Fatty Acids and the Innate Immune System: A Study Infecting *Caenorhabditis elegans* with *Pseudomonas aeruginosa*

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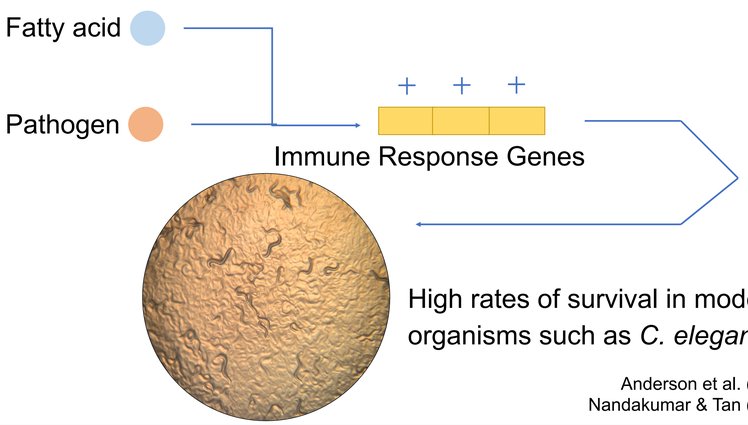
What did I study?

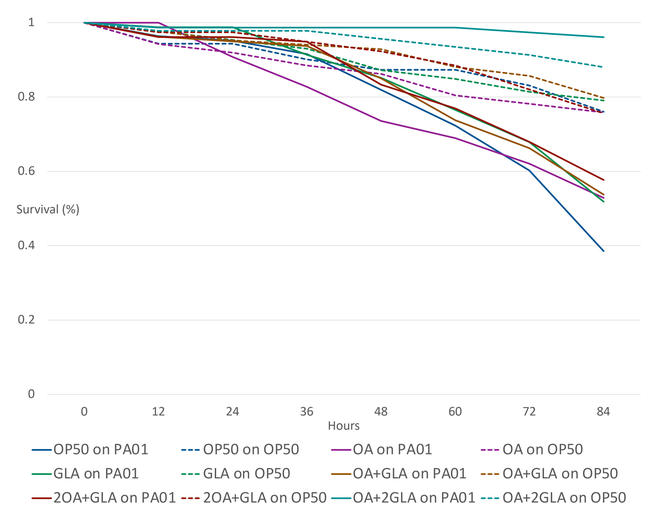
- Fatty acids are an important part of our diet and have been studied as mediators of the innate immune system
- The innate immune system provides immediate responses to potential pathogens and is highly active in the gut
- Certain fatty acids have been shown to increase the activation of immune response genes and increase survival to infection



Anderson et al. (2019)
Nandakumar & Tan (2008)

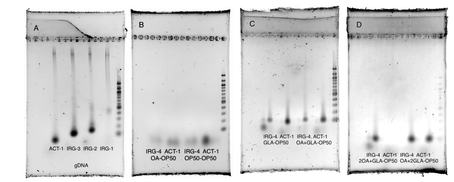
Did the worms survive?

- Fatty acid supplementation did increase survival
- A double proportion of gamma-linolenic acid to oleate acid appears to increase survival above even the uninfected worms
- This may be because gamma-linolenic acid has a special effect on bioaccumulation in the gut of *C. elegans*
- Further studies should investigate the exact influence gamma-linolenic acid has on *C. elegans*

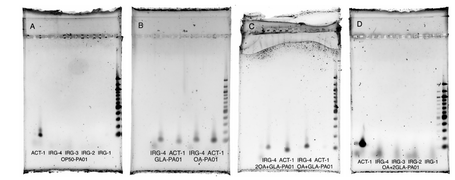


Survival curves of N2 *C. elegans* on *P. aeruginosa* (strain: PA01) and *E. coli* (OP50) after fatty acid supplemented diets. Nematodes were grown on OP50 lawns for 24 hours prior to transfer with various supplemented fatty acids. Nematodes transferred to OP50 control plates are depicted in dashed lines. A ratio of (1) equates to 4 mM fatty acid in OP50 and (2) equates to 8 mM.

Were genes expressed?



Gel electrophoresis of PCR reactions for control gDNA and cDNA from nematodes in control treatments.

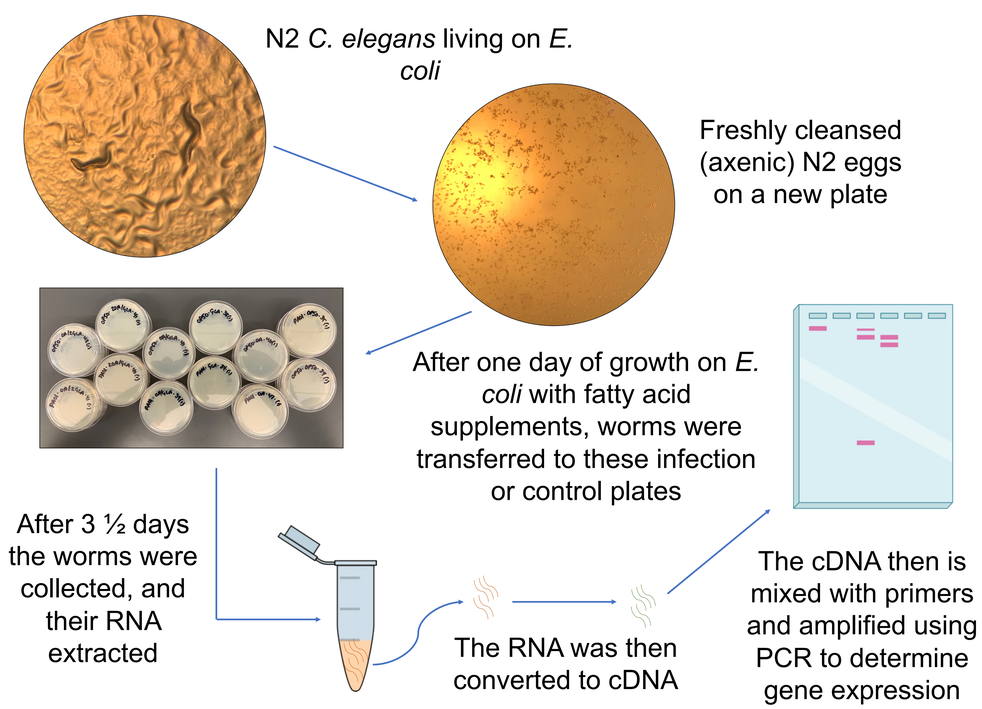


Gel electrophoresis of PCR reactions of cDNA from nematodes in pathogenic treatments.

- Worms fed on gamma-linolenic acid had a higher rate of immune response genes as compared to their control genes when exposed to the pathogen
- This is also seen with the worms fed a combination of oleate acid and gamma-linolenic acid
- These results indicate a higher rate of immune response gene expression in the presence of a pathogen

How did I study it?

- Basics of growing *C. elegans*
  - N2 nematodes were raised on an *E. coli* diet (OP50 strain)
  - It only takes a matter of days for worms to reach adulthood
- Synchronization and axenization of the worms
  - The age of the worms had to be synchronized
  - The microbiome of the worms had to be cleansed (axenized)
  - This was accomplished using bleach which killed adults but left eggs untouched and removed any contaminants
- Infection of the worms
  - Worms were infected with PA01 by transferring them to a plate with a PA01 lawn which they would eat just like *E. coli*
- RNA extraction
  - RNA was extracted to measure expression of the genes of interest after fatty acid treatment and infection
- cDNA synthesis
  - This RNA was converted to complementary DNA so my primers could bind to it
- Genetic primers
  - Primers were built to bind to the specific genes of interest
  - This allowed me to confirm that the genes I was studying were activated and then compare activation levels across fatty acid treatments



Acknowledgments

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References

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