Effect of Tomatoes on the Inflammatory Response in Active College Age Adults

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August 2014
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Abstract

- Consumption of tomato products, primarily products high in lycopene, has been linked to a decrease in inflammation and inflammation related diseases.
- Reactive protein concentration can be used to quantify the onset of inflammation within the body brought on during exercise.
- In this study, ten volunteers (five male/five female) participated in two dietary cycles (high and low in tomato products, lasting two weeks each) after which saliva samples were taken to measure CRP concentration.
- No significant correlation was found between consumption of lycopene and inflammation. Further studies with larger sample sizes, different lycopene supplements, and a controlled diet may produce different results.

Introduction

- Inflammation is a complex cascade of events that makes up part of the biological response to injury of vascular tissues (Palozza et al. 2010). While inflammation has a protective role (removal of the injurious stimuli and initiation of the healing process), inflammation can cause temporary discomfort and chronic inflammation can cause irreversible damage to vascular integrity Leading to serious diseases (Lee et al. 2012).
- The immune system secretes proteins such as HMGB1 to start the cascade of events resulting in inflammation. HMGB1 induces the production of inflammation-mediating cytokines such as C-reactive protein (Lee et al. 2012). The production of cytokines is reduced by anti-inflammatory and immunomodulating compounds (Riso et al. 2006), including lycopene, produced by tomatoes. Lycopene inhibits HMGB1 surface receptors which inhibits the production of cytokines (Lee et al. 2012).
- Studies have shown an inverse relationship between a high lycopene diet and reduced cardiovascular inflammation (Burton-Freeman et al. 2012) and a direct relationship between high lycopene diet and endothelial function (Kalanteris et al. 2012). The purpose of this study was to investigate the effect of a diet containing tomatoes, tomato products, and V8® as a lycopene supplement, on levels of the inflammatory marker, C-reactive protein, in saliva of active college age aged adults.

Results

- Neither the high or low lycopene diet had a significant effect on the measured concentration of CRP. The concentration of CRP among participants, both on the high and low lycopene diets was highly varied.
- The mean values/standard deviation of CRP concentration- high lycopene diet before and after exercise were 1,679 ± 3,319, 3,577 ± 2,722 pg/mL.
- The mean values/standard deviation - low lycopene diet before and after exercise were 3,577 ± 3,577, 4,347 ± 5,009 pg/mL (Figure 1).
- Comparison of analogous groups revealed non-significant P values (0.225 to 0.643).
- The mean values/standard deviation of CRP concentration for male participants- high lycopene diet before and after exercise were 611 ± 1,024/2,961 ± 3,038 pg/mL. Low lycopene diet- 2,738 ± 2,938/5,721 ± 6,070 pg/mL.
- The mean values/standard deviation female participants- high lycopene diet before and after exercise were 3,014 ± 2,944/4,347 ± 2,455 pg/mL. Low lycopene diet- 4,405 ± 3,679/7,513 ± 3,924 pg/mL.

Materials and Methods

- Volunteers. Ten male/ ten female (18-26), who participate in a minimum of ten hours of physical activity per week, are free of disease and pregnancy, and are students attending Brigham Young University-Hawaii.
- Dietary cycles. Two weeks each. High lycopene diet: minimum daily consumption of 25.5mg lycopene from V8 Juice original® and tomato-based products. Followed by: Low lycopene diet- no tomatoes or tomato products. Crossover study.
- Sample collection. At the termination of each 2 week portion of the testing, subjects participated in a 15 minute workout ascending and descending stairs to induce overall inflammation in the body. Saliva samples of 125 µL were collected using cryotubes (Salimetrics, LLC 2013) and inflammation markers were measured using an ELISA research assay kit. Data were analyzed using a one way ANOVA and Fisher individual test.

Discussion

- Results of this experiment were non-significant.
- Large variance in CRP concentration among samples and small sample sizes may explain why the results were not congruent with previous studies.
- In future studies samples sizes should be increased.
- In the previous studies, Lyco-mato® was used to supplement lycopene. In this study V8® was used as a lycopene supplement. It is unknown whether the V8® manufacturing process in anyway affects the contained lycopene. Additionally, there is the potential that other supplements and/or chemicals, contained within the V8® drink may actually counteract the inflammatory inhibition of the lycopene.
- Lack of statistical difference between pre and post exercise inflammation on either diet may reflect an experimental failure to induce inflammation during the ascending and descending stair workout. Increasing the duration or intensity of the workout in future studies to ensure a strong inflammatory response is recommended.

Acknowledgements

- Special thanks to the Institutional Review Board of Brigham Young University Hawai‘i, the Biology department of BYUH for the funding of materials and provided resources. Gratitude goes out to all who participated. Appreciation to Brad Smith and Randy Day, who helped organize, analyze and revise this study.

References


Figure 1. The average C-reactive protein concentration in participants on high and low lycopene diets, pre and post exercise. The upper and lower shaded region of the box plot represents the third and first quartile respectively. The crosshair delineates the mean value (in bold) and the bar indicates the median value.

Figure 2. The box plots of C-reactive protein concentration in females (pink) and males (blue) on high and low lycopene diets, pre and post exercise. The upper and lower most shaded region represents the third and first quartile respectively. The crosshair delineates the mean value (in bold). The bar indicates the median value of the measurements.