



Vanessa Er,
PhD Student,
National Institute for
Health Research (NIHR),
Bristol Nutrition Biomedical
Research Unit,
Level 3, University Hospitals
Bristol Education & Research
Centre, Bristol, UK.

Correspondence to:
E: vanessa.er@bristol.ac.uk

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Department of Health. VE
is the recipient of a research
studentship at the NIHR
Bristol Nutrition Biomedical
Research Unit.

Illustrations

Both illustrations taken
from: World Cancer Research
Fund, Research American
Institute for Cancer Research.
Food, nutrition, physical
activity, and the prevention of
cancer: a global perspective.
Washington DC: AICR, 2007

Tomatoes and prostate cancer: a continuing story

How it all started

The role of tomatoes in prostate cancer has generated considerable interest since it was first mentioned in a diet and lifestyle study in *Adventist Men*. Mills and colleagues [1] reported that a high intake of tomatoes was associated with a lower risk of prostate cancer. At the time, researchers were not interested in the tomato per se, but were studying the relationship between retinol (vitamin A), carotenoids and prostate cancer. Tomato was included in the study as it is a rich-source of vitamin A. It was not until the Health Professional Follow-Up Study that the connection between lycopene and prostate cancer was made [2]; men who consumed more than 10 servings/week of tomato-based products had a 36% lower risk of prostate cancer than those who had less than 1.5 servings/week.

Lycopene: chemistry, biology and dietary sources

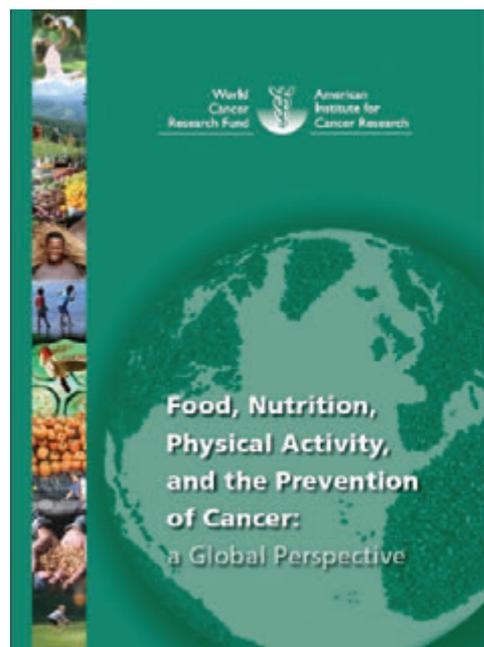
Lycopene – the major carotenoid in tomatoes – was postulated to confer the ‘protective effect’ of tomatoes on prostate cancer. This is mainly due to its antioxidant properties, but also because it is the most abundant carotenoid in the plasma, and is present in the prostate gland [2]. Lycopene, a potent singlet oxygen quencher,

is very effective in reducing oxidative stress, a major contributor to cancer development and progression. It also reduces cell proliferation and induces apoptosis in prostate cancer cell lines. Nevertheless, whether the association between tomatoes and prostate cancer is due to whole tomato or lycopene remains contentious.

About 80% of lycopene intake in the Western diet derives from tomatoes and tomato-containing products. It gives fruit and vegetables a red colour, and is found in grapefruit, pomegranate and watermelon. Mechanical processing, such as heating, mashing, blending and chopping, stimulates the release of lycopene, which is why tomato products have higher lycopene content. It is also soluble in oil, which means the bioavailability of lycopene is increased when tomatoes are cooked in oil or ingested with dietary fat. Before you hit the stores to stock up on baked beans, tomato ketchup or pizza, bear in mind that they are high in sugar, salt and fat, whereas pasta sauce, tomato juice and cooked tomatoes are healthier options.

What we found

In our study published in the *Journal of Cancer, Epidemiology, Biomarkers and Prevention* [3], men who consumed more than 10 servings of tomatoes and tomato products/week had an 18%



RECOMMENDATIONS

BODY FATNESS

Be as lean as possible within the normal range of body weight

PHYSICAL ACTIVITY

Be physically active as part of everyday life

FOODS AND DRINKS THAT PROMOTE WEIGHT GAIN

Limit consumption of energy-dense foods
Avoid sugary drinks

PLANT FOODS

Eat mostly foods of plant origin

ANIMAL FOODS

Limit intake of red meat and avoid processed meat

ALCOHOLIC DRINKS

Limit alcoholic drinks

PRESERVATION, PROCESSING, PREPARATION

Limit consumption of salt
Avoid mouldy cereals (grains) or pulses (legumes)

DIETARY SUPPLEMENTS

Aim to meet nutritional needs through diet alone



from dietary intervention studies, but most are small-scale and of poor quality [6]. Nevertheless, a UK study found that men ate more tomatoes and tomato products following a diagnosis of prostate cancer [7]. It is telling, indeed, as research shows that prostate cancer survivors now like to receive dietary and lifestyle advice, especially from health professionals [8,9]. In light of this, there is added urgency for high quality randomised controlled trials to establish whether there is a causal relationship between tomatoes, lycopene and prostate cancer to resolve these speculations.

Take-home message:

- Tomatoes and lycopene may help prevent prostate cancer
- High quality randomized controlled trials (RCTs) are needed to establish if they prevent prostate cancer development and recurrence
- There seems to be no harm eating lots more tomatoes!

lower risk of prostate cancer than in the general population. To examine whether meeting dietary and lifestyle recommendation reduces prostate cancer risk, we assessed the diet and lifestyle of 1,806 men aged 50-69 with prostate cancer, comparing them with 12,500 cancer-free men.

We also developed a prostate cancer 'dietary index', which consists of dietary components that have been linked to prostate cancer; selenium, calcium and foods rich in lycopene [4]. Men with an optimal intake of these nutrients and foods had a decreased risk of prostate cancer, the association being discernible with consumption of over 10 servings per week of tomatoes and their products. The cut-off was chosen as in the HPFS study [2], which to date provides the strongest evidence of a link between tomatoes and prostate cancer. So what is a serving? It is the equivalent of a medium size tomato (about 80g), 150mL of tomato juice, or 3 heaped tablespoons of baked beans.

We also look at adherence to the World Cancer Research Fund (WCRF) and the American Society for Cancer Research (AICR) recommendations on physical activity, diet and body weight for cancer prevention. Only the recommendation on plant foods – high intake of fruits, vegetables and dietary fibre – proved to be associated with a reduced risk of prostate cancer.

What is next

Although many laboratory studies have demonstrated chemopreventive effects of tomato and/or lycopene against prostate cancer, epidemiological studies have yielded mixed results. This could be due to several factors, mainly the introduction of prostate-specific antigen (PSA) test has helped in checking for symptoms that indicate early-stage prostate cancers, which often are indolent and are not otherwise easily detected. Prostate cancers now being detected are more heterogeneous in nature, which makes it harder to identify the risk factors for a subset of these cancers that will become aggressive and progress. (A detailed explanation by Edward Giovannucci can be found on the WCRF blog [5].)

Another important puzzle that needs solving is whether tomatoes and lycopene are involved in prostate cancer progression or recurrence. There are some encouraging findings

men who consumed more than 10 servings/week of tomato-based products had a 36% lower risk of prostate cancer than those who had less than 1.5 servings/week.

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