Alaskan Lowbush Cranberry Extends Lifespan in *C. elegans*

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ABSTRACT

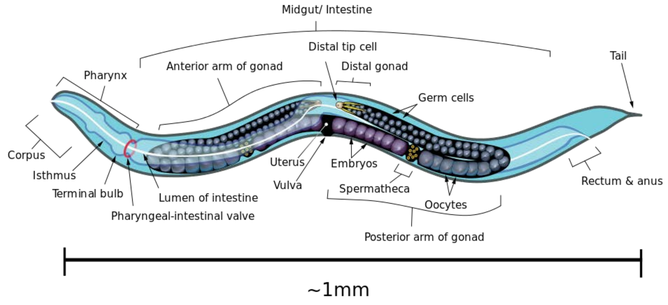
I tested the hypothesis that lowbush cranberries affect healthy aging in a dose dependent manner. This was done by observing the effect of cranberry extract on the lifespan of wildtype *Caenorhabditis elegans*. Results of the project may be useful in understanding what components of botanicals extend lifespan and provide neuronal protection. Using Alaskan botanicals provides a local focus, as well as having ethnobotanical value in studying the medical potential of traditional foods. The effect of lowbush cranberry was tested by running C. elegans lifespans at various concentrations of botanical extract. The extract was also tested for anthocyanin concentration, to provide insight on how anthocyanin affects healthy aging.

Background

Caenorhabditis elegans is a nematode that lives in temperate soils. They are well studied, and the fate of every cell in *C. elegans* is known. The worms are small, about 1mm in length. They have a life cycle of around 4 days, and individuals have a lifespan of about 2 weeks. In the lab, they are kept on agar plates seeded with OP50-1 strain *E. coli*. Since so much is known about *C. elegans*, and they are easy to keep in the lab, they are fantastic model organisms. Their short lifespan makes them particularly suited for studies of neuronal aging.

The botanicals examined in the Taylor laboratory, including lowbush cranberry, have a history of food and medicinal use among Alaska Natives (Jones 2010). Modern science can now investigate the value of these foods, such as lowbush cranberry, both by biochemical analysis for known beneficial compounds and whole-animal studies of the effects of such a diet. Ethnobotanical studies have the potential to bring attention to environmental issues, as well as bring attention to issues facing indigenous populations (Schultes, 1994). Not only does a project studying local botanicals provide valuable biomedical information, it can benefit the local population as well.

Other plants have been shown to affect the lifespan of *C. elegans*. For example, commercial blueberry polyphenols have been shown to extend *C. elegans* lifespan (Wilson, 2006). One study has already found the American cranberry to affect C. elegans lifespan in a dose dependent manner (Guha, 2012). The value of testing Alaskan lowbush cranberry is emphasized by evidence suggesting that the Alaskan lowbush cranberry may have more bioavailable anthocyanin than the American cranberry (Vorsa, 2005).



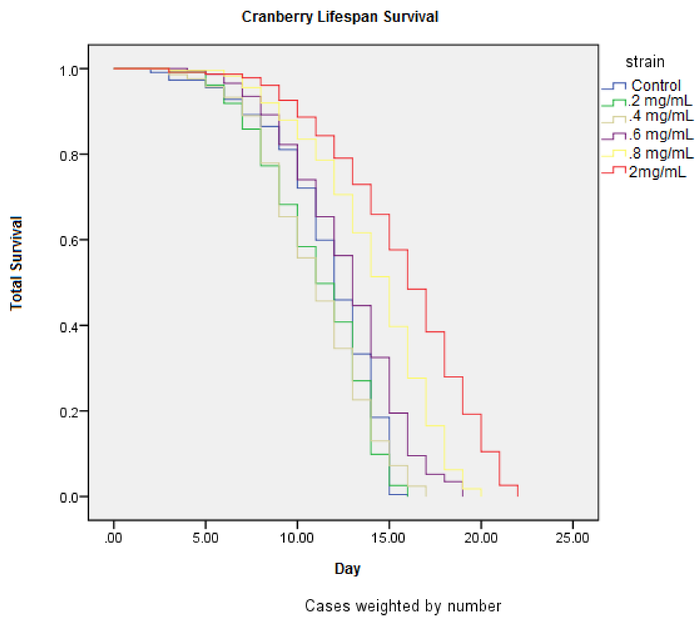
METHODS

Agar plates (nematode growth medium) were prepared with several concentrations of lowbush cranberry extract, as well as a control lacking the extract. Once this was done, OP50-1 E. coli was used to seed the plates, providing an additional food source for the animals. Before animals were transferred to the experimental plates, a synchronous population was established, to ensure animals involved in the lifespan were the same age. This was done using the egg lay technique, in which gravid adult worms are transferred to new plates for several hours before being removed. The synchronous eggs are then allowed to grow to full adulthood before being transferred to experimental plates. Twenty of these animals were transferred to each plate used for the experiment. There were three replicates of each experimental group (0.2mg/mL, .4mg/mL, .6 mg/mL, .8mg/mL, and 2mg/mL), and of the control. These plates were monitored for 2 to 3 weeks, with transferring of animals taking place as needed to ensure that the progeny of the experimental worms are not counted. Animals remaining alive were be counted, and any dead or missing individuals noted. Once all animals were dead, the data will be analyzed using Kaplan-Meier survival statistics to determine if lowbush cranberry had any effect on their minimum, maximum, and average lifespan. Lifespans were carried out at 25 degrees Celsius.

An anthocyanin assay was also carried out, using pH changes and oxidizers to measure relative concentrations of anthocyanins in the extracts used in the Taylor laboratory. In the future, this data will be used to compare anthocyanin concentration with lifespan data to gain an understanding of the link, if any, between anthocyanins, antioxidant activity, and neuronal protection.

RESULTS

Kaplan-Meier analysis of lifespan data did show a positive correlation between cranberry extract dose and extension of lifespan. Neither the .2mg/mL or .4mg/mL doses produced significant differences lifespan of the animals compared to a control. However, .6mg/mL, .8mg/mL, and 2mg/mL doses caused a statistically significant extension of lifespan, and demonstrated a dose dependent relationship between cranberry extract and lifespan of the animals.



CONCLUSIONS

Alaskan lowbush cranberry extract was shown to extend lifespan in *C. elegans.* The next step is to carry out another lifespan using the significant doses, but only after using UV radiation to kill the bacteria on the plates. This should demonstrate that lifespan extension is an effect of the extract itself, and not bacterial metabolites.

Other tests carried out in the Taylor laboratory on other extracts which may now be applied to lowbush cranberry include fluorescent imaging of *C. elegans* motor neurons to observe how neuronal aging is effected by the extracts.

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