

Applied Statistical Methods - Exercise 6

Peter von Rohr

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Problem 1: Experiment Evaluation

In the paper by (Manzocchi et al. 2020) 4 different feeding treatments for dairy cows were compared. The different feeding treatments consisted of

Treatment	Feed
1	hay
2	grass-silage
3	maize silage
4	shredlage

From the results section of the paper, the values for energy corrected milk (ECM in kg/day) and coagulation time (CGT in min) of the milk are shown in the table below.

Treatment	ECM	CGT
1	24.3	11.0
2	23.6	10.6
3	25.0	10.5
4	23.8	10.3

The standard errors of the means (SEM) for the above reported target variables were

Response	SEM
ECM	1.18
CGT	0.60

The real experiment is designed according to an incomplete latin square where in two runs groups of six cows were assigned to each of the four treatments. For the purpose of this exercise, we simplify the experimental design and assume that groups of 6 cows were assigned to the treatments all at the same time. The paper mentions that besides of the treatment numerous fixed effects (experimental run and interactions between treatments and experimental runs) and covariates (lactation stage) were considered. But unfortunately, no estimates for the different effects were given. Hence we are assuming that the treatment is the major effect on our responses.

Your Tasks

- Simulate a dataset with 6 cows per treatment and assign to each of the cows a value for the two responses ECM and CGT with mean values shown in the table above and with standard deviation equal to the SEM values.

- Analyse the dataset with a fixed linear effect model
- Verify whether you can reproduce the results of the paper
- Think about what type of contrasts are ideal for this type of dataset.

Problem 2: Significance and Size of Dataset

For some of the LM-analyses done in Problem 1, the results might not be significant. The same was also true in the paper. Their reported results were also declared to be non-significant. This might have two reasons.

1. Either the generated dataset is just a “bad” example due to the unfortunate random numbers that were drawn or
2. The size of the dataset is too small.

Check both reasons by implementing the following tasks

Your Tasks

- Repeat the simulation 30 times and check how many times a significant effect of one of the treatments can be reported.
- Increase the size of the dataset until one of the treatment effect is significant.

References

Manzocchi, Elisa, Werner Hengartner, Michael Kreuzer, and Katrin Giller. 2020. “Effect of feeding hay vs. silages of various types to dairy cows on feed intake, milk composition and coagulation properties.” *Journal of Dairy Research* 87 (3): 334–40. <https://doi.org/10.1017/S0022029920000801>.