BDA HM10

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March 2025

16.1

The data consists of preference indices $\in [-1, 1]$ in two groups. The index is modeled as a Student t distributed random variable, with mean distributed normally and scale distributed uniformly, separately for the two groups. In Figure 1 we show posterior estimates of the parameters, their differences, effect size and posterior predictive check on the data. Difference of means show that 99.5% of posterior credible values are such that $\mu_2 > \mu_1$. The HDI does not touch the ROPE $[-0.05, 0.05]$. Difference of scales shows no evidence for variation in scale between the two groups. Lastly, effect size's HDI is completely above the ROPE $[-0.2, 0.2]$, proving small effect size at least.

Instead of the preference index, now we study the total amount of food consumed, using the same model. Figure 2 shows results. HDI's of posterior distributions for difference of means, difference of scales and effect size are too broad to accept the null hypothesis of zero differences. More data should be collected. However, we surely wouldn't reject the null in favor of some effect.

16.2

We read the data and set the ROPEs as follows:

```
myDataFrame = read.csv( file="RatLives.csv" )
xName="Group"
yName="DaysLive"
fileNameRoot = "Figures/FliesAndRats/RatLives-"
RopeMuDiff=c(-100,100) ; RopeSdDiff=c(-10,10) ; RopeEff=c(-1,1)
```

Results are shown in Figure 3. Groups definitely differ in terms of central tendency and scale, and we observe a very large effect size. The normality parameter is quite small, signaling that outliers are present in the data and a fat tailed distribution best fits them. Posterior predictive checks confirm the goodness of fit.

Such outliers are mostly low values, i.e., rats dying young. In order to correct for the left-skewness of the distribution, we square the values as follows:

```
myDataFrame = read.csv( file="RatLives.csv" )
xName="Group"
myDataFrame = cbind( myDataFrame , DaysLiveSq = myDataFrame$DaysLive^2 )
yName="DaysLiveSq"
fileNameRoot = "Figures/FliesAndRats/RatLives-DaySq-"
RopeMuDiff=c(-100000,100000) ; RopeSdDiff=c(-100000,100000) ; RopeEff=c(-1,1)
```

Figure 4 shows that the resulting posteriors are more symmetrical, and have a higher normality ν. Difference of means and scale remain significant, and we confirm a very large effect size (¿1 at least), even though slightly reduced if compared to the previous analysis. This is likely due to the tradeoff between scale and normality: considering squared years, the estimated normality is higher and the scale is higher as well. This slightly reduces the effect size.

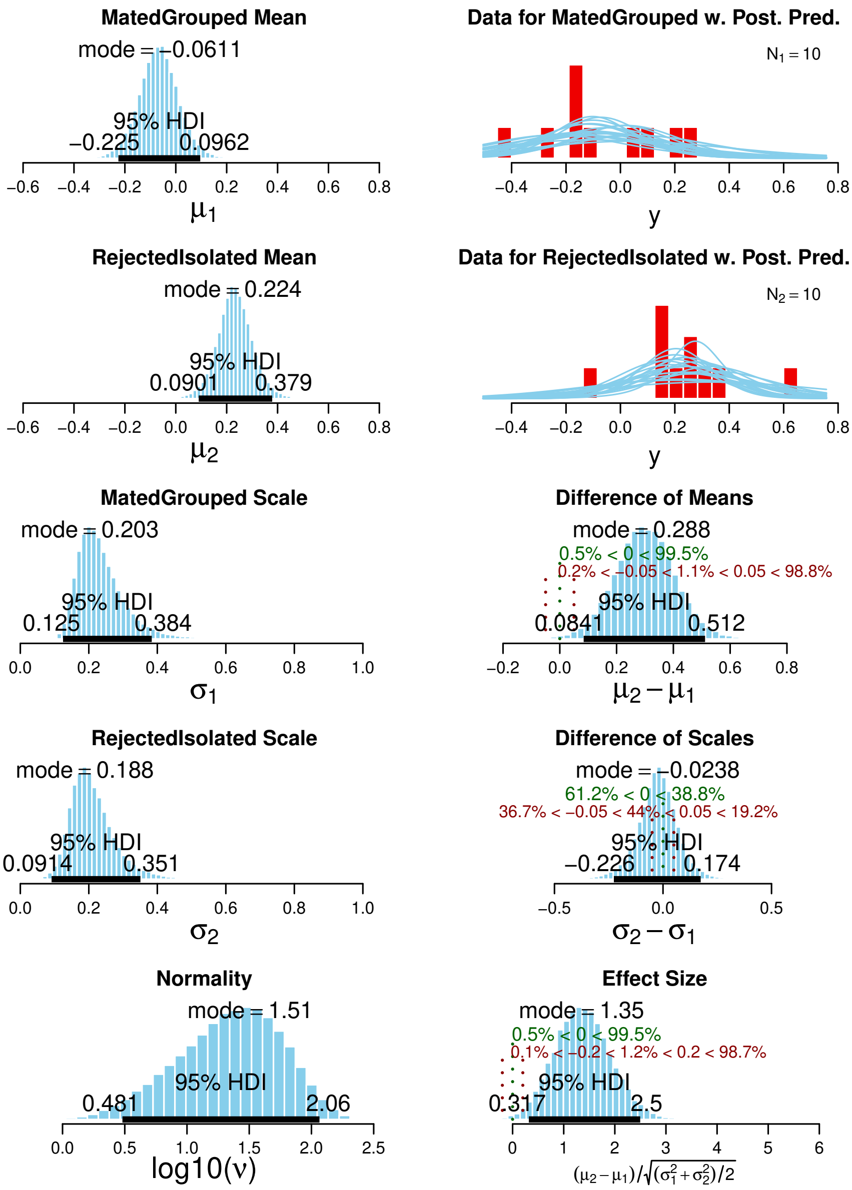

Figure 1: Exercise 16.1 A.

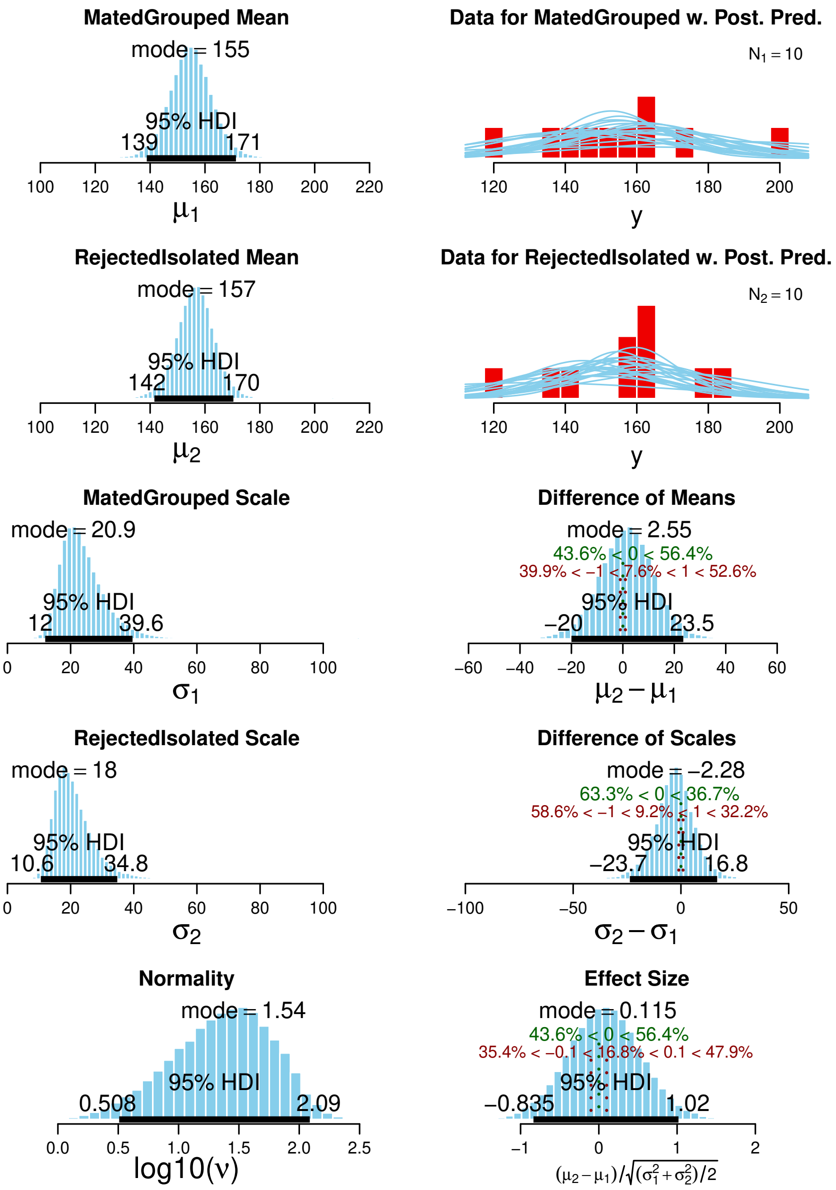

Figure 2: Exercise 16.1 B.

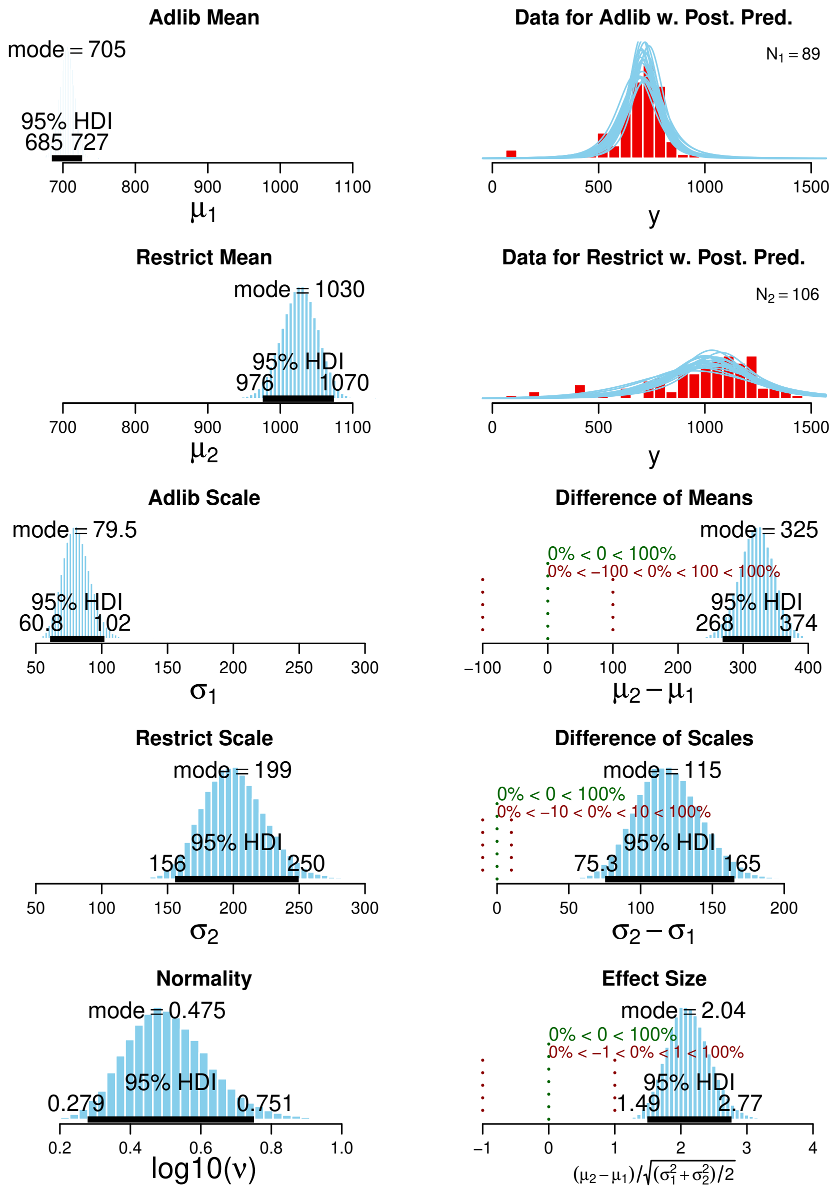

Figure 3: Exercise 16.2 A.

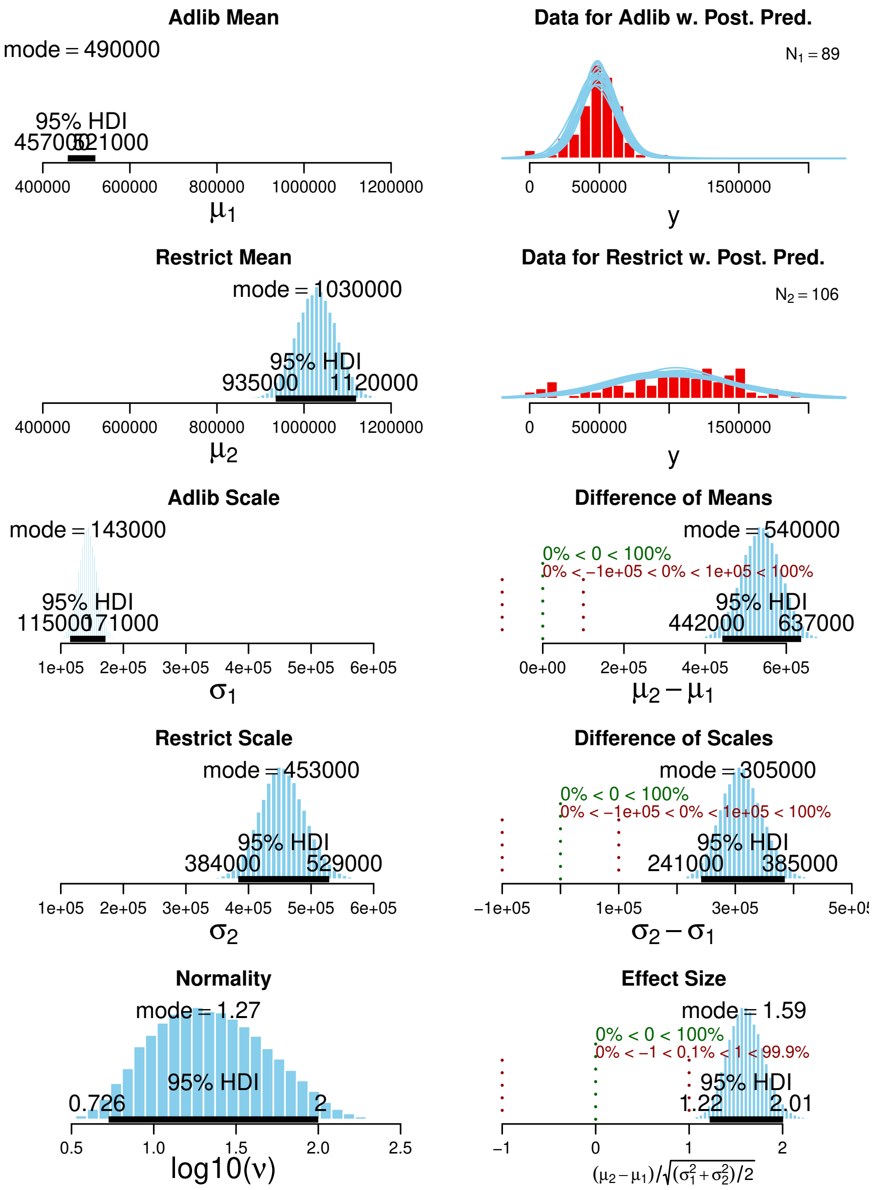

Figure 4: Exercise 16.2 B.