ROLE OF DIETARY MODIFICATION AND VITAMINS IN PROSTATE CANCER

Horst W. H. SOMMERKAMP¹, Raja B. KHAULI²


ABSTRACT : Prostate cancer incidence and nutrition are closely connected and show large food-related differences. Lowest cancer incidence in Asian countries is observed under low-calorie, soy-based food. Mediterranean nutrition has cancer protective components (fruit, vegetables, oil, seafood). The highest cancer incidence in the United States goes along with high-calorie food, red meat and fat ingestion. Changes in lifestyle and nutrition can influence the cancer risk. Dietary supplements and vitamins are in wide use and part of a complementary and alternative medicine.

Prevention of prostate cancer is a necessity for countries with a high prevalence of this disease and there are several ways to execute this. A change of dietary habits and the use of complementary medicine are two of the valuable and widespread tools. They encompass nutritional changes, food supplements and alterations in lifestyle. An increasing percentage of men make use of complementary and alternative medicine (CAM) for cancer prevention and as an adjunct to conventional therapy [1].

In prostate cancer there is ample evidence that nutrition plays a major role in tumorigenesis and progression. Furthermore some vitamins have shown to have a preventive or modifying effect in clinical and experimental settings [2-3].

DIETARY MODIFICATION

The wealth of information on the interrelation between nutrition and prostate cancer has led to the concerning question whether prostate cancer is a “nutritional disease” [4]. The vast differences in prostate cancer incidence between Eastern and Western countries [5] (Table I) with dissimilar dietary habits and food composition seem to offer an explanation for the observed facts.

A number of nutritional risk factors – components of the Western food – have been identified:
- High total calorie uptake/body mass index over 30 [6]
- Total fat consumption/saturated fatty acids [7]
- Red meat (beef) [8]
- Milk and milk products [9]

Most of these risk factors are provided by the components of the Western nutrition, especially in the United States. Asian food in contrast lacks these factors in conjunction with a very low incidence of prostate cancer. Mediterranean diet has a position in between these extremes. Unfavorable changes in dietary habits can enhance the cancer incidence, as shown by Chinese and Japanese [10-11] immigrants to the United States: The adoption of the Western lifestyle lead to a significant rise in cancer prevalence after 2-3 decades. On the other hand the change from nutritional habits with increased risk to a superior lifestyle has shown to be effective [12].

There are components of the Asian nutrition [13] which may account for the worldwide lowest incidence in prostate cancer:
- Low calorie and animal protein uptake
- High uptake of vegetables and fibres
- Soy and soy products
- Green tea-consumption

A major preventive role is attributed to the Phytoestrogens provided by soy (Flavonoids) and linseed (Lignans). These have a weak estrogenic effect

<table>
<thead>
<tr>
<th>REGION</th>
<th>Cases/100,000 men</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>California</td>
<td>WM*  49.6</td>
</tr>
<tr>
<td></td>
<td>CM**  82.5</td>
</tr>
<tr>
<td>Michigan</td>
<td>WM   51.2</td>
</tr>
<tr>
<td></td>
<td>CM    91.1</td>
</tr>
<tr>
<td>Connecticut</td>
<td>WM*  46.8</td>
</tr>
<tr>
<td></td>
<td>CM**  72.3</td>
</tr>
<tr>
<td>MEDITERRANEAN</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td>8.1</td>
</tr>
<tr>
<td>Portugal</td>
<td>11.3</td>
</tr>
<tr>
<td>Spain</td>
<td>17.0</td>
</tr>
<tr>
<td>Italy</td>
<td>17.6</td>
</tr>
<tr>
<td>France</td>
<td>23.6</td>
</tr>
<tr>
<td>ASIA</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>1.8</td>
</tr>
<tr>
<td>India</td>
<td>4.8</td>
</tr>
<tr>
<td>Japan</td>
<td>5.1</td>
</tr>
</tbody>
</table>

* White men  ** Colored men

TABLE I

COMPARISON OF PROSTATE CANCER INCIDENCE BY REGION [Muir, 1987]
inducing an inhibitory effect on prostate cell growth and proliferation. Soy is one of the most protective agents and used for prevention and treatment [14]. Studies on dietary intervention [15-16] have shown that soy is PSA-effective in men at risk.

Green tea, which is regularly consumed in China, contains – like red wine – polyphenols, which have shown to be prostate cancer preventive [17]. Mediterranean food obviously has a preventive effect on prostate cancer incidence. The nutrition is based on plant-oils and seafood, combined with a high intake of fruit and vegetables. Components are:

- Plant oil (olive oil), fish oil
- Fish and seafood
- Vegetables and fruit (parsley, tomatoes)
- Spices (oregano, marjoram)
- Red wine

These components are preventive even in countries with a high uptake of saturated fat like in Saudi Arabia [18]. Mediterranean nutrition is rich in oils containing mono-unsaturated fatty acids (MUFA) with known cancer-preventive effects [19]. In Lebanon prostate cancer incidence is rather low and does not belong to the five leading cancer causes [20-21]. This is in contrast to most European and overseas countries.

The preventive effect of seafood was investigated by Augustsson [22]. The consumption of fish more than three times per week lead to a drop in risk (0.56 RR, relative risk) in a follow-up—period of 12 years.

There is abundant proof of the beneficial effects of Lycopenes (tomato) in the literature. Prospective studies [23] have demonstrated that frequent tomato intake or the increased ingestion of tomato sauce led to a significant drop in prostate cancer risk. PSA-concentration in patients scheduled for surgery could be lowered within 3 weeks by tomato sauce ingestion [24]. These findings were sustained by animal experiments: tumor growth was substantially delayed under lycopene and vitamin E. Tomato powder but not lycopene inhibited carcinogenesis in chemically induced rat cancer [25].

Dietary supplements

In addition to the adoption of a risk-diminishing nutrition some dietary supplements have shown to be preventive and inhibitive with respect to prostate cancer. Supplements widely used for this purpose are:

<table>
<thead>
<tr>
<th>TABLE II</th>
<th>VITAMIN RECOMMENDATIONS AND SUPPLEMENTATION IN PROSTATE CANCER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U.S. DAILY REQUIREMENT</td>
</tr>
<tr>
<td>Vitamin A Carotenes*</td>
<td>3500 I.U.</td>
</tr>
<tr>
<td>Vitamin D*</td>
<td>400 I.U.</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>15-30 I.U.</td>
</tr>
<tr>
<td>Selenium</td>
<td>70 mg/day</td>
</tr>
</tbody>
</table>

* β-carotene and vitamin A supplementation is only advised in men with initially low levels and in conditions of heightened oxidative stress: men receiving β-carotene supplements have been shown to have a higher risk for prostate cancer development and mortality, particularly smokers (see text).

* Vitamin D supplementation is not recommended for the prevention of prostate cancer, and is only advised by increasing intake of Vitamin D foods.
Soy products / Isoflavonoids
- Selenium
- PC-SPES

Genistein concentrated polysaccharide (GCP), obtained from a soy extract, is widely used as a part of complementary medical therapy in Japan, Korea and other parts of Asia [26]. In men with proven cancer results with 5 g/day were disappointing. However, interesting results were obtained by Ornish and coworkers [12] with GCP combined with a low-fat vegan diet and antioxidants in men with localized prostate cancer under watchful waiting. This regimen led to a drop in PSA-concentration by 5% in contrast to a rise of 1% in the control group.

Selenium-supply is of major importance for prostate cancer prevention [27] and a constituent of many trials [28-29]. Earlier studies [30] had shown that a daily supplementation with 200 μg of selenium was associated with a 63% reduction in prostate cancer incidence. Men with low plasma levels have a 4 to 5-fold increased risk of prostate cancer [31]. In the ongoing SELECT-Trial [28], selenium (200 μg) and vitamin E (400 mg) daily are combined for prevention, the results of which are to be published in 2013.

PC-SPES, a supplement composed of herbs, has strong estrogenic properties and is widely used in the United States. Due to the side effects and cost it is not suited for prevention but for therapeutic supplementation in cancer cases [32].

VITAMINS

Vitamin supplementation for prostate cancer is summarized in Table II.

Vitamin D (Calcitriol, D3)
Vitamin D is a constituent of food (egg yolk, fish-oil, liver, milk) or converted from precursors in the skin (D2) under ultraviolet exposure. Low vitamin D levels are associated with an increased risk for prostate cancer [33]. On the other hand calcitriol is a potent inhibitor of cell growth in prostate tumor cell lines [34], and in clinical investigations [35]. Deficiencies in vitamin D supply can thus be a dietary problem or due to a reduced synthesis in the skin. Asian and Mediterranean food contains sufficient vitamin D3 and offers one explanation for the low prostate cancer rate. Men living in regions with low sun exposure (Scandinavia) or reduced skin synthesis through pigmented skin (Afro-Americans) have significantly higher prostate cancer rates. Sun exposure has shown to be preventive for the development of prostatic carcinoma in a recent study [36]. As calcitriol productions decreases with age, deficiencies may result in men of old age even in countries with adequate supply by food composition. Supplements of 400-800 IU per day are recommended in these cases.

Vitamin E
Vitamin E is an important antioxidant preventing genetic damage and tumor-cell proliferation [37]. Lycopene plus vitamin E leads to tumor necrosis [38] and reduced tumor growth rate [39] in experimental settings.

Its importance in prostate cancer prevention came into attention with the Finnish Study [40] which revealed a reduced incidence of prostate cancer by 32% in smokers supplemented by Vitamin E and carotene. A subsequent trial confirmed these findings [41] for current smokers or recent quitters with 100 IU of supplemental vitamin E daily. International prevention trials (ATBC study: “α-tocopherol–β-carotene”) were initiated with combining vitamin E with other preventive agents (β-carotene, selenium and others). Again only in smokers a weak preventive effect was seen on follow-up after 5-8 years of α-tocopherol supplementation [42].

REFERENCES


