Lycopene: A Potential Prostate Cancer Fighting Antioxidant – A structured review

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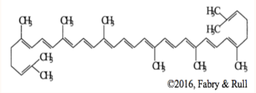


Introduction

Prostate cancer is currently the second leading cause of cancer mortality in men in the United States[1]. It is found to be the most common type of cancer making it a major research topic[2]. Some studies have found significant associations between dietary factors and prostate cancer, such as lycopene, a potent carotenoid antioxidant naturally found in abundance in tomato products[3]. In addition to the antioxidant properties of lycopene, other mechanisms may also play a significant role in prostate cancer prevention[1]. The relationship between lycopene's antioxidant properties and the reduced risk of prostate cancer has been studied using experimental research with a variety of sample sizes and types of studies. The results from these epidemiological studies derived from investigations focusing strictly on the ingestion and absorption of lycopene through the intake of tomato based products[4]. Of the fourteen different carotenoids found in the human body, tomatoes and tomato products account for nine of them[5].

In order to better understand this association, a structured literature review was conducted using the appropriate means and methods.

Research Question

Does lycopene as a carotene reduce the risk of prostate cancer in men?

Methods – Table 1. Methods Data

Database search: JNCI, PubMed, and AACR

Keywords: (lycopene AND tomato product AND prostate cancer AND prevention AND carotene AND nutrition)

Limitations	JNCI	PubMed	AACR	Total
Keywords	5	17	17	39
English	5	17	17	39
Reviews excluded	5	11	16	32
Relevance by title/abstract	3	2	3	8
Total	3	2	3	**8**

Results - Table 2. Research Data

Author	Study details	Measurements	Findings
(Giovannucci, Rimm, Liu, Stampfer, & Willett, 2002)	• **Prospective cohort** • 47,365 men aged 40-75	• Questionnaire • Cohorts between 1986-1998 • Mantel-Haenszel summary (CI:0.95)	• **A high tomato based diet was correlated with reduced risk of prostate cancer**
(Kristal, et al., 2011)	• **Case control** • 1683 cases and 1751 placebo controls men aged 55+	• Presence of cancer seen by biopsy, PSA levels and DRE exams • Polymotous logistic models	• **No association** • **A decrease in incidence of prostate cancer** • **Primarily high PSA10ug/dL was associated with an increased risk**
(Lu, et al., 2001)	• **Case control study** • Cases: 65 males with prostate cancer • Controls: 132 cancer free men	• Interview, blood and tissue samples • Dietary questionnaire • Qualitative nominal and ordinal data	• **Higher plasma concentration of lycopene** is associated with a **reduced risk of prostate cancer**
(Wu, et al., 2004)	• **Case control study (2 control sets)** • 450 prostate cancer cases and 450 controls	• Follow up questionnaire • Blood sampling • Food frequency questionnaire (FFQ)	• **High lycopene concentrations lower prostate cancer**
(Wang, Jacobs, Newton, & McCullough, 2016)	• **Prospective cohort study** • 5,018 included (average age 72)	• Self-reported questionnaire • Hazard Ratio (HRs) & 95% Confidence Intervals (CIs) for PCSM • FFQ	• **No overall association** between pre-diagnostic or post-diagnostic dietary lycopene and tomato product intake and PCSM (95% CI 0.78–1.28; p=0.92)
(Zu et al., 2014)	• **Prospective cohort study** 1986-2010 • 49,898 male health professionals	• FFQ every 4 years + questionnaire • Cox regression • Tissue microarrays and immunohistochemistry	• **Lycopene intake was inversely associated with incidence of total prostate cancer** and lethal prostate cancer (95% CI=0.56-0.94; P_{trend}= .04)
(Boileau, et al., 2003)	• **Case control** • 194 male rats induced with prostate cancer	• Diet of whole tomato powder • Kaplan Meier survival curves	• **Tomato powder was more effective in inhibiting cancer growth → lycopene and other compounds**
(Peters, et al., 2007)	• **Case control** • 692 prostate cases & 844 random controls	• Laboratory analysis • Blood drawls • Serum concentrations • Assessment questionnaires	• **No association** between lycopene and prostate cancer • Beta carotene was associated with a higher risk of prostate cancer

Discussion

Key Findings:

- The research yielded 3 prospective cohort study, 5 randomized case-control study with one done on rats.
- Several studies suggested an inverse association between lycopene and prostate cancer
- There were conflicting results in the research obtained (serum vs. dietary)

Contextualization:

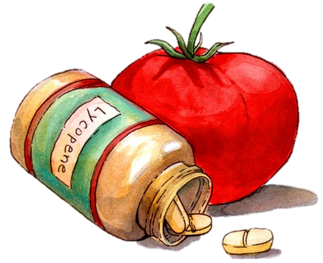
- The research suggests that lycopene from tomato products, most notably tomato paste, may have an inverse association with prostate cancer in men[3]
- Lycopene is an antioxidant found in fruits and vegetables that are red in colour
- The mechanisms in which this is achieved is still unknown → is lycopene effective on its own?
- Serum lycopene does not appear to be effective in reducing the risk of prostate cancer

Limitations:

- Very few reliable studies on this matter have been published and a number of these are conflicting. (limited by methodology)
- Most studies focused on a population of men aged 65+, however, to emphasize the prevention of prostate cancer, it will be important to create cohort studies, including young men in order to observe the possible cancer preventing qualities of lycopene.
- Small sample sizes and biases introduced problems (detection bias, selection bias, misclassification bias, response bias, etc.)
- Findings from studies with a focus on rats may not apply to human populations.

Implications:

- In the future, more research is needed to investigate the association between lycopene intake and risk of prostate cancer, especially among men who are 65 years old or more.
- Further studies are also necessary to clarify the detailed mechanism of lycopene reducing the risk of prostate cancer.
- If more scientific research is established, lycopene and other tomato products might help reduce the risk of prostate cancer.
- Future policies or guidelines cannot be established due to inconclusive research and data sets



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Conclusion

This literature review yields unclear results: five of the eight studies reviewed prove an inverse association with lycopene and prostate cancer (2+ servings a day)[3], while the three others showed no association or statistically insignificant results. While there does appear to be a distinctive difference in results from serum lycopene (negative results) and dietary lycopene (positive results), the mechanisms are still too unclear to make a definitive conclusion. From these studies, new questions arise: is it lycopene alone that is responsible for reducing the risk of prostate cancer or are there other mechanisms involved[4]? The results from the studies reviewed appear to be difficult to reproduce (as per the varied results) and encompassed many limitations and biases, which questions their overall validity.

Future research on the inverse association between lycopene and prostate cancer, particularly the mechanism behind the association, will need to be done in order to provide more confirmative results

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