Lead Review Article

April 1999: 95–103

Diet, Micronutrients, and the Prostate Gland

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Diseases of the prostate gland, particularly adenocarcinoma and benign prostatic hyperplasia (BPH), are age-related. Prostate cancer is the most commonly occurring tumor in U.S. men. Differences in the incidence of this disease among ethnic populations are not due solely to genetic differences. Many efforts have been devoted to studying associations between nutrition and prostate cancer. The strongest association appears to be related to total fat intake and increased risk of this malignancy. Evidence also exists to suggest a role for certain micronutrients, such as zinc, selenium, vitamin E, lycopene, phytoestrogens, and phytosterols, although the role of nutrition and micronutrients in protection against prostate cancer is less convincing. Further research is necessary.

Introduction

As humans age, several physiologic systems undergo a decline and the prevalence of chronic disease increases. Aging is also often accompanied by economic, psychologic, and social changes that can affect nutritional status[1] and impair nutrient intake. Several micronutrients have been associated with a decreased risk of both infectious and chronic diseases.[2] Aging produces physiologic alterations that modify the need for a variety of essential nutrients.[1] Poor mineral nutrition in the elderly is often attributed to low dietary intake.[3] Several factors may be responsible for mineral deficiencies in the elderly, including poor appetite induced by medications and alterations in taste and smell. Changes in gastrointestinal and renal function may also be involved in mineral deficiencies.

Aging also affects changes in the endocrine system. Some such manifestations are evident in postmenopausal women. Declining estrogen levels have been associated with osteoporosis, Alzheimer's disease, and a variety of metabolic disorders. Advancing age in men is frequently associated with changes in the endocrine system and is often related to diseases of the prostate gland. The relationship between age and carcinoma of the prostate gland is more closely associated than the relationship between age and benign prostatic hyperplasia (BPH).

In the United States and most other affluent countries, prostate cancer is the second most common cause of cancer mortality. The incidence and mortality rates of prostate cancer vary geographically, but are strongly associated with affluence and dietary factors related to affluence.[4,5] Significant increases in prostate cancer risk are observed in populations who migrate from low-risk countries, such as Japan and Poland, to the United States.[6,7] Likewise, large temporal increases in prostate cancer incidence and mortality were noted in Japanese as they became more Westernized.[5] Such early reports clearly implicated exogenous factors, including diet, in the predisposition of prostate cancer. Secular trends in the incidence rates between Caucasian men in the United States and in the United Kingdom reveal the U.S. rates to be two to three times higher during an approximately 20-year period.[8] The more intensive screening procedures used in the United States, such as the prostate-specific antigen (PSA) test, and not necessarily diet, most likely explain the widening gap in the incidence of prostate cancer between white U.S. and U.K. populations. It is noteworthy that these are significant international and ethnic variations in the incidence and mortality of prostate cancer.[9,10] Although new diagnostic technologies (e.g., transrectal ultrasound) and screening tests (PSA) have been developed, predicting the outcome of the disease has remained difficult.[11]

There are a host of nonnutritional factors that may play a role in the genesis of prostate cancer, including endocrine status, genetics, occupation, and other conditions.[12–14] Clinical and epidemiologic studies of familial risk of prostate cancer reveal a trend of increasing risk with increasing number of affected relatives and an earlier age of onset in affected relatives. Nephrolithiasis is reportedly related to an increased risk of prostate cancer; lesser associations have been observed with other concomitant diseases including diabetes mellitus and hypertension.[12] Occupational exposure studies have revealed that certain industries have an excess of prostate cancer mortality, but

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links to specific exposures (e.g., cadmium, pesticides, cutting oils, etc.) are not yet well established.[13,14]

Nutrition and Prostate Cancer

Fat

Considerable attention has been devoted to the role of nutrition in the genesis of prostate cancer.[15,16] Despite strong ecologic data and largely consistent case-control and cohort data on dietary fat and prostate cancer, the role of this nutrient remains unclear.[15] According to Kolonel,[15] much of the evidence of associations between diet and prostate cancer is weak and inconsistent. Nevertheless, many epidemiologic studies have suggested a link between dietary fat intake and the incidence of prostate cancer.[5,16–20] Epidemiologic investigations have suggested an association between dietary fat intake and prostate cancer, particularly with regard to the risk of advanced prostate cancer.[21] But supporting evidence from animal and in vitro studies is lacking, with the search for a suitable animal model slowing progress in the field. Indeed, the evidence from animal studies is varied.[22]

Essential fatty acids possess a complex array of both biochemical and pathologic actions.[23] It is possible that dietary fatty acids are involved in the genesis of prostate cancer and that they contribute to the progression of the disease. It is also possible that changes in dietary fat content influence prostate cancer growth via the effects of a specific type of fatty acid. For example, linoleic acid is capable of stimulating androgen-unresponsive human prostate cells in vitro.[24] Other fatty acids present in fish oils, however, may actually inhibit prostate cell growth. Thus, there is a cogent need to fill many of these gaps in the research involving associations between fatty acids and prostate cancer at both the molecular and clinical level.

Several excellent reviews and discussions have appeared recently that describe various aspects or studies of dietary fat and prostate cancer.[15,16,21] There have been many attempts to correlate dietary factors with prostate cancer risk and progression. It has been emphasized recently[21] that it is important to establish criteria for causation or association factors in the interpretation of experimental outcomes.[25] Such associations may be related to factors such as chance, bias, confounding, reverse cause, cause, or a combination of factors.[26] The effect of lifestyle exposure from environmental causes is reinforced by the observation of different international variations and the increased incidence observed in populations who migrate from low- to high-risk communities.[27]

Early studies[28–30] revealed strong positive associations between prostate cancer incidence or mortality and per capita fat consumption among different countries, including the United States. The traditional Western total fat intake of approximately 40% of total energy has been recognized as a major risk factor for prostate cancer.[31–33] Nutritional assessment in homogeneous populations is difficult even when the macronutrients are determined (e.g., meat or milk), which contribute significantly to the amount of fat consumed. Dietary assessments based on food frequency questionnaires are often limited in sensitivity and specificity.

Efforts to summarize the relationship between dietary fat and prostate cancer have been difficult despite the fact that many such epidemiologic studies are considered to be case-controls.[21,27] Many of these studies of invasive cancers attempted to isolate confounding factors between various populations, such as migrants, and identify environmental factors that might be alterable via intervention.[27] Dietary fat appears to be the strongest environmental risk factor for prostate cancer. Giles and Ireland[27] reviewed 14 studies of total fat intake and found that 12 retrospective studies found a positive association and six found a negative association. Prospective studies revealed one positive and one negative association.[27] These authors concluded that much of the evidence of associations between diet and prostate cancer was weak and inconsistent.[27]

More recently, Zhou and Blackburn[21] sought to examine relationships between dietary fat and prostate cancer by separating descriptive studies from case-control studies. These authors also reviewed specific studies that measured animal fat intake and saturated fat intake. In addition, case-control studies evaluated monounsaturated and polyunsaturated fat intake. Of the 16 aggregated descriptive studies, half revealed a positive association between dietary fat and prostate cancer risk.[17] Only five of the 16 studies looked at total fat: three showed no association and two revealed a positive association. Most case-control studies reviewed by Zhou and Blackburn found significant associations between prostate cancer risk and high dietary intake of total fat.[21,34–36]

Table 1[19,34–48] summarizes the case-control studies of the association between dietary fat and prostate cancer risk. Eleven of the 17 studies revealed a positive association between dietary fat and prostate cancer risk. No negative associations were noted. Generally, and perhaps expectedly, the risk of prostate cancer was more pronounced in older subjects, implying that associations were age-related. Although many epidemiologic studies have shown a positive association between cancer and dietary fat, the strength of the outcome, in most, may have been compromised because patient age and tumor stage and aggressiveness were not always fully considered.[16] Despite these possible limitations of both retrospective and prospective studies, there is a convincing positive association between dietary fat and prostate cancer.

Other epidemiologic studies have focused on the association between intake of animal fat,[27,35,36,40,42,44,47,49] saturated fat,[34,35,37–39,41,43,46] monounsaturated fat,[34,35,37,40] and

Table 1. Association Between Dietary Fat Intake and Prostate Cancer Risk

Author(s)	Cohort[a] Size	Association[b]	Comment/Major Finding
Andersson et al.[37] (1996)	526	+	Stronger association with advanced cancer
Ghadirian et al.[38] (1996)	232	0	Weak inverse association between fat intake and risk
Graham et al.[39] (1983)	262	+	Greater risk beyond age 70
Heshnat et al.[34] (1985)	181	+	Age-related risk
Kaul et al.[40] (1987)	55	0	Risk
Kolonel et al.[35] (1988)	452	+	Risk greater beyond age 70
Mettlin et al.[41] (1989)	371	0	Risk
Mettlin et al.[41] (1989)	371	+	High-fat milk consumption and cancer
Meyer et al.[42] (1997)	215	+	Total energy intake related to preclinical cancer
Mishina et al.[43] (1985)	100	0	Risk
Ross et al.[36] (1987)	284	+	Risk
Talamini et al.[44] (1986)	166	0	Risk
Veierød et al.[45] (1997)	72	0	Small cohort
Vlajinac et al.[46] (1997)	101	+	Several confounders
Walker et al.[47] (1992)	166	+	Risk
West et al.[19] (1991)	358	+	Aggressive cancer in aged
Whittemore et al.[48] (1995)	1655	+	Total and advanced cancer risk

[a] Case-control studies.

[b] + = positive association, 0 = no association.

polyunsaturated fat[38,42,48,50] and their relationship to prostate cancer risk. Some of these investigations failed to detect a significant association.[38,40,42,44] There was a negative association between linoleic acid intake and prostate cancer risk in aged men.[38] No association was found between energy-adjusted intake of saturated fat, monounsaturated fat, or polyunsaturated fat and the incidence of prostate cancer.[45] There was evidence of an inverse association with animal fat, monounsaturated fat, and saturated fat.

Significant associations with advanced cancer were reported for dietary intake of total,[20,48,49] saturated, monounsaturated, and polyunsaturated fats.[19] A notable finding has been the strong positive association with intake of animal products, particularly red meats, although this alone does not specifically implicate fat. Meat is a somewhat heterogeneous entity when evaluated in epidemiologic studies. According to Giles and Ireland,[27] the association between beef and cancer risk could be due to meat alone, an effect of fat contained in the meat, or even an effect of carcinogens created in the cooking process.[27] However, there is no convincing evidence to support such hypotheses. It has been pointed out that inconsistent associations can be caused, at least in part, by methodologic limitations of case-control studies.[17] Issues in the design and interpretation of investigations of fatty acids and cancer have been addressed.[50]

Soy Protein and Plant Foods

Consumption of soy-based foodstuffs is much greater in Asian countries than in the United States. The average consumption of soy protein in Taiwan is 35 g/day per capita.[51] Genistein and daidzein, both isoflavones or phytoestrogens, are found in relatively high concentrations in soy-based foodstuffs.[52,53] Genistein and daidzein, along with their ß-glucoside conjugates, are present in soybeans in amounts of up to 3 mg/g. Hence, the isoflavone intake in the Taiwanese population may reach 100 mg/day. The average isoflavone intake in the Asian population is estimated to be about 50 mg/day—far greater than the amount present in the diet of the average American.[52]

It has long been recognized that there is a several-fold decrease in prostate cancer mortality in Japanese men compared with U.S. men.[54] This difference has been attributed in part to the high soy protein content of the Japanese diet.[52] Isoflavones can inhibit the growth of androgen-dependent and androgen-independent prostate cancer cell lines.[55] Genistein and daidzen, along with several other phytoestrogens, stimulate the transcriptional activity of recombinant human estrogen receptor alpha (ER-α) and estrogen receptor beta (ER-ß).[56] The idea that the estrogenic potency exhibited by the isoflavones is associated with a decreased risk of prostate cancer is an attractive hypotheses, but such a relationship must be more clearly defined by both basic and clinical studies. The mechanism of action of isoflavones does not necessarily reside exclusively in their ability to interact with steroid receptors, since isoflavones exert other nonhormonal effects on tumor angiogenesis.[16] Genistein may have other biochemical mechanisms wherein it inhibits proliferation of human prostate cancer cell lines.[56]

Other epidemiologic studies have reported associations between the consumption of plant foods (e.g., fruit) and prostate cancer. Of these evaluated, two were retrospective and eight were prospective studies:[27] three showed negative associations and four showed positive associations with risk of prostate cancer. One retrospective study reportedly was significant.[57] Vegetables were measured in various ways in these studies, and included

carrots, green vegetables, and tomatoes. Collectively, of the 13 plant food studies evaluated, there were nine positive associations and 16 negative associations. Evidence of a protective effect of fruits and vegetables was weak and inconsistent.[27]

Fruits and vegetables contain several different carotenoids, including ß-carotene, which can be metabolized to vitamin A. The effect of dietary ß-carotene on prostate cancer risk has been estimated in a total of nine studies—six retrospectively and three prospectively.[27] While some interesting trends were noted, the evidence of a protective effect of ß-carotene on the incidence of prostate cancer was weak and inconsistent. Similar findings were reported by Ghadirian et al.,[38] wherein there was no association between ß-carotene and other carotenes and prostate cancer. In three investigations of vegetable intake, with particular emphasis on ß-carotene intake,[20,44,58] there were no associations. Two other studies[59,60] reported inverse associations.

Epidemiologic studies have suggested that ß-carotene and vitamin E supplemented concomitantly or separately in the diet may influence the development of cancer.[61] Long-term supplementation with α-tocopherol, but not ß-carotene, reduced prostate cancer incidence and mortality in male smokers. Another report studied the association between physical activity and prostate cancer in an α-tocopherol–ß-carotene cancer prevention study.[62] While the focus of the study was not specifically the effect of these nutrients on prostate cancer risk, there was a protective effect of physical activity on prostate cancer. In reevaluating the effect of dietary ß-carotene on prostate cancer,[63] a positive association between ß-carotene intake and prostate cancer risk was found among older men. Overall, the majority of study outcomes do not convincingly establish a relationship between ß-carotene and prostate cancer risk. Further studies are needed.

Lycopene

Information regarding the effects of lycopene in humans is derived primarily from epidemiologic studies because human intervention trials have been limited.[64,65] A diet rich in carotenoid-containing foods has been associated with a number of health benefits, including the possible prevention of cancer of the prostate gland.[65] Epidemiologic[66–68] and clinical[69] studies indicate that tomato consumption may exert anticancer effects in humans, especially with regard to gastrointestinal and prostate cancer. Lycopene is the major carotenoid in tomatoes and along with other carotenoids is rich in antioxidant activity. Lycopene can be detected in the rat prostate gland.[70] While the liver contains high concentrations of lycopene, there are physiologically significant levels in the rodent prostate gland.

Two prospective studies have examined the association between tomato consumption and the risk of prostate cancer.[66,71] A cohort study of Seventh Day Adventists monitored during a 6-year period revealed that the consumption of tomato products (and also of beans, lentils, and peas) was significantly associated with a lower risk of prostate cancer.[71] In a large and comprehensive study of tomato consumption and prostate risk, estimated intakes of total carotenoids, ß-carotene, L-carotene, lutein, and ß-cryptoxanthin were not associated with risk of prostate cancer.[68] Conversely, higher estimated lycopene intake was inversely related to risk of prostate cancer. In general, the greater the frequency of consuming tomato products, the greater the risk reduction.

When serum lycopene levels were obtained from men who developed prostate cancer (13-year period of study) and compared with those of matched controls, there was no statistical difference.[72] However, the sample size of the cohort was quite small. In another study,[73] serum carotenoid levels failed to reveal an association with risk of prostate cancer. Again, there were difficulties in the interpretation of these findings based on blood sampling intervals and the possibility of the intermingling of patients with BPH.

The mechanism by which lycopene might exert a protective effect against prostate cancer risk is poorly understood. The rodent prostate gland assimilates lycopene, but anatomical localization fails to address any mechanism(s) of action. Giovanucci[68] has suggested several possible mechanisms for the anticancer properties of lycopene. Because lycopene is not metabolized to vitamin A, it may exert very potent antioxidant effects. It also quenches very efficiently singlet oxygen and free radicals. Finally, lycopene may protect cellular components from specific types of damage from highly reactive oxygen species.

Vitamin A

Vitamin A has long been recognized as essential for cell growth and development. It exists in two dietary forms, namely, the carotenoids, found in plant sources, and the alcohol or aldehyde forms and their esters, found in animal sources. There are also more than 200 synthetic vitamin A derivatives called retinoids.

The relationship between vitamin A/retinol and prostate cancer risk was estimated in various ways in nine studies; three reported a negative association and six identified a positive association.[27] The results of only two studies, however, were statistically significant. The intake of vitamin A and its constituents failed to yield any appreciable associations with prostate cancer risk, except for a weak positive association between retinol and risk of advanced cancers.[37] A positive association with total vitamin A intake has been observed in some studies of older men[35,48] as well as younger men.[34,60,74] One study failed to find an association between total vitamin A intake and prostate cancer risk, but the results did suggest a risk reduction in the uppermost quartile of retinol intake.[38] An

inverse association between retinol and prostate cancer was reported in a case-control study, although the effect of the disease itself on serum levels could not be excluded.[73] The mechanism(s) by which retinoids affect prostate cell growth remains largely unknown, but in vitro studies indicate that prostate ductal growth and branching can be inhibited by 13-*cis*-retinoic acid and all-*trans*-retinoic acid.[74]

Selenium and Vitamin E

Selenium has been recognized as an essential nutrient on the basis of its ability to serve interchangeably with vitamin E in several of its biochemical functions,[75] and it can act synergistically with the vitamin. Selenium compounds reportedly inhibit tumorigenesis in a number of experimental animal models and in human supplementation studies, leading to a reduction in cancer risk.[76] It has been suggested that selenium compounds act as cancer chemopreventive agents.[77,78] Willett et al.[79] reported a strong association between low serum selenium levels and an increased incidence of prostate cancer.

Alpha-tocopherol, a form of vitamin E, supplemented long-term (average 5 years) in the diet, substantially reduced prostate cancer incidence and mortality in male smokers.[61] Yoshizawa et al.[80] recently reported in a randomized intervention trial that the risk of prostate cancer for men receiving a daily supplement of 200 μg selenium was one-third that of men receiving placebo. The significance of these findings is discussed by Taylor and Albanes.[81] The current findings,[80] combined with other reports from two randomized trials,[61,82,83] lend support for effective prostate cancer prevention strategies. These accumulated findings are provocative, albeit limited and somewhat inconsistent.

Zinc

It has been known for many years that the mammalian prostate gland contains a number of biochemical constituents, including zinc. Although zinc appears to function in a variety of metabolic events, neither its physiologic nor its pathologic actions within the prostate gland are fully understood. Zinc concentration in the prostate gland is much higher than in other human tissues.[84] The uptake of zinc by the prostate gland in experimental animals is an androgen-dependent process. There is some evidence that zinc levels may be elevated in BPH and decreased in prostate carcinoma.[85] Prostate neoplasms secrete less zinc in prostatic fluid obtained by digital rectal massage.[86] It has been proposed that the inability of malignant prostate cells to accumulate high zinc levels results in increased citrate oxidation and the coupled ATP production essential for the progression of malignancy.[87]

Kolonel[15] reported on the relationship between nutrition and prostate cancer including the dietary components cadmium and zinc. Unfortunately, associations between the risk of prostate cancer and these heavy metals were too incomplete to draw any conclusions regarding their importance. In an age-adjusted epidemiologic study, a positive association between prostate cancer (all stages combined) and zinc was observed.[37] After adjustment for energy intake, however, there was no apparent association between prostate cancer and any of the nutrients investigated, including zinc. Interestingly, pumpkin seeds (*Cucurbita pepo*) contain relatively high levels of zinc, and there are many vegetables rich in zinc including spinach, brussels sprouts, cucumbers, string beans, and some other green vegetables. Because the physiologic and pathologic role of zinc in the prostate gland is poorly understood, any therapeutic supplementation of this micronutrient must be viewed as empirical. While a hypothesis involving zinc supplementation as a chemoprotective is intriguing, neither basic nor clinical studies have yet fully confirmed such an association.

Miscellaneous Factors

Alcohol. Alcohol consumption appears to have little association with prostate cancer risk.[27] In an evaluation of several retrospective studies that included alcohol, none were observed to have an odds ratio that was significantly different from 1.0. Six prospective studies exhibited a similar pattern.[27] In another study,[88] an elevated risk was observed at very high levels of alcohol consumption. Lumey et al.[89] recently confirmed what the majority of alcohol studies have observed—that there is no relationship between alcohol consumption and prostate cancer.

Vitamin D. Laboratory and clinical data indicate an antitumor effect of $1,25(OH)_2$ vitamin D on prostate cancer.[90] Calcium from food sources and supplements independently increased risk. Interestingly, high fructose intake was related to a lower risk of advanced prostate cancer. Fruit intake was inversely associated with risk of advanced prostate cancer, and this association was accounted for by fructose intake. Non-fruit sources of fructose were similarly associated with lower risk of advanced prostate cancer.[90] Fructose, like zinc, is present in unusually high quantities in mammalian sex accessory glands, including the prostate. These findings provide indirect evidence for a protective influence of high $1,25(OH)_2$ vitamin D levels on prostate cancer and support recommendations for increased fruit consumption and avoidance of high calcium intake to reduce the risk of advanced prostate cancer.

Diabetes mellitus. The relationship between diabetes mellitus and risk of prostate cancer has been studied,[91–94] but the findings have been somewhat inconsistent. People with diabetes have a lower risk of prostate cancer and this risk decreases over time after diagnosis of diabetes.[91] Henderson et al.[92] reported a nonsignificant inverse relationship between the progression of diabetes and prostate cancer. Other studies have reported a lower

prevalence of diabetes among men with prostate cancer;[93] no association was detected between these two diseases in a large prospective study.[93] The underlying mechanism(s) involved in these associations (or lack thereof) are unclear. Inherent metabolic changes associated with diabetes mellitus seem unlikely to be related to any age-related hormonal events in the prostate gland.

Nutrition and BPH

Etiology and Incidence

BPH is a common cause of morbidity among older men.[95] The etiology of BPH remains unknown, but the condition is manifest by hyperplasia of both the epithelial and stromal tissues of the prostate. This hyperplasia often leads to restricted urinary outflow. The incidence of BPH increases with advancing age and is the most common cause of lower urinary tract obstructive and irritative symptoms. Although BPH and prostate cancer are common in older men, there is no convincing evidence that men with BPH are at higher risk for prostate cancer.[95] Androgens, particularly dihydrotestosterone, may be involved in the genesis of BPH.

Less attention has been focused on nutrition and BPH. BPH is relatively uncommon among Asian men, yet the incidence of BPH in Japanese men increases when they migrate to the United States.[96] The therapies used in treating prostate cancer (e.g., surgery, radiation, hormones, and chemotherapy) are less common in the medical management of BPH. Pharmacologically, BPH may be treated with α_1 adrenergic blockers (e.g., prazosin, terazosin) and/or 5α-reductase inhibitory drugs (e.g., finasteride). Finasteride blocks the conversion of testosterone to dihydrotestosterone. The efficacy of these drugs resides chiefly in restoration of urinary flow. Pumpkin seeds that contain cucurbitacins purportedly have some 5α-reductase inhibitory activity. Licorice (*Glycyrrhiza glabra*) also contains an ingredient that appears to interfere with the conversion of testosterone to dihydrotestosterone.

Phytosterols

Table 2 illustrates the findings of two studies[97,98] of dietary nutrients and BPH. The effectiveness of phytosterols in patients with nonsevere BPH was recently assessed in a randomized, placebo-controlled double-blind study.[97] This phytosterol preparation consisted mainly of ß-sitosterol and led to the clinical improvement of urinary peak flow following a 6-month treatment period. It is noteworthy that the lipophilic extracts of sabal fruit (*Serena repens, Sabal serrulata* [American dwarf palm]) have been used to treat BPH.[99] The hexane extract of the pulp and seed contains a complex mixture of free fatty acids and their esters. There are also small quantities of ß-sitosterol in the extract.[96] Beta-sitosterol can inhibit human prostate cancer cell growth in vitro. The mechanism may involve the activation of the sphingomyelin cycle and the induction of apoptosis.[100]

Ohno et al.[98] evaluated 100 case subjects with BPH and 100 age-matched hospital patients in Japan. There was no association between total dietary fat intake and BPH. These investigators also studied the effects of dietary ß-carotene on the progression of prostate disease and found a protective association between ß-carotene intake and prostate cancer risk. This finding was consistent across two control series hospital controls and patients with BPH.

Phytoestrogens

Phytoestrogens are present in soybeans and are represented by the isoflavonoids, which include genistein and daidzen. While genistein has an affinity for the human estrogen receptor,[56] it can also decrease the growth of both BPH and prostate cancer tissue in histoculture.[101] The mechanism of action of genestein is multifaceted, and it would be simplistic to suggest that it is acting only as a hormone receptor antagonist.

Summary

There have been many efforts to elucidate an association between nutrition and prostate cancer. Studies attempting to relate total fat intake to this malignancy seem to be the most convincing. There are many confounding factors involved in the genesis of prostate cancer that complicate clear or definitive associations. The evidence of the usefulness of dietary supplements or other chemoprotectants in the medical management of prostate cancer is equally unconvincing. Dietary zinc supplements may hold some empirical value, but the therapeutic use of this metal bears little relationship to either the physiologic or pathologic basis for its actions. It is possible that some phytoestrogens such as genistein and daidzen might prove useful in the dietary management of prostate cancer, but long-term case-control studies are first necessary.

The etiology of BPH, like that of prostate cancer, remains unknown. The association between BPH and nutrition is even less evident than that between prostate cancer and nutrition. Epidemiologic studies of phytosterols (e.g., ß-sitosterol) have been limited. Although phyto-

Table 2. Studies of Diet and BPH

Author	Nutrient Investigated	Comment/Major Finding
Berges et al.[97] (1995)	ß-sitosterol	Symptomatic improvement
Ohno et al.[98] (1988)	ß-carotene/total fat	BPH Risk

estrogens appear to possess both hormonal and nonhormonal properties, their effect on the clinical course of BPH is not clear. Finally, it is doubtful that other micronutrients (e.g., zinc) or phytochemicals (e.g., licorice, pumpkin seeds) exert any significant actions upon epithelial or stromal tissues in the hyperplastic prostate.

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