Fixing Oxidative Damage: The Effect of Antioxidants on Telomere Length

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Poor lifestyle choices can lead to excess free radicals that shorten telomeres, the end caps of chromosomes. Telomere shortening is linked to cellular senescence and premature aging. This experiment tests whether antioxidants, which donate electrons to free radicals, affect telomere damage in the organism Daphnia pulex. It was hypothesized that Daphnia pulex exposed to oxidative stress and an antioxidant treatment would have longer telomeres than those without antioxidants. To test this, four cultures were exposed to oxidative stress via a 1.25mg/L and 2.50mg/L H_2O_2 solution, four were exposed to the same oxidative stress and antioxidants, and four cultures received neither to serve as a control. Telomere length was then compared through gel electrophoresis. The RF value for each condition was calculated by comparing the distance the DNA traveled to the loading dye. The RF values of the DNA exposed to H_2O_2 and antioxidants were larger than those without the antioxidant, with mean RF values of 0.90 ±0.006 in the 1.25mg/L H_2O_2 solution compared to 0.83±0.003 without the antioxidant and 0.86±0.004 in the 2.50mg/L solution compared to 0.82±0.004 ($p<0.0001$). Larger RF values were associated with smaller DNA fragments, so it was concluded that Daphnia exposed to oxidative stress and antioxidants experienced greater telomere shortening. A possible explanation for the rejection of the proposed hypothesis is that green tea also has oxidative properties. To address this discrepancy, a different antioxidant could be used or the tea altered to reduce oxidation. Additionally, a thicker gel could be used to view smaller fragments.