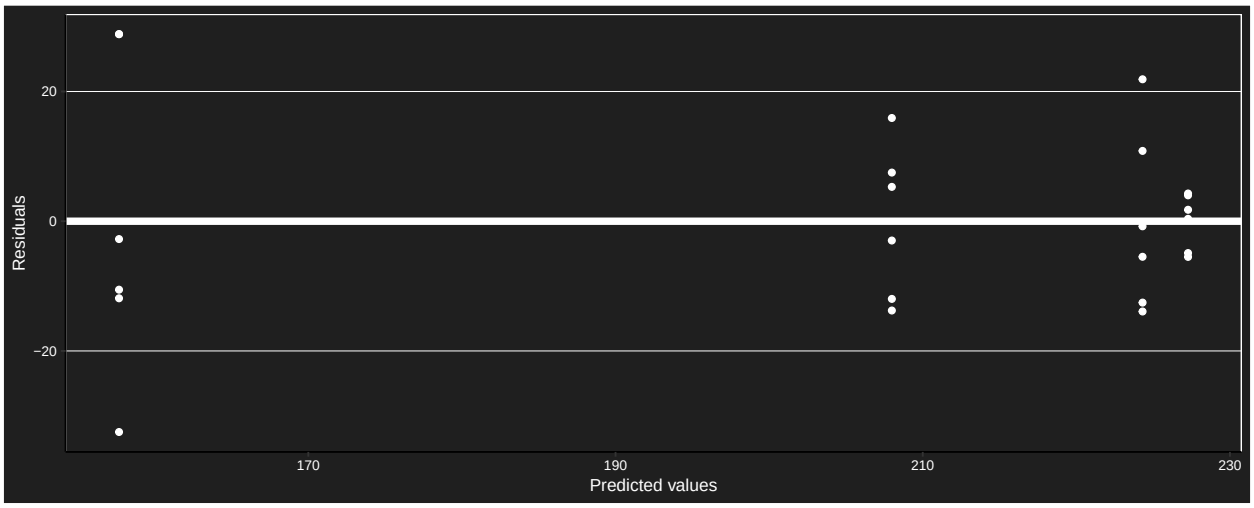
Tabla descriptiva totales

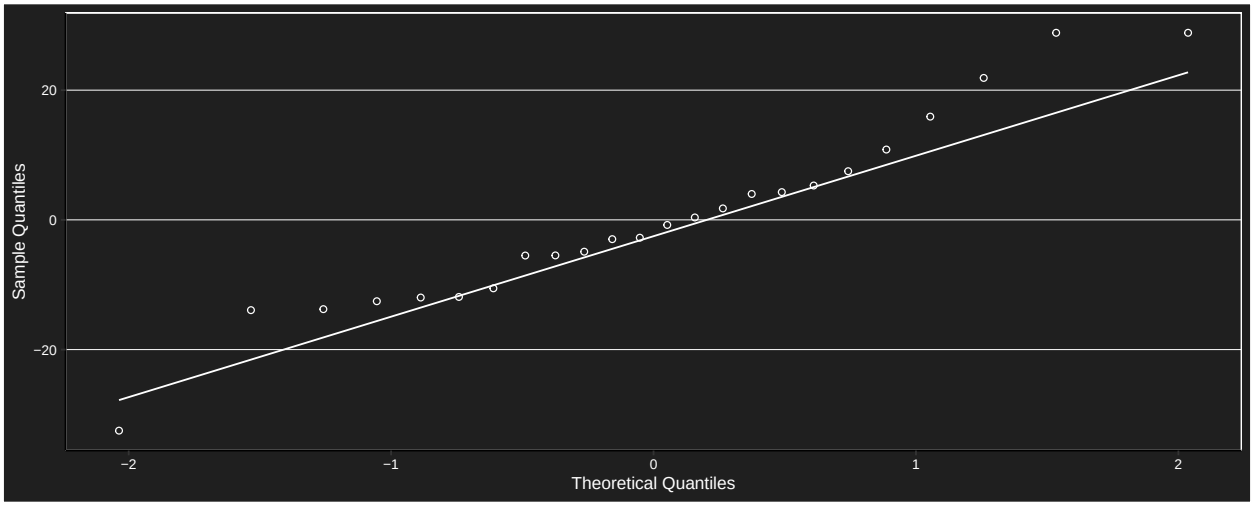
```
##        CAR MAD N     TOTALS           sd           se          ci
## 1    ACIDS   I 6 157.676284 24.414795650  9.967298586 25.62175670
## 2    ACIDS  MM 6 207.988730 11.656957335  4.758932904 12.23322648
## 3    ACIDS   M 6 227.273538  4.284625610  1.749191081  4.49643882
## 4    ACIDS  SM 6 224.311311 13.987405810  5.710334510 14.67888217
## 5  CATIONS   I 3  20.971755  7.741948182  4.469815867 19.23206544
## 6  CATIONS  MM 3  21.053410  2.577853260  1.488324274  6.40374250
## 7  CATIONS   M 3  23.270464  2.761512785  1.594360150  6.85997805
## 8  CATIONS  SM 3  17.826367  3.175919852  1.833618181  7.88942227
## 9     STAT   I 3   1.721122  0.263331773  0.152034670  0.65415239
## 10    STAT  MM 3   1.447652  0.116290919  0.067140593  0.28888266
## 11    STAT   M 3   1.541716  0.132691300  0.076609358  0.32962346
## 12    STAT  SM 3   1.909504  0.007733369  0.004464862  0.01921075
## 13  SUGARS   I 6 266.880792  8.481943277  3.462738843  8.90125357
## 14  SUGARS  MM 6 301.680355 34.616722145 14.132217637 36.32802196
## 15  SUGARS   M 6 350.625756 31.182386756 12.730156086 32.72390800
## 16  SUGARS  SM 6 428.368083 26.752778568 10.921776116 28.07531930
```

Modelo y supuestos

```
## Linear mixed-effects model fit by REML
##   Data: dataAT
##   Log-restricted-likelihood: -86.62191
##   Fixed: TOTALS ~ MAD
## (Intercept)       MADMM        MADM       MADSM
##   157.67628    50.31245    69.59725    66.63503
##
## Random effects:
##  Formula: ~1 | REP
##         (Intercept) Residual
## StdDev:   0.1187511  15.3783
```

```
##
## Number of Observations: 24
## Number of Groups: 3
```





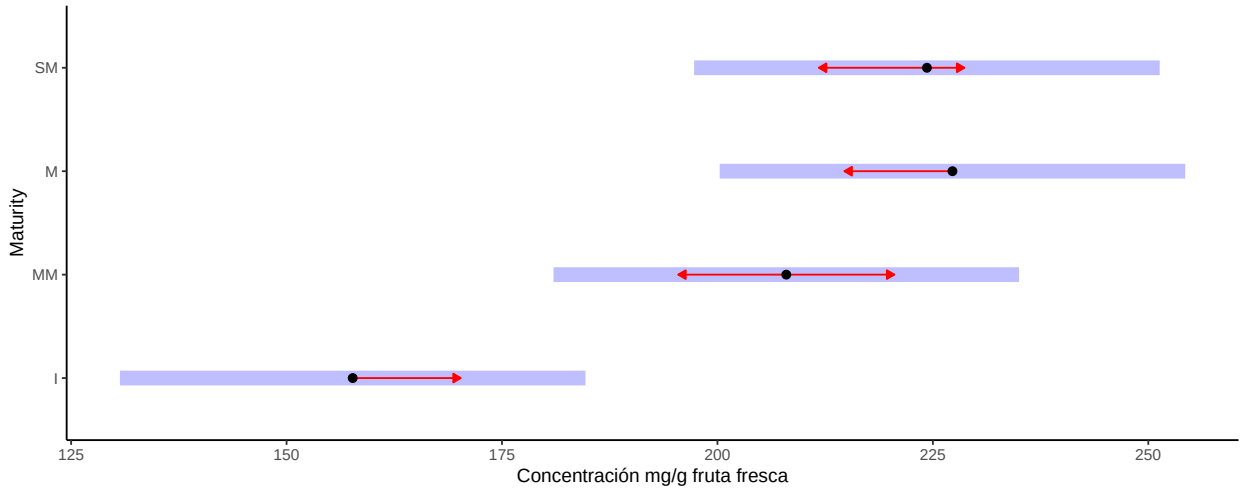

```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.95588, p-value = 0.3613
```

Anova

```
##             numDF denDF  F-value p-value
## (Intercept)     1    18 4234.257  <.0001
## MAD             3    18   26.349  <.0001
```

Test de Tukey

```
## $emmeans
##  MAD   emmean       SE df lower.CL upper.CL
##  I   157.6763 6.278539  2 130.6619 184.6907
##  MM  207.9887 6.278539  2 180.9744 235.0031
##  M   227.2735 6.278539  2 200.2592 254.2879
##  SM  224.3113 6.278539  2 197.2969 251.3257
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast  estimate       SE df t.ratio p.value
##  I - MM   -50.31245 8.878665 18  -5.667  0.0001
##  I - M    -69.59725 8.878665 18  -7.839  <.0001
##  I - SM   -66.63503 8.878665 18  -7.505  <.0001
##  MM - M   -19.28481 8.878665 18  -2.172  0.1689
##  MM - SM  -16.32258 8.878665 18  -1.838  0.2886
##  M - SM     2.96223 8.878665 18   0.334  0.9868
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```

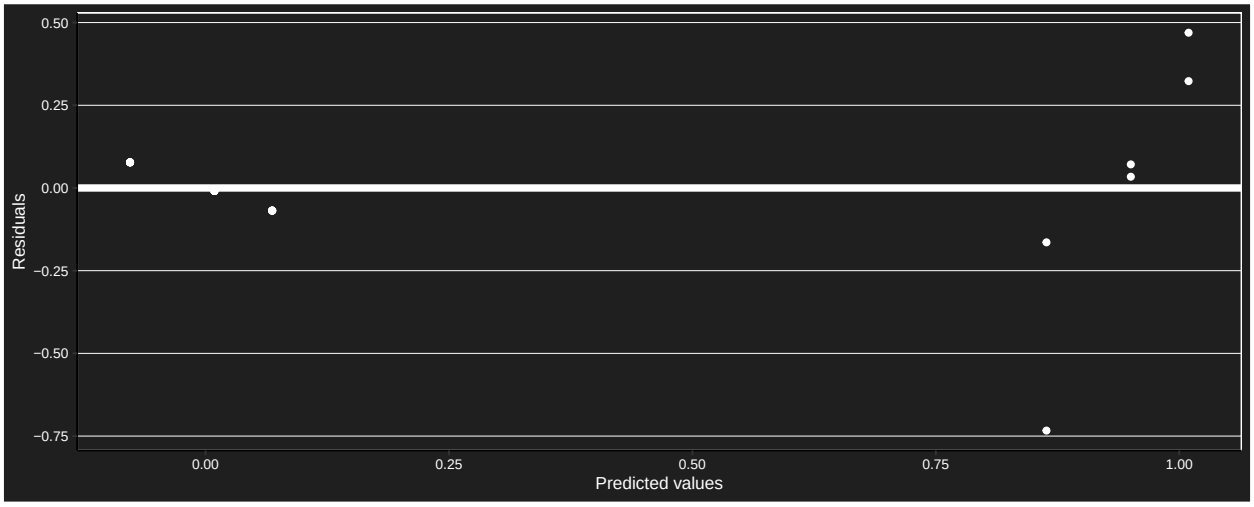


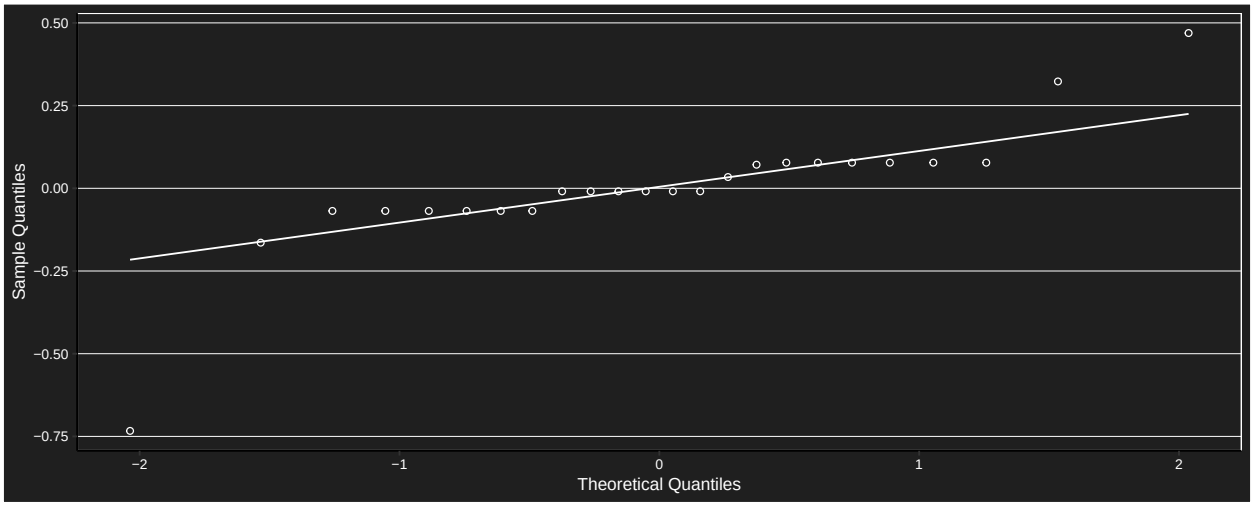
Ácido tartárico

Modelo y supuestos

```
## Linear mixed-effects model fit by REML
##   Data: tar
##   Log-restricted-likelihood: -3.096888
##   Fixed: CONS ~ MAD
##   (Intercept)         MADMM          MADM         MADSM
##  8.709897e-17 -1.263513e-16 -2.220446e-16  9.411357e-01
##
## Random effects:
##  Formula: ~1 | REP
##         (Intercept)  Residual
```

```
## StdDev:  0.09563016 0.2258815
##
## Number of Observations: 24
## Number of Groups: 3
```





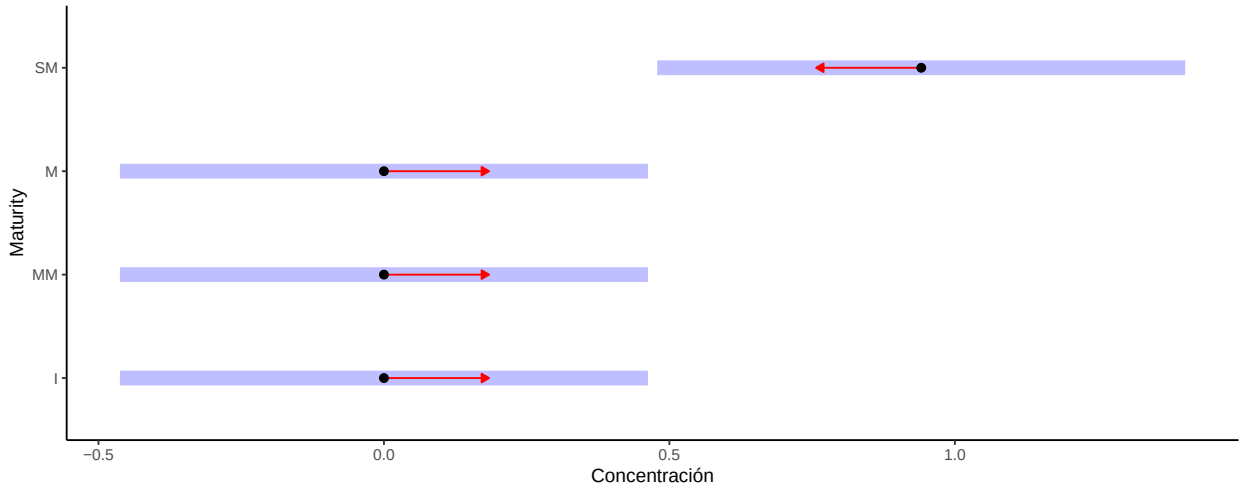

```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.75036, p-value = 5.041e-05
```

Anova

```
##             numDF denDF  F-value p-value
## (Intercept)     1    18 10.69872  0.0042
## MAD             3    18 26.03961  <.0001
```

Test de Tukey

```
## $emmeans
##  MAD    emmean        SE df   lower.CL  upper.CL
##  I   0.0000000 0.1074808  2 -0.4624524 0.4624524
##  MM  0.0000000 0.1074808  2 -0.4624524 0.4624524
##  M   0.0000000 0.1074808  2 -0.4624524 0.4624524
##  SM  0.9411357 0.1074808  2  0.4786832 1.4035881
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate        SE df t.ratio p.value
##  I - MM    0.0000000 0.1304127 18   0.000  1.0000
##  I - M     0.0000000 0.1304127 18   0.000  1.0000
##  I - SM   -0.9411357 0.1304127 18  -7.217  <.0001
##  MM - M    0.0000000 0.1304127 18   0.000  1.0000
##  MM - SM  -0.9411357 0.1304127 18  -7.217  <.0001
##  M - SM   -0.9411357 0.1304127 18  -7.217  <.0001
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```

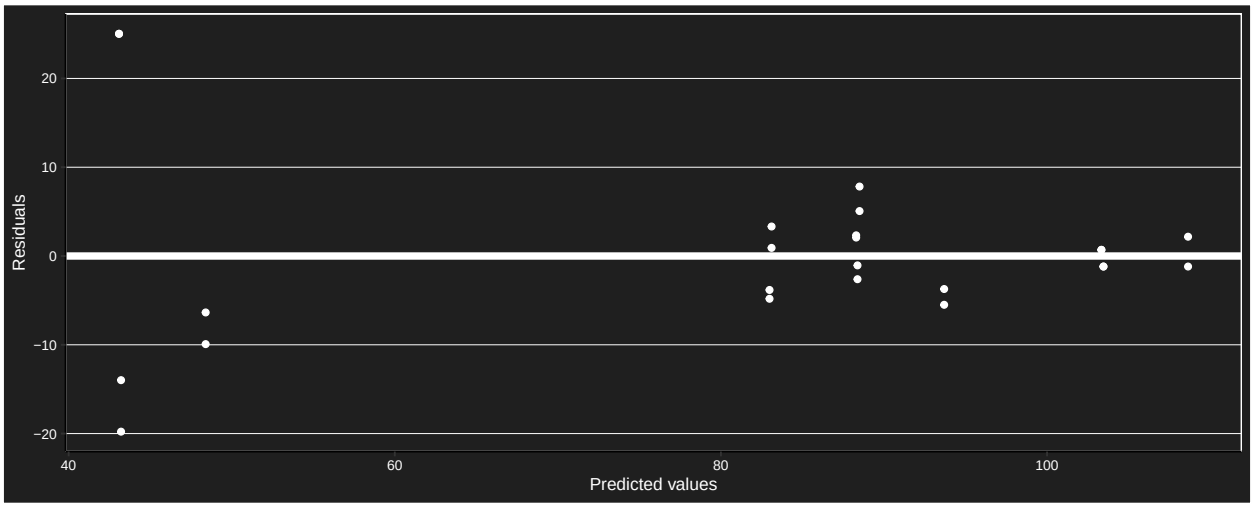


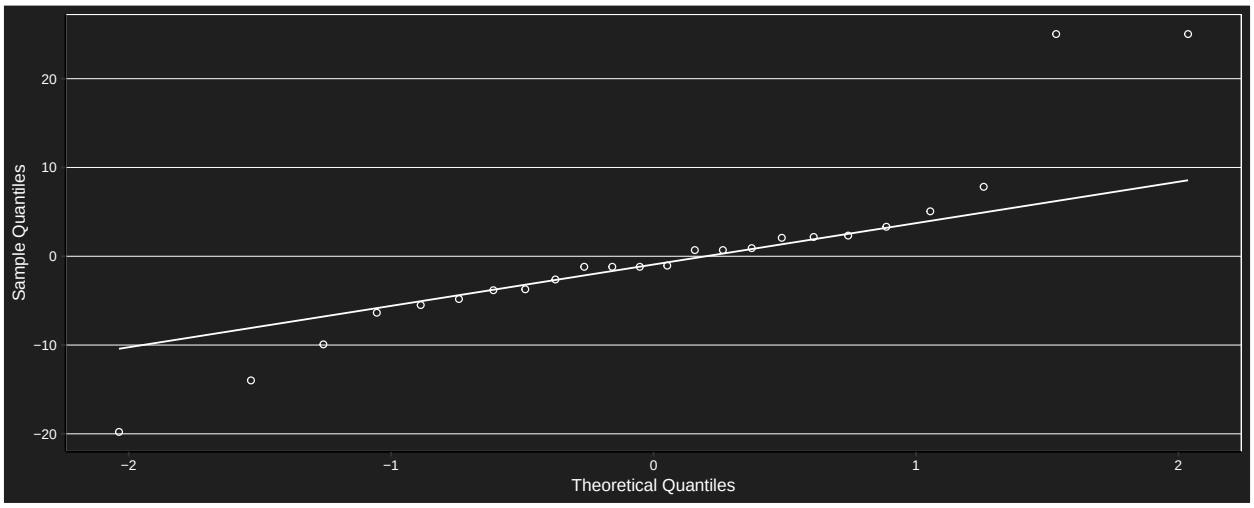
Ácido málico

Modelo y supuestos

```
## Linear mixed-effects model fit by REML
##   Data: mal
##   Log-restricted-likelihood: -66.5285
##   Fixed: CONS ~ MAD
## (Intercept)       MADMM        MADM       MADSM
##    44.90213    45.28740    60.24536    39.89247
##
## Random effects:
##  Formula: ~1 | REP
```

```
##         (Intercept) Residual
## StdDev:    3.184406 19.91438
##
## Variance function:
##  Structure: Different standard deviations per stratum
##  Formula: ~1 | MAD
##  Parameter estimates:
##         I         M        MM        SM
## 1.0000000 0.0829966 0.2681539 0.1785083
## Number of Observations: 24
## Number of Groups: 3
```





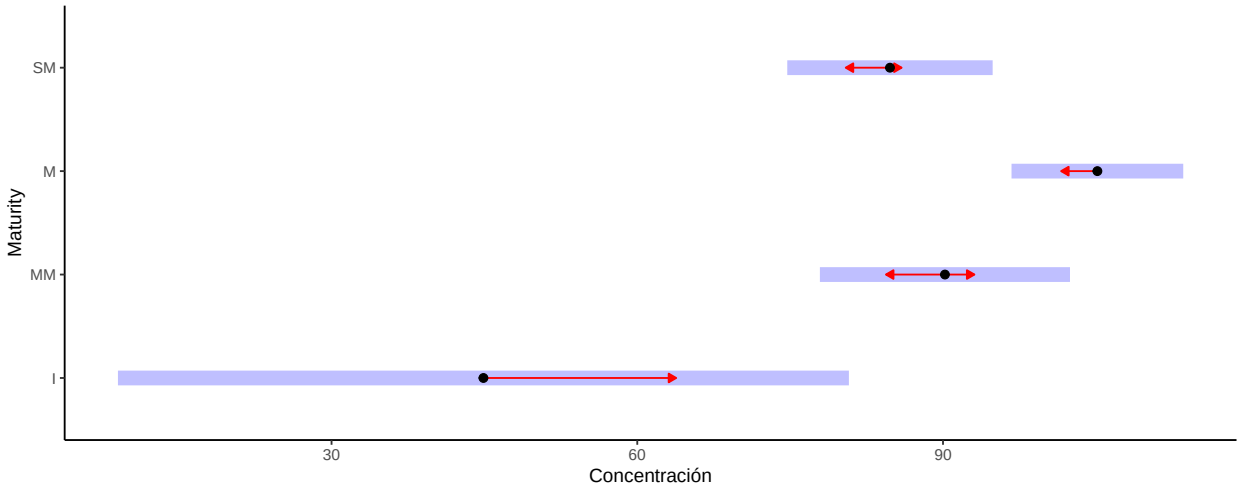

```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.87203, p-value = 0.005766
```

Anova

```
##             numDF denDF   F-value p-value
## (Intercept)     1    18 2706.3660  <.0001
## MAD             3    18   77.8867  <.0001
```

Test de Tukey

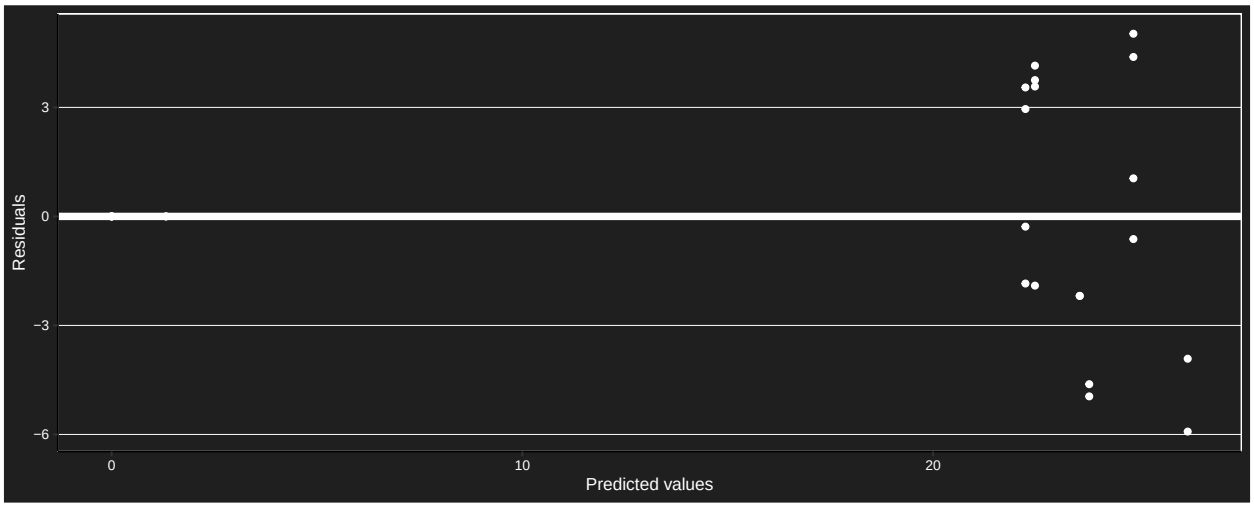
```
## $emmeans
##  MAD    emmean       SE df lower.CL  upper.CL
##  I    44.90213 8.335302  2  9.03822  80.76604
##  MM   90.18953 2.851834  2 77.91908 102.45998
##  M   105.14749 1.958431  2 96.72104 113.57394
##  SM   84.79460 2.342295  2 74.71652  94.87268
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast  estimate       SE df t.ratio p.value
##  I - MM   -45.28740 8.417240 18  -5.380  0.0002
##  I - M    -60.24536 8.157966 18  -7.385  <.0001
##  I - SM   -39.89247 8.258529 18  -4.830  0.0007
##  MM - M   -14.95796 2.282130 18  -6.554  <.0001
##  MM - SM    5.39493 2.618971 18   2.060  0.2038
##  M - SM    20.35289 1.600470 18  12.717  <.0001
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```

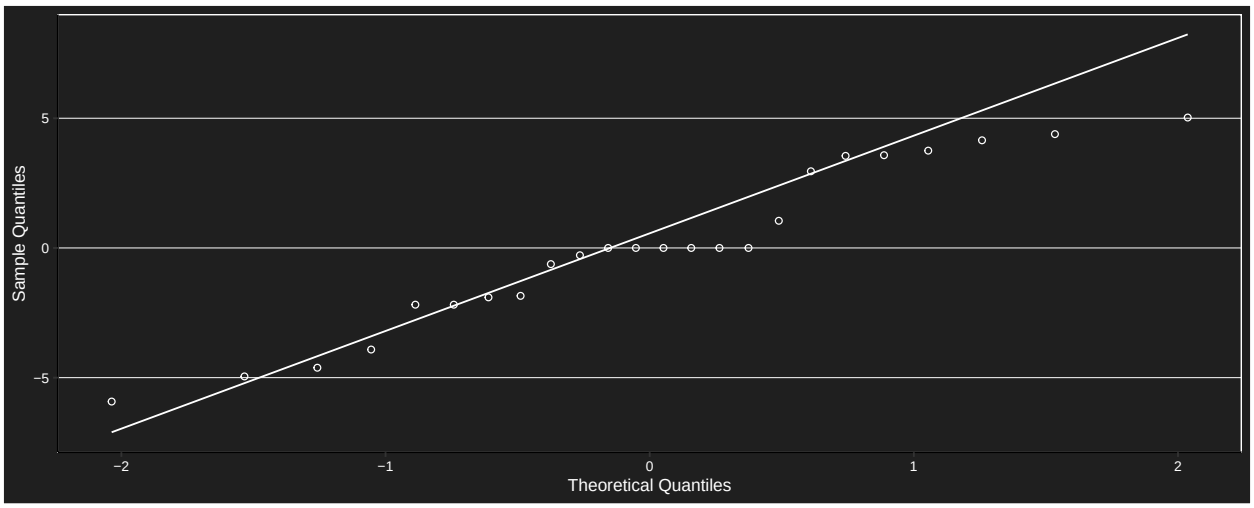


Ácido quínico

Modelo y supuestos

```
## Linear mixed-effects model fit by REML
##   Data: qui
##   Log-restricted-likelihood: 58.15489
##   Fixed: CONS ~ MAD
## (Intercept)       MADMM        MADM       MADSM
##   0.3746778  24.8769430  22.2481448  22.4797612
##
## Random effects:
##  Formula: ~1 | REP
##         (Intercept)     Residual
## StdDev:   0.6710272 1.179409e-16
##
## Variance function:
##  Structure: Different standard deviations per stratum
##  Formula: ~1 | MAD
##  Parameter estimates:
##            I            M           MM           SM
## 1.000000e+00 2.223316e+16 3.723258e+16 3.666682e+16
## Number of Observations: 24
## Number of Groups: 3
```





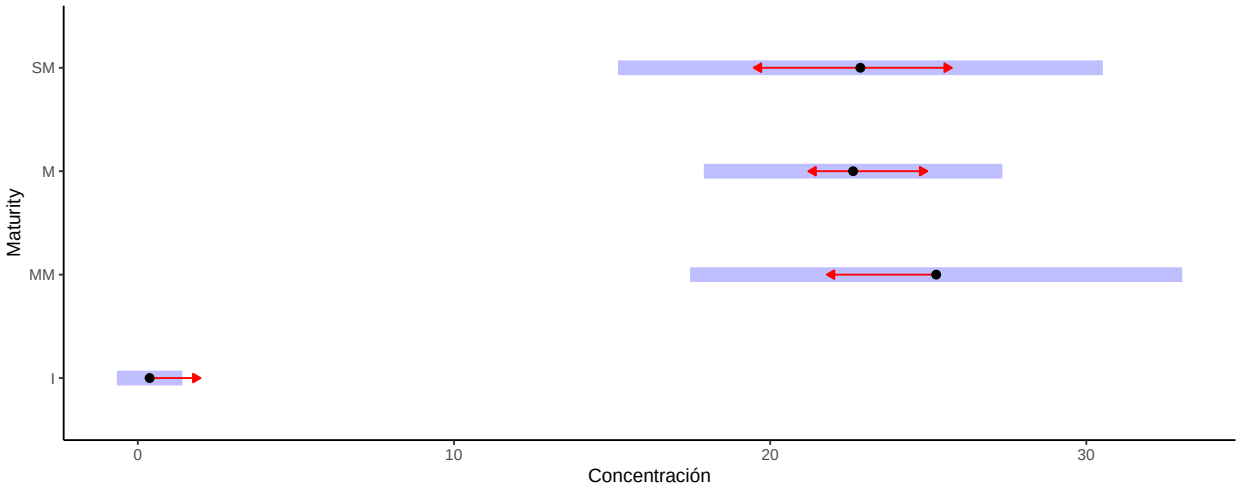

```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.94578, p-value = 0.2191
```

Anova

```
##             numDF denDF   F-value p-value
## (Intercept)     1    18   2.42807  0.1366
## MAD             3    18 262.20498  <.0001
```

Test de Tukey

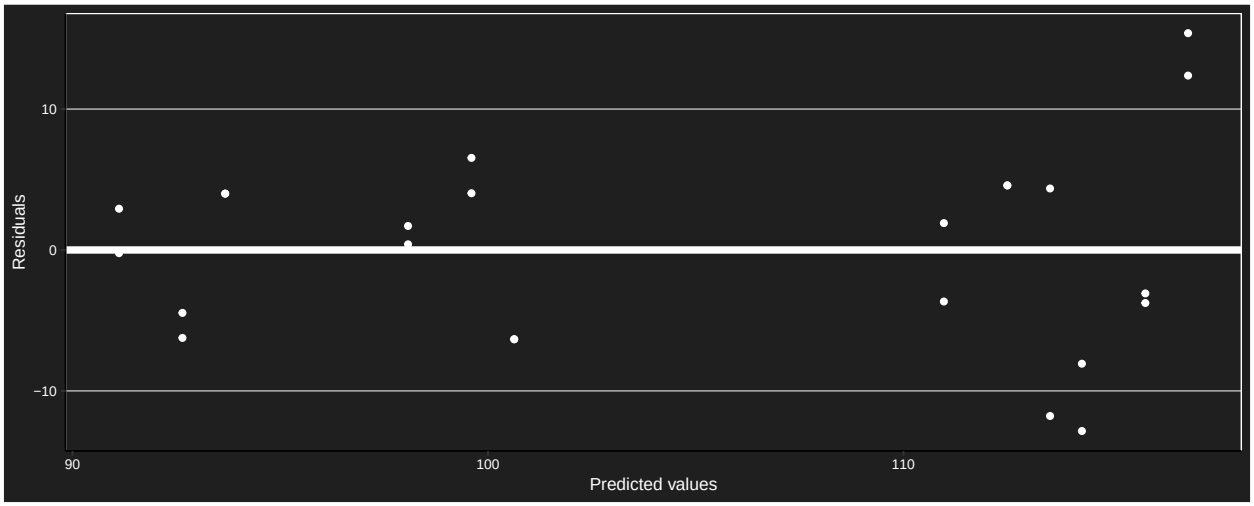
```
## $emmeans
##  MAD    emmean        SE df  lower.CL upper.CL
##  I    0.374678 0.2404514  2 -0.659901  1.40926
##  MM  25.251621 1.8087710  2 17.469107 33.03413
##  M   22.622823 1.0971801  2 17.902038 27.34361
##  SM  22.854439 1.7817756  2 15.188077 30.52080
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate       SE df t.ratio p.value
##  I - MM   -24.876943 1.792717 18 -13.877  <.0001
##  I - M    -22.248145 1.070508 18 -20.783  <.0001
##  I - SM   -22.479761 1.765476 18 -12.733  <.0001
##  MM - M     2.628798 2.088019 18   1.259  0.5992
##  MM - SM    2.397182 2.516097 18   0.953  0.7772
##  M - SM    -0.231616 2.064678 18  -0.112  0.9995
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```

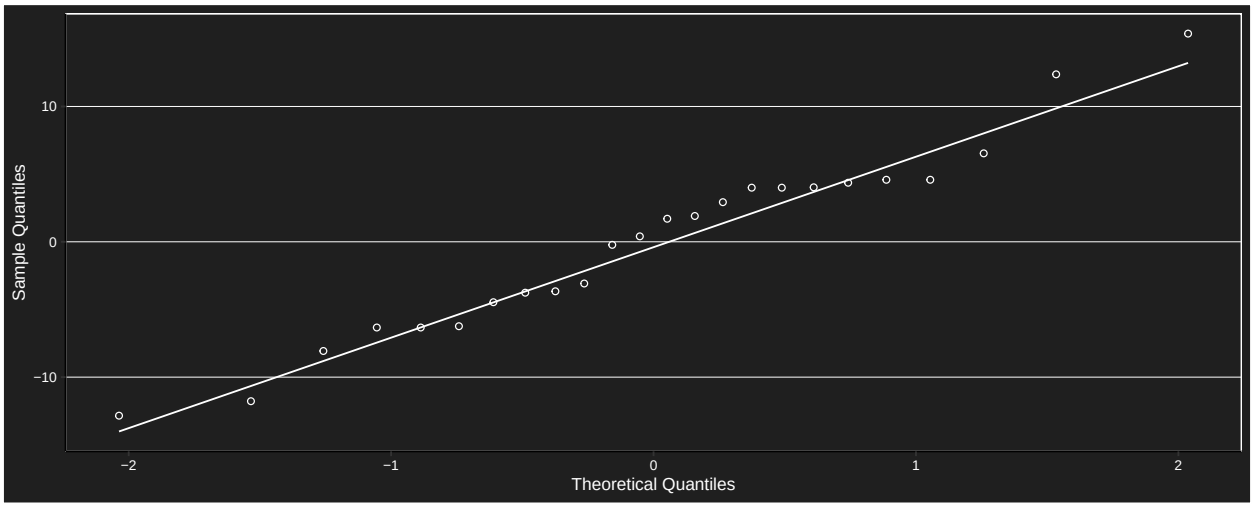


Ácido succinico

Modelo y supuestos

```
## Linear mixed-effects model fit by REML
##   Data: suc
##   Log-restricted-likelihood: -72.91629
##   Fixed: CONS ~ MAD
## (Intercept)       MADMM        MADM       MADSM
##  112.333486  -19.851894  -12.896247    3.321665
##
## Random effects:
##  Formula: ~1 | REP
##         (Intercept) Residual
## StdDev:    2.089065 7.567785
##
## Number of Observations: 24
## Number of Groups: 3
```






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.96753, p-value = 0.6065
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##       Df F value Pr(>F)
## group  3  1.4818 0.2497
##       20
```

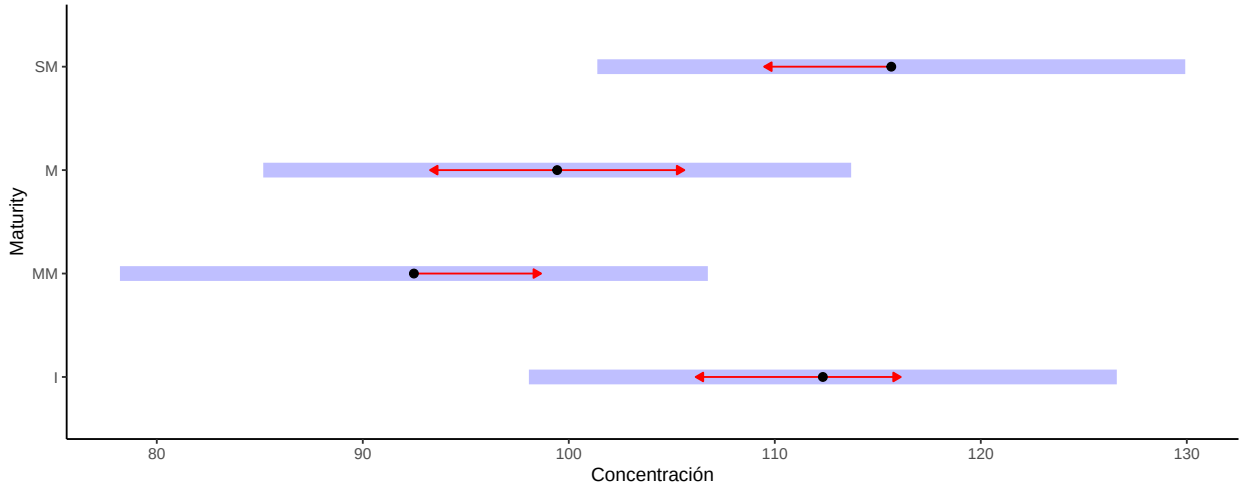
Anova

```
##             numDF denDF   F-value p-value
## (Intercept)     1    18 2869.0535  <.0001
## MAD             3    18   12.3959   1e-04
```

Test de Tukey

```
## $emmeans
##  MAD    emmean       SE df  lower.CL upper.CL
##  I   112.33349 3.316619  2  98.06323 126.6037
##  MM   92.48159 3.316619  2  78.21133 106.7519
##  M    99.43724 3.316619  2  85.16698 113.7075
##  SM  115.65515 3.316619  2 101.38489 129.9254
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate       SE df t.ratio p.value
##  I - MM    19.851894 4.369263 18   4.544  0.0013
##  I - M     12.896247 4.369263 18   2.952  0.0389
##  I - SM    -3.321665 4.369263 18  -0.760  0.8711
##  MM - M    -6.955647 4.369263 18  -1.592  0.4076
```

```
##  MM - SM  -23.173559 4.369263 18  -5.304  0.0003
##  M - SM   -16.217912 4.369263 18  -3.712  0.0079
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```



Relación de ácidos orgánicos y acidez total titulable ATT.

```
##          CAR MAD N        CONS          sd          se          ci
## 1  Tartárico   I 6   0.0000000  0.00000000  0.00000000  0.00000000
## 2  Tartárico  MM 6   0.0000000  0.00000000  0.00000000  0.00000000
## 3  Tartárico   M 6   0.0000000  0.00000000  0.00000000  0.00000000
## 4  Tartárico  SM 6   0.9411357  0.48306748  0.19721147  0.50694823
## 5     Málico   I 6  44.9021340 19.15238481  7.81892835 20.09919520
## 6     Málico  MM 6  90.1895317  4.02201511  1.64198079  4.22084600
## 7     Málico   M 6 105.1474897  3.36357515  1.37317381  3.52985564
## 8     Málico  SM 6  84.7945992  5.36803324  2.19149040  5.63340540
## 9    Quínico   I 6   0.4406633  0.68267270  0.27869996  0.71642106
## 10   Quínico  MM 6  25.3176063  3.81400139  1.55705955  4.00254899
## 11   Quínico   M 6  22.6888082  2.24262162  0.91554644  2.35348706
## 12   Quínico  SM 6  22.9204245  3.75680532  1.53370935  3.94252539
## 13 Succínico   I 6 112.3334865  6.53452657  2.66770930  6.85756508
## 14 Succínico  MM 6  92.4815923  4.78050904  1.95163464  5.01683657
## 15 Succínico   M 6  99.4372398  4.82401388  1.96939542  5.06249209
## 16 Succínico  SM 6 115.6551513 12.41879308  5.06995105 13.03272407
## 17       ATT   I 3   1.7792000  0.05079843  0.02932848  0.12619028
## 18       ATT  MM 3   1.6064000  0.02789695  0.01610631  0.06929987
## 19       ATT   M 3   1.8282667  0.20390638  0.11772541  0.50653154
## 20       ATT  SM 3   1.3845333  0.08352756  0.04822466  0.20749396
## 21   TOTALac   I 6 157.6762838 24.41479565  9.96729859 25.62175670
## 22   TOTALac  MM 6 207.9887303 11.65695743  4.75893294 12.23322658
## 23   TOTALac   M 6 227.2735377  4.28462553  1.74919105  4.49643873
## 24   TOTALac  SM 6 224.3113107 13.98740598  5.71033458 14.67888234
## 25      <NA>   I 6 266.8807917  8.48194315  3.46273879  8.90125343
## 26      <NA>  MM 6 301.6803547 34.61672247 14.13221777 36.32802229
```

```
## 27      <NA>   M 6 350.6257562 31.18238676 12.73015609 32.72390800
## 28      <NA>  SM 6 428.3680832 26.75277911 10.92177634 28.07531986
## 29     ACIDS   I 6 157.6762838 24.41479565  9.96729859 25.62175670
## 30     ACIDS  MM 6 207.9887302 11.65695733  4.75893290 12.23322648
## 31     ACIDS   M 6 227.2735378  4.28462561  1.74919108  4.49643882
## 32     ACIDS  SM 6 224.3113107 13.98740581  5.71033451 14.67888217
```

Concentración del ratio azúcares totales / ácidos orgánicos totales a distintos estados.

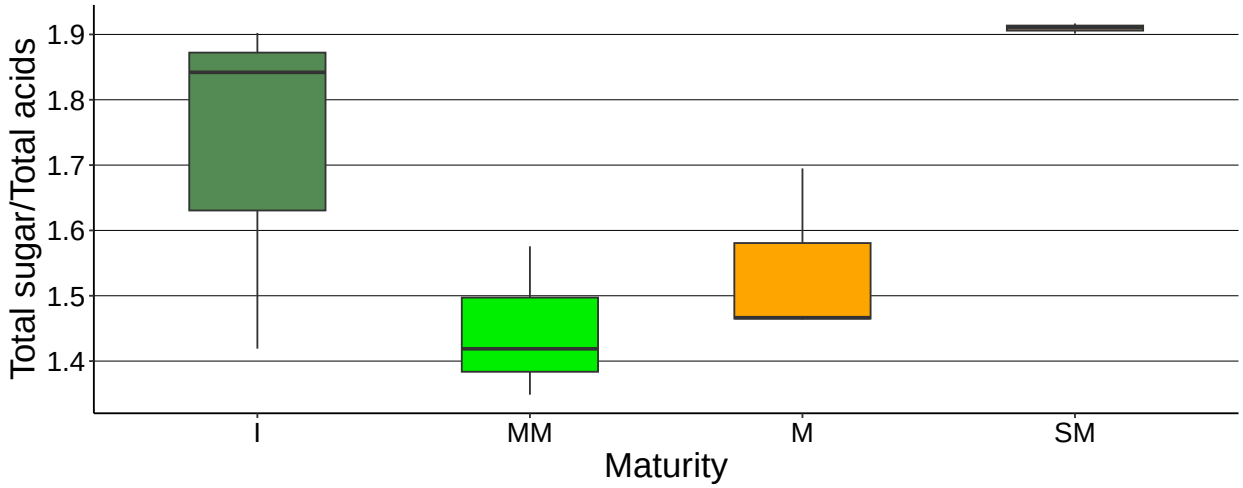
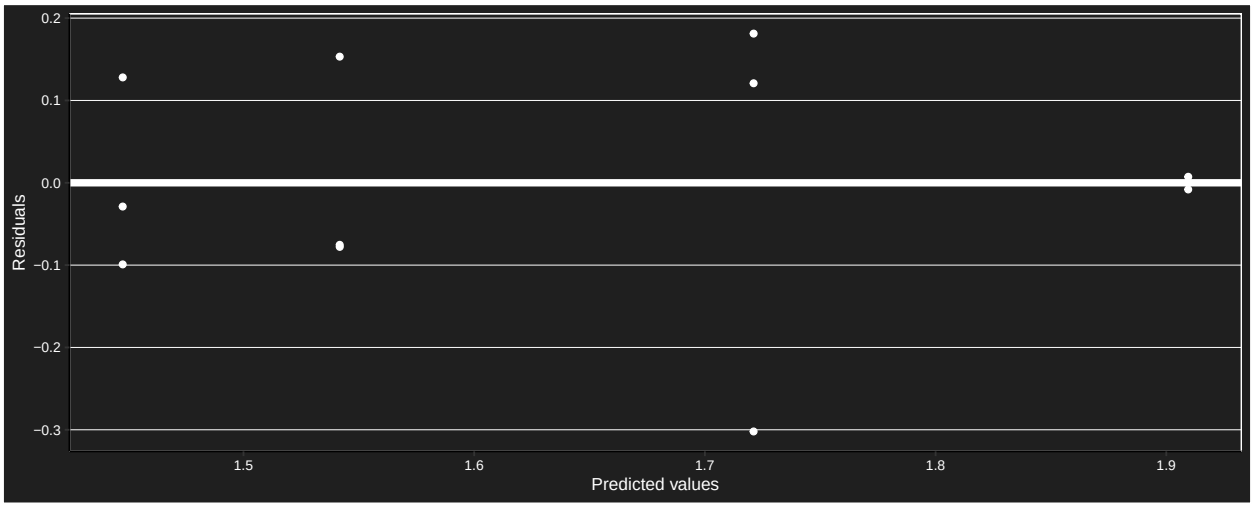


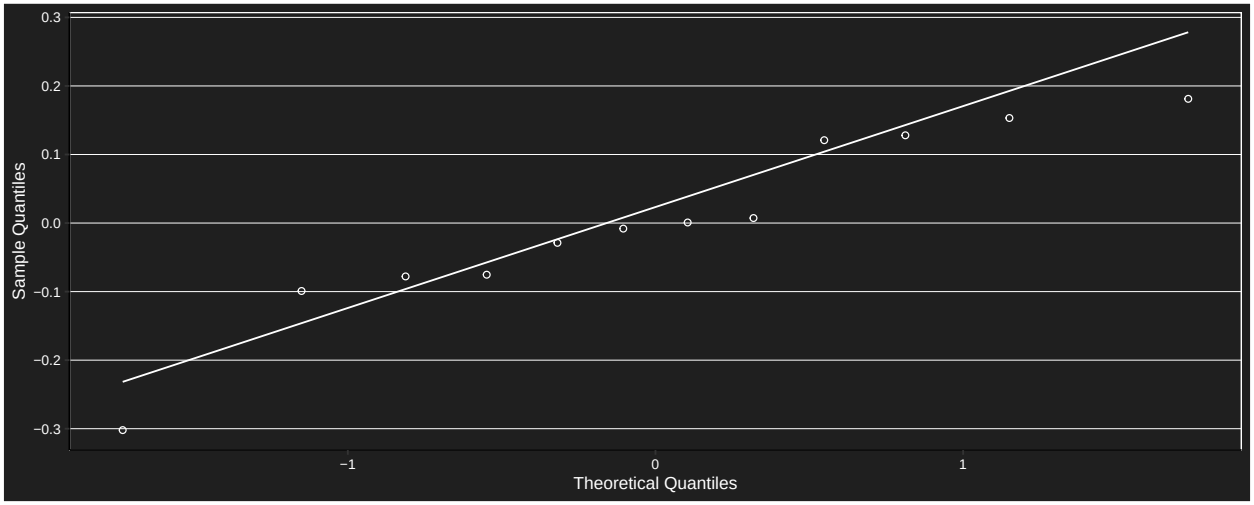
Tabla descriptiva totales

```
##   MAD N   TOTALS          sd          se         ci
## 1   I 3 1.721122 0.263331773 0.152034670 0.65415239
## 2  MM 3 1.447652 0.116290919 0.067140593 0.28888266
## 3   M 3 1.541716 0.132691300 0.076609358 0.32962346
## 4  SM 3 1.909504 0.007733369 0.004464862 0.01921075
```

Relación ST/AT (azúcares totales / ácidos totales)

```
## Linear mixed-effects model fit by REML
##   Data: dataSTAT
##   Log-restricted-likelihood: 1.185396
##   Fixed: TOTALS ~ MAD
## (Intercept)       MADMM        MADM       MADSM
##   1.7211225  -0.2734708  -0.1794066   0.1883818
##
## Random effects:
##  Formula: ~1 | REP
##          (Intercept) Residual
## StdDev: 0.0009997037 0.158534
##
## Number of Observations: 12
## Number of Groups: 3
```






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.92623, p-value = 0.3418
```

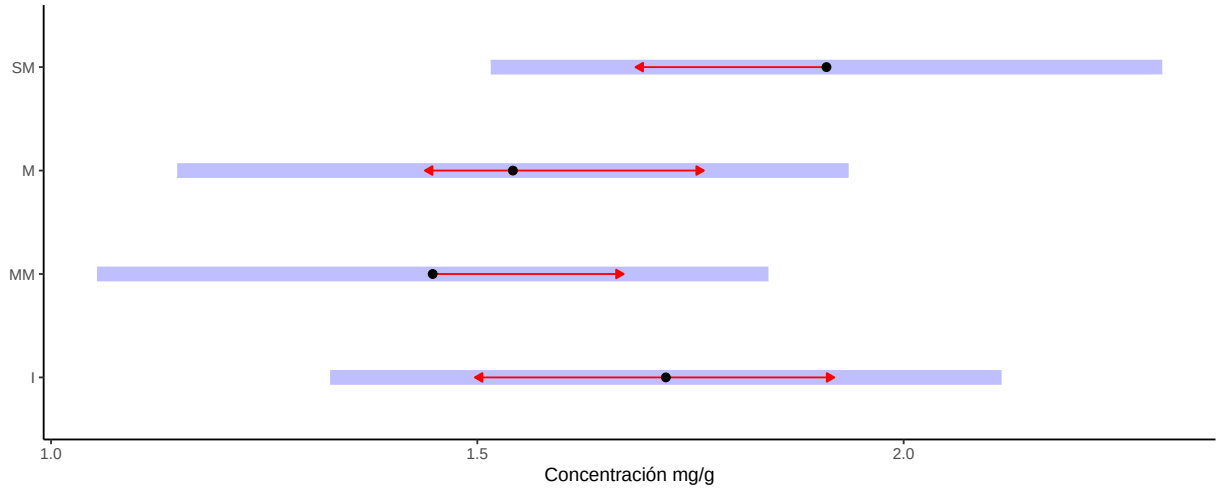
Anova

```
##             numDF denDF   F-value p-value
## (Intercept)     1     6 1307.5624  <.0001
## MAD             3     6    4.9724  0.0457
```

Test de Tukey

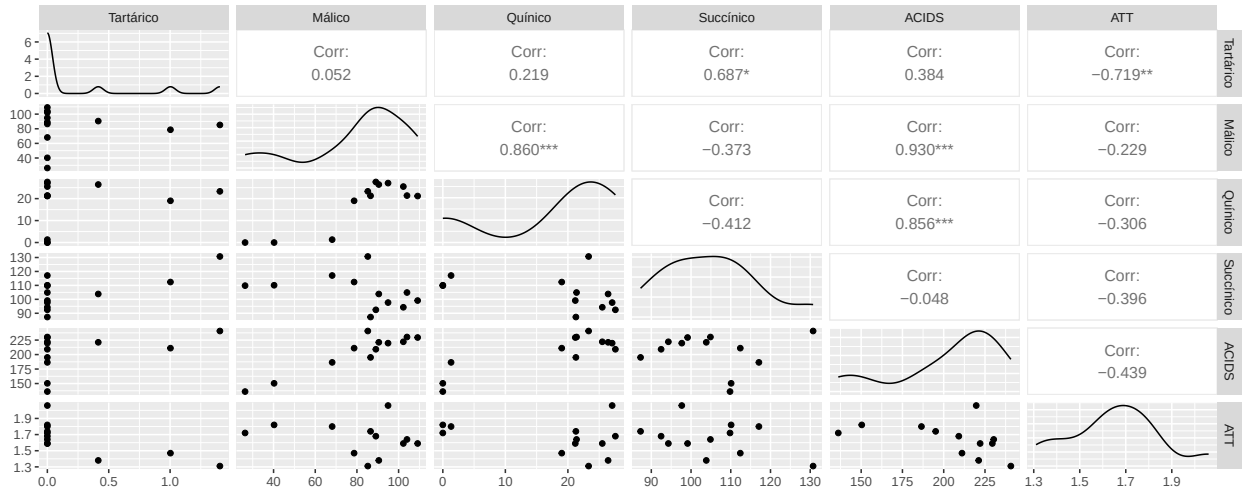
```
## $emmeans
##  MAD   emmean         SE df lower.CL upper.CL
##  I   1.721123 0.09153149  2 1.327294 2.114951
```

```
##  MM  1.447652 0.09153149  2 1.053824 1.841480
##  M   1.541716 0.09153149  2 1.147888 1.935544
##  SM  1.909504 0.09153149  2 1.515676 2.303332
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate        SE df t.ratio p.value
##  I - MM    0.2734708 0.1294425  6   2.113  0.2498
##  I - M     0.1794066 0.1294425  6   1.386  0.5497
##  I - SM   -0.1883818 0.1294425  6  -1.455  0.5142
##  MM - M   -0.0940642 0.1294425  6  -0.727  0.8831
##  MM - SM  -0.4618526 0.1294425  6  -3.568  0.0443
##  M - SM   -0.3677884 0.1294425  6  -2.841  0.1041
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
```



Correlaciones

Correlaciones de Pearson.




```
##
##  Pearson's product-moment correlation
##
## data:  FACO$Málico and FACO$Quínico
## t = 5.3299, df = 10, p-value = 0.000333
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.5649710 0.9600656
## sample estimates:
##       cor
## 0.8600213
```

```
##
##  Pearson's product-moment correlation
##
## data:  FACO$Tartárico and FACO$Succínico
## t = 2.9895, df = 10, p-value = 0.01358
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.1866812 0.9043389
## sample estimates:
##       cor
## 0.6869819
```

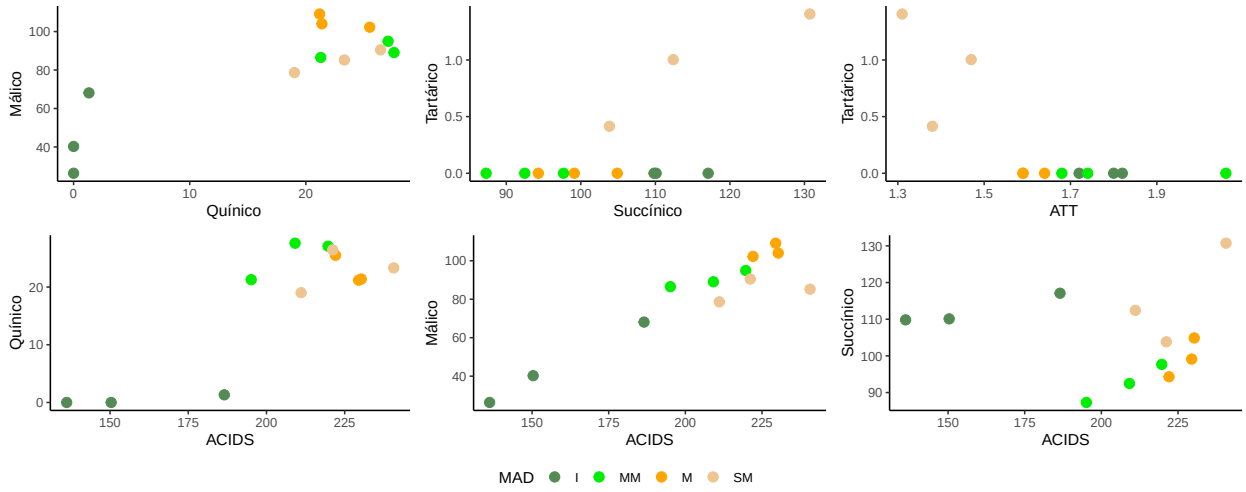
```
##
##  Pearson's product-moment correlation
##
## data:  FACO$ATT and FACO$Tartárico
## t = -3.2686, df = 10, p-value = 0.00845
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.9151410 -0.2464551
## sample estimates:
##        cor
## -0.7187027
```

```
##
```

```
##  Pearson's product-moment correlation
##
## data:  FACO$ACIDS and FACO$Quínico
## t = 5.2307, df = 10, p-value = 0.0003839
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.5539018 0.9587847
## sample estimates:
##       cor
## 0.8557676
```

```
##
##  Pearson's product-moment correlation
##
## data:  FACO$ACIDS and FACO$Málico
## t = 8.0069, df = 10, p-value = 1.169e-05
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.7639902 0.9805782
## sample estimates:
##       cor
## 0.9300893
```

Gráficos de correlación detallados por estado.



- Correlaciones: Se evidenciaron relaciones lineales entre los ácidos orgánicos, entre el ácido málico y el ácido quínico con un coeficiente de correlación (r) de 0.8600213 y un valor de p=0.000333, y entre el ácido tartárico y el ácido succínico con un r=0.6869819 y un p-valor=0.01358. La acidez titulable total (TTA) mostró una asociación lineal significativa únicamente con el ácido tartárico, con un r=-0.7187027 y un p-valor=0.00845. Sin embargo, esta asociación inversa está vinculada al hecho de que el ácido tartárico solo aparece en cantidades mínimas en frutas muy maduras. La concentración total de ácidos con ácido quínico presentó una correlación de 0.8557676 con un p-valor=0.0003839. Mientras tanto, el ácido málico mostró un r=0.9300893 y un p-valor=1.169e-05. En ambos casos, estos ácidos explican el aumento en la concentración total de ácidos a lo largo del proceso de maduración de la fruta.