

Prostate Cancer: Adjusting Diet Modifying Risk

Kay Dilley and Professor Margaret Rayman

Prostate Cancer month 2010 reminds us that prostate cancer is still the most common male cancer in the UK. Kay Dilley, Nutritionist and Professor Margaret Rayman, University of Surrey and co-authors of 'Healthy Eating: The Prostate Care Cookbook', provide some top tips for key dietary changes to help your patients reduce their risk of developing prostate cancer.

With thirty five thousand new diagnoses each year, prostate cancer in the UK remains the most common cancer to affect men and the second most common cause of cancer death (CancerStats 2009). Most known risk factors cannot be modified; increasing age, family history of prostate or breast cancer and African-American ancestry. Dietary modification, therefore, provides an important opportunity for intervention.

Rates of prostate cancer are highest in Western countries where diets are rich in meat and fat and low in plant foods. By contrast, the incidence is lowest in Asian countries where diets tend to be low in meat and saturated fats yet high in plant foods, fibre and fish (Aldercreutz 1995). Migration and Westernisation from Asia and Asian diet bring with it increased risk of prostate cancer (Shimizu et al. 1991).

Foods To Enjoy... (see Table 1 for summary)

Lycopene & Tomatoes

The most convincing evidence for a chemopreventive agent in prostate cancer is lycopene and its primary source, tomatoes. A meta-analysis of 21 studies indicates a 19% risk reduction with frequent consumption of cooked tomatoes (Etminan et al. 2004). The protective effect is thought to be exerted through antioxidant activities (Wertz et al. 2004).

Soya, Phytoestrogens and Legumes

Soyabbeans and soya products such as tofu and soya milk are a dietary staple in Asian countries where prostate cancer mortality is low (Aldercreutz 1995). This has sparked a large body of research into soya and its constituent isoflavones, a class of phytoestrogen. The two major naturally occurring isoflavones in soya, genistein and daidzein, are thought to be responsible for this beneficial effect of soya foods.

A recent meta-analysis of 14 epidemiological studies (Yan and Spitznagel 2009) indicated that consumption of soya products have the potential to reduce prostate cancer risk by up to 26%. Early intervention studies have also produced promising results (summarized in Trottier et al. 2009), however, more intervention studies in Western populations are needed before conclusions can be drawn.

Selenium

Numerous high-quality studies provide a strong body of evidence for a protective effect from high selenium intakes (Shamberger & Frost 1969, Brinkman et al. 2006; WCRF/AICR 2007). The Nutritional Prevention of Cancer (NPC) Trial included supplementation with 200 mcg selenium (as selenium yeast) per day for 4½ years and was linked to a 63% reduction in risk compared to placebo (Clark et al 1996). The effect of selenium appears greater in protecting from advanced disease (Etminan et al 2005; WCRF/AICR 2007) and in smokers (Nomura et al.2000; van den Brandt et al. 2003).

The recently published Selenium and Vitamin E Cancer Prevention Trial (SELECT) did not find any benefit of selenium supplementation with 200 mcg/d. However,

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participants had high circulating selenium levels at baseline. Selenium intake in the UK is much lower than in the US (Combs 2001) making this country a more appropriate target for dietary intervention.

Vitamin E

There is limited supportive evidence for a role of vitamin E (Heinonen et al. 1998).

Vitamin D and Oily Fish

Vitamin D, obtained primarily by the action of UVB radiation from sunlight on the skin, may have a protective effect. Prostate cancer incidence and mortality appears higher where exposure to UVB radiation is low (Trottier et al. 2009). However, more research is needed. In populations of high latitude and in individuals at high risk of deficiency due to reduced exposure to sunlight (elderly or inactive) there may be benefit in supplementation (Trottier et al. 2009) or increased dietary intake. Oily fish are one of the best dietary sources of vitamin D and have additional suggested benefits due to their content of long-chain omega-3 fatty acids and selenium. Marine omega-3 fatty acids have been shown to be beneficial to prostate cancer (Augustsson et al. 2003).

Allium and Cruciferous Vegetables

During the natural ageing process and during chopping, Allium vegetables e.g. garlics, leeks, onions, form organo-sulphur compounds which are thought to have anti-proliferation and anti-angiogenic effects.. A small intervention study, demonstrated that garlic, has the potential to reduce markers of disease progression and improve disease symptoms (Durak et al. 2003). Garlic needs be chopped and left to stand for ten minutes to allow the active compounds to form.

Cruciferous vegetables e.g. cauliflower and broccoli contain glucosinolates, which, upon chopping or chewing, form biologically active compounds known as isothiocyanates and indoles (Higdon et al 2007). Evidence from human studies has been inconsistent due to difficulties in assessing intake, the varied type and concentration of glucosinolate content in cruciferous vegetables, the loss of the active compounds in cooking and interindividual variations in effect due to varied genotypes. There is however some promising evidence; one study of predominantly white men found that high intakes (more than one portion per day) were linked to a 40% reduced risk of extraprostatic cancer (Kirsh et al., 2007).

Polyphenols

Polyphenols are known for their antimicrobial, antioxidant and anti-cancer activities. Several polyphenol-rich foods have been implicated in reducing prostate-cancer risk. The evidence is greatest for green tea (*Camellia Sinensis*), with growing interest in pomegranate (reviewed Syed et al 2007). However, many of the studies are undertaken in either Asian populations or at very high concentrations of polyphenol intakes. The science is still developing in this area and there are many other confounding factors that can contribute to the observed reduction in prostate cancer. The greatest effect in Asian populations, is seen with increasing duration, quantity and frequency of tea consumption. The polyphenols present in tea are thought to be responsible, exerting effects through a number of mechanisms (summarised in Adhami and Mukhtar 2006).

Studies looking at a beneficial role for pomegranate polyphenols are ongoing (Pantuck et al. 2006). Other polyphenols and polyphenol-rich foods which may have

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relevant chemopreventive effects including berries, grapes, tumeric and figs suggests potential benefit from inclusion of a wide variety of fruit and vegetables in the diet.

Although the exact mechanism has yet to be identified, polyphenol containing plants such soya, tea and fruit and vegetables have an excellent nutrition profile and should be encouraged as part of a healthy balanced diet.

...and Foods to Limit

Overcooked, Burnt or Processed Meat: Partly due to the formation of carcinogens known as heterocyclic amines that are produced at high temperatures (Kolonel 2001) (WCRF/AICR 2007).

Excessive Intakes of Dairy: More than 1,500-2,000 mg calcium /day (WCRF/AICR 2007) may be harmful as it may lead to a reduced circulating vitamin D (Giovannucci et al., 1998). However, it is important to balance between adequate calcium intake for maximum bone growth and development with excessive intakes. Achieving the recommended three dairy portions per day will not cause any detrimental effect.

Fat, Saturated Fat: High intakes, particularly of saturated fats, have been consistently linked to an increased risk of prostate cancer while low fat diets may slow its progression (Stacewicz-Sapuntzakis et al. 2008).

Conclusions

For some, diet may be the only active form of treatment. Consciously making dietary changes is associated with a positive, optimistic attitude and a feeling of being in control providing both physiological and psychological benefits. Generally it is preferable to include complete foods in the diet rather than supplements.

The evidence strongly supports a more plant based eating environment as well as the governments "eatwell" plate – more fruit, vegetables, and wholegrain starches and oily fish, less meat, cutting down on overall saturated fat and low fat dairy products.

Table 1: The foods and food components linked with a beneficial or detrimental effect on prostate cancer development or progression

Food/Food component	Definition/description
Beneficial	
Tomatoes/Lycopene	A potent antioxidant carotenoid pigment responsible for the red colour of some fruits and vegetables, most notably tomatoes, followed by watermelon and grapefruit.
Soya, phytoestrogens and other legumes	Phytoestrogens are plant compounds which are structurally similar to endogenous oestrogens. Soya beans are a species of legume, rich in the phytoestrogen isoflavone (soya alternatives to milk / yogurt / cream, tofu, soya nuts, soya beans)
Selenium	A trace mineral incorporated into proteins in the body (brazil nuts, organ meats, fish, seafood).
Vitamin E	A fat-soluble vitamin with potent antioxidant effects found in the fats and oils of plants (wheat germ, vegetable oils, margarine, nuts, seeds).
Vitamin D	A hormone-like vitamin, well known for its role in bone health. Obtained primarily from exposure to sunlight of the appropriate wavelength but some can be obtained in the diet.
Fish oils	Omega-3 fatty acids found in oily, cold-water fish (salmon, tuna).
Allium vegetables	Bulbous plants (garlic, onion, spring onions, shallots, leeks).

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Cruciferous vegetables	Edible plants from the <i>Cruciferae</i> family (broccoli, brussels sprouts, cabbage, cauliflower, kale, watercress, turnip, rocket).
Polyphenols e.g green tea pomegranate	A diverse group of plant chemicals with antioxidant and antimicrobial activities which give colour, odour and flavour to foods and drinks.
Detrimental (when eaten regularly)	
Burnt, overcooked or Processed meat	Cooking at high temperature e.g. barbequing. Processed meat (bacon, burgers, sausages).
Excessive consumption of Dairy products	Dairy in the UK is the main source of calcium and therefore care needs to be taken when advising on dairy consumption. The lower fat versions should always be recommended and advice to reduce intake should only take place for those consuming excessive quantities. Replacing dairy with soya alternatives is an excellent option — calcium fortified versions should always be recommended.
Fat and saturated fat	Animal fats such as butter, cream, cakes, biscuits and fatty meats.

Table 2: Recommendations for target intake of the relevant foods

Food/Food component	Recommended target intake
Beneficial	
Tomatoes/Lycopene	Aim to eat meals with a tomato-based sauce <i>at least</i> twice per week. The rapid clearance of lycopene from the blood (and tissues) reflects the need to consume lycopene-containing foods regularly, preferably daily.
Soya phytoestrogens and other legumes	3-4 servings of soya foods per day e.g. 200ml of soya milk alternative, a serving of soya yogurt alternative or 80g servings of soya foods such as tofu, soya dairy alternatives, soya nuts and other legumes.
Selenium	Aim for 100-150 mcg/day in total. This would be provided in a portion of kidney, a few brazil nuts every few days, or a combination of two to three portions of liver, poultry, fish, seafood, eggs or cashew nuts. Smokers may wish to aim for the higher end of the range. Maximum safe supplement dosage: 100 mcg per day.
Vitamin D	2 portions of oily fish per week plus other dietary sources of vitamin D (see table 3). Consideration should be given to supplement up to 25mcg per day see http://ods.od.nih.gov/factsheets/vitamind.asp
Fish oils	2-4 portions of oily fish per week. One portion per week may have some benefit. White fish and sea food should also be included in the diet. Weekly intake should not exceed a total of 4 portions of oily fish with no more than one portion of either shark, swordfish or marlin, due to the possible build up of pollutants in fish oils.
Allium vegetables	3 or more garlic cloves per week or 3 or more 80g servings of <i>Allium</i> vegetables per week
Cruciferous vegetables	3-5 80g servings of cruciferous vegetables per week

Table 3: Lists of beneficial foods

Allium Vegetables	Oily fish	Polyphenols
Chives	Kipper	Green tea
Garlic	Mackerel	Pomegranate juice
Leeks	Pilchards	Pomegranate fruit

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Onion Scallions (spring onion) Shallots	Salmon Trout Sardines Herring Tuna Anchovies Bloater Carp Eel Sprats Swordfish Whitebait	Berries and other fruits
Cruciferous Vegetables Bok choy (Pak choi) Broccoli Brussels sprout Cabbage Cauliflower Collard Garden cress Horseradish Kale Mustard Radish Rocket Swede Turnip Watercress	Phytoestrogens Soya Soya beans ('Edamame') Tofu (soya bean curd) Natto (An Asian food) Tempeh (An Asian food) Soya dairy alternatives e.g. milk, yogurt, spread, cheese, custard, ice cream Soya meat alternatives e.g. soya bacon, sausages and burgers Other soya products e.g. bread, cereal, flour, nuts (roasted soya beans), pasta, protein, sauce	Selenium Brazil nuts Eggs Fish Organ meats Poultry Seafood
Lycopene Dried apricots Guava Papaya Pink grapefruit Sundried tomatoes Tinned tomatoes Tomato juice Tomato ketchup Tomato puree Tomato soup Watermelon	Legumes Peanuts Beans e.g. broad, black, haricot, white, pinto, kidney, aduki, Beans e.g. broad, black, haricot, white, pinto, kidney, aduki, Pea and Chick peas Lentils	Vitamin D Oily fish Sundried shiitake mushrooms Eggs Margarine Fortified breakfast cereal- few are fortified with vitamin D. Dried skimmed milk powder.
		Vitamin E Eggs Mango Margarine Nuts Palm oil Rapeseed oil Salmon Sardines (tinned in tomato sauce) Seeds Soya bean oil Spinach Sweet potato Tomatoes Wheatgerm

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