An Investigation into the Impact of a Stress Treatment on the Abundance of the Euryarchaeota Microbe in Cattle

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Introduction

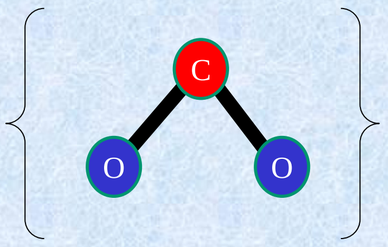
Climate Change

- In recent months there has been a global surge in protests demanding action on climate change.
- One-third of all Irish greenhouse gas emissions in 2017 were due to agriculture and in particular cattle farming.
- Cattle contribute to global warming through the production of methane by the Euryarchaeota microbe present within their digestive systems.
- Methane has a global warming potential of approximately 30. This means that 1 Kg of Methane emitted into our atmosphere is equivalent to the emission of 30 Kg of Carbon Dioxide.

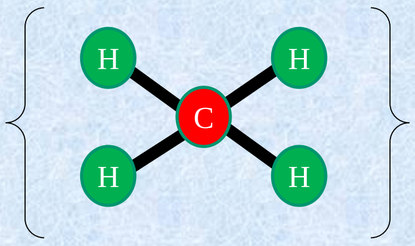
Objectives

- The aim of this project was to investigate whether the use of a stress treatment impacted the Euryarchaeota microbe's abundance.
- Potential factors including the diet of the cattle and the residual feed intake observed were analysed for their impact on the relative abundance on the microbe.

Carbon Dioxide



Methane



C Carbon O Oxygen H Hydrogen

Table 1:Cattle Frequency Per Treatment & Diet

	Control	Treatment	Total
Concentrated Feed	7	12	19
Forage	8	11	19
Total	15	23	38

Background

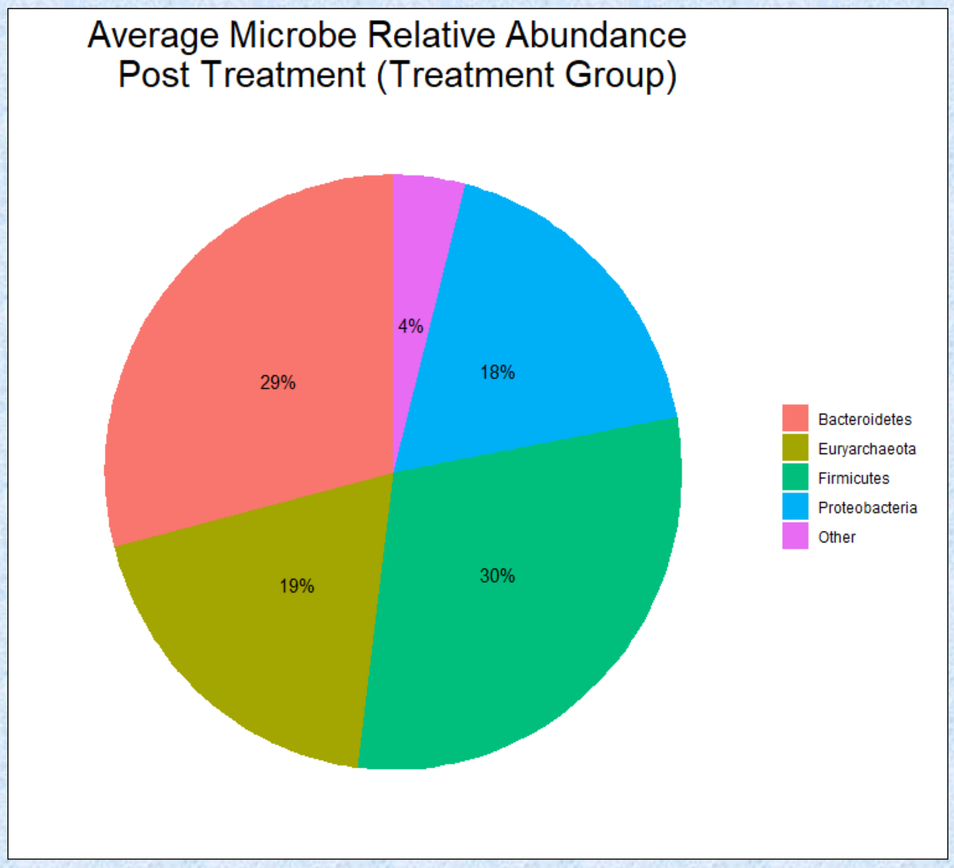
- The Treatment group was injected with the stress treatment 3 times. 3 Samples were taken from all cattle at the same time: prior to first injection, at the time of the 3rd injection and a post treatment sample.
- As can be seen in Table 1, with the Treatment and Control groups the cattle were approximately evenly split between the two diet factors: Concentrated Feed & Foraging.

Data Preparation

- The dataset contained sampling recordings for in excess of 20 microbes and other substances in the form of relative abundancies.
- As many of these features had a relatively low abundance, the exploratory analysis focused on the 6 largest microbes in terms of relative abundance.
- A number of observations were removed due to the following:
  - One animal fell ill during the study and required treatment.
  - Due to an incorrect sampling technique, this observation was removed.

Methodology

- As the data provided was in terms of relative abundancies for each of the microbes detected, analysis of the data was primarily in the form of T-tests and ANCOVA modelling.
- For the independent samples T-test to be conducted the assumptions of normality and equal variances must hold. These assumptions were verified using the Shapiro – Wilk Normality Test and F-Tests.
- During the ANCOVA model building stage, the Euryarchaeota microbe relative abundance was used as the dependent variable with variables accounting for sampling round, diet and residual feed intake included in the model.



Conclusions

Stress Treatment

- The analysis conducted did not find any statistically significant impact on the relative abundance of the Euryarchaeota microbe as a result of the stress treatment

Diet

- The diet of cattle was found to have a significant impact on the relative abundance of the Euryarchaeota microbe with a primarily concentrated feed diet found to lower the microbe's relative abundance.

Residual Feed Intake

- Cattle with a lower residual feed intake classification were found to have a slight decrease in their Euryarchaeota microbe relative abundance.