
Introduction

There is little question currently that BPH prevention and perhaps partial treatment may occur via heart-healthy processes [1, 2]. Almost all documented heart-healthy interventions or lifestyle changes can prevent some aspect of BPH/LUTS. It is also interesting that some of the older and emerging cardiovascular risk markers may also be predictive of LUTS severity. For example, the Boston Area Community Health survey looked at a random sample of 5,502 adults aged 30–79 years [3]. LUTS was defined as an American Urological Association Symptom Index (AUASI) of 8 or higher. Significant correlation was found among men and women for LUTS and higher CRP, which suggested that LUTS is also an inflammatory process. Of course, there are also some processes of BPH that are clearly out of the realm of complete lifestyle control; for example, it is also well recognized that aging and/or genetics plays a role in the etiology of BPH for many men [4–7]. It is interesting that some of these past studies suggest a very strong genetic and familial component with BPH. Regardless, the focus of this chapter is on lifestyle changes or parameters that may or may not impact BPH.

Alcohol

Regular alcohol intake appears to lower the risk of BPH, and the form of alcohol and perhaps quantity does not appear to make a difference. It is interesting that an experimental technique that involves an intraprostatic injection of approximately 6–12 mL of absolute ethanol at 5–10 sites in the prostate (“transurethral ethanol ablation”) has had moderate success thus far in treating BPH. Significant positive changes have been observed in International Prostate Symptom Score (IPSS), maximum flow rate (Q_{\max}), mean residual volume (PVR), and prostate volume within several months. This technique causes a coagulative necrosis of the tissues via dehydration and nerve ending alpha-receptor destruction [8–10]. Obviously intraprostatic injection of alcohol is different from consumption of alcohol, but perhaps not radically different.

Earlier and even recent prospective or other epidemiologic studies, such as the Health Professionals Follow-up Study and others, continue to suggest that moderate and even larger alcohol intakes could be associated with a lower risk of BPH [11–15], which could be more efficacious in those with a lower body mass index (BMI). Additionally, the derivation of the alcohol

(beer, hard liquor, or wine) did not matter. Regardless, arguably the most convincing evidence that alcohol might lower BPH risk was a meta-analysis of 19 studies that included 120,091 men; 16 studies were candidates for pooled analysis, and 12 of these considered BPH to be the primary outcome [16]. Alcohol intakes across most levels of consumption were associated with a significant reduction in BPH. For example, even an alcohol intake of 36 g/day or more was correlated with a 35 % reduction in risk ($p < 0.001$). Interestingly, the inverse relationships appeared to be more robust with increased intake, but all dosage intakes provided protection. Yet the protection afforded with alcohol was not observed with LUTS. The authors point to the potential beneficial effects of alcohol as further evidence that “systemic metabolic disturbances may drive BPH pathogenesis” so that a multitude of heart-healthy protective mechanisms could protect against BPH. It is also plausible that lower androgen levels in heavy drinkers [13], a reduced sympathetic tone, and even HDL increases could be other mechanisms whereby BPH is prevented or progression rates are reduced [17].

Blood Pressure/Hypertension

Prescription alpha-blockers for BPH were first developed and utilized for hypertension [18]. Thus, it should not be a surprise that high blood pressure mitigation or the prevention of hypertension may reduce BPH. The metabolic syndrome, which includes obesity, dyslipidemia, hypertension, and glucose abnormality, appears to be correlated with BPH risk [19]. Thus, again, it is not a surprise that hypertension can increase the risk of or exacerbate BPH [20].

Caffeine/Coffee

Few studies have been conducted on caffeine sources, especially coffee and BPH. The scarce data demonstrate either no impact of coffee on BPH [21–23] or a slightly increased risk [12]. In reality, many of these past studies are from Europe (Italy), where coffee drinking itself is

associated with other behaviors, which would make it difficult to truly isolate the impact of this kind of consumption. Regardless, in my opinion patients should be encouraged to consume coffee or caffeine in moderation, not only for their quality of life but because more recent overall general health data have reported multiple potential positive outcomes from reduced rates of liver, brain, and other neurologic diseases [24].

Caloric Intake

Preliminary evidence is beginning to accumulate that some form of caloric restriction might delay the onset of numerous diseases and theoretically improves survival from a variety of diseases [25]. Interestingly, at least in laboratory and animal studies, there have been consistent reductions in the following parameters with some form of caloric restriction:

- Fat mass
- Inflammatory markers
- Insulin
- Insulin insensitivity
- IGF-1
- Oxidative stress
- Sympathetic activity
- Thyroid axis
- Visceral fat

Thus, it is not surprising that caloric control has some evidence in animals that it may inhibit prostate cell proliferation rates [26, 27]. Some of the researchers from the randomized, placebo-controlled trial known as the Prostate Cancer Prevention Trial (PCPT) decided to try to answer a critical dietary question [28]. A total of 3,341 men from the placebo arm of the PCPT were evaluated during 6 years of the trial. The original trial included 5 mg of daily finasteride versus placebo to prevent prostate cancer, but this study analyzed observational data from the placebo arm of this trial. Low caloric intake was independently associated with a significantly lower PSA velocity ($p = 0.05$). Thus, it is probable that a lower caloric intake could be associated with a healthier profile and reduces prostate cell proliferation rates.

It is interesting that a recent clinical trial of 31 abdominally obese type 2 diabetic men actually

tested whether a severe caloric restriction diet (−1,000 cal/day) or a high-protein reduced-calorie diet (−600 cal/day) could impact urologic markers [29]. Remarkably, within 8 weeks there were significant improvements with both diets with glucose, LDL, IIEF-5, sexual desire inventory (SDI), and IPSS. After 8 weeks, all of the participants were then maintained on the −600 calorie, high-protein diet for 44 weeks; after 1 year the results were maintained, including reductions in inflammatory markers and further improvements in IIEF-5, SDI, and IPSS scores. Thus, just 5–10 % body weight reduction in a short or over a longer period has immediate and sustainable impacts on a variety of urologic parameters, including BPH/LUTS.

It should also be noted that as interesting as it is that some form of caloric restriction has an impact on health parameters, it is not an easy task to follow on a regular basis. Although weight-loss goals can be achieved for some individuals without any exercise at all, it should also be reiterated that exercise provides a mental health boost and reduction of the more unhealthy visceral fat that caloric restriction is not able to achieve in human clinical trials [30]. In addition, I am often asked if caloric restriction of some form matters in the minority of individuals who excessively exercise. In other words, if an individual is able to maintain heart-healthy parameters, including weight, but consumes an excessive amount of calories and eliminates them through exercise (like some Olympic athletes), is that permissible and healthy? Research has not adequately addressed this issue, but it appears that caloric excess in the setting of excessive exercise and the maintenance of heart-healthy parameters is also a healthy scenario, but this again is based on opinion, because there is a lack of clinical data addressing this interesting issue.

Cardiovascular Disease Markers (LDL, HDL Triglycerides, Etc.) and Inflammation

Despite being mentioned earlier, it is important to reiterate and slightly expand on the concept that increases in cardiovascular and inflammatory

markers appear to be associated with an increase in BPH or the progression of this condition [1–3]. There is some preliminary data to suggest that one or more abnormal lipid markers may increase the risk of BPH in some individuals [31], but this should not be a surprise, because the prostate itself produces and stores large amounts of cholesterol [32]. Thus, any abnormalities in cholesterol metabolism might cause detrimental effects on prostate tissue. Reductions in LDL and triglycerides and improvements in HDL could prevent or delay the progression of BPH.

For example, CRP tends to be a marker of systemic inflammation but may also be a marker of intraprostatic inflammatory changes [33], and prostatitis and infections of the prostate also appear to be related to BPH and/or clinical outcomes of some BPH patients [34, 35]. It should also be of interest that a preliminary cohort study found a lower risk of BPH and the progression of this condition with regular use of nonsteroidal anti-inflammatory drugs (NSAIDs) [36] and a randomized trial of celecoxib (100 mg at 9 PM) versus placebo for refractory nocturia from BPH found a significant improvement in this parameter [37]. This evidence suggests that at least reducing inflammation might favorably impact this disease. Interventions that positively impact lipid and inflammatory markers may improve BPH prognosis when utilized early and in the right patient [38, 39], but whether or not they will improve outcomes any better than existing BPH treatments is highly questionable [40].

Diabetes/Glucose Intolerance/Metabolic Syndrome

There is a strong association in the medical literature of glucose intolerance and BPH incidence and progression. Higher glucose and insulin levels may act as a mitogen on prostate tissue and appear to accelerate BPH, and this has been known for quite some time [41–46]. Insulin resistance is a key component of the metabolic syndrome, and these synergistic negative parameters may provide a multifactorial etiology for this condition. For example, excessive insulin may stimulate the liver to produce more insulin-like

growth factor (IGF-1), and multiple areas along the IGF pathway, including in and around the prostate, may be impacted [47–49]. Additionally, secretion of other growth factors, such as fibroblast growth factor (FGF), can also occur in diabetic prostate tissue [50].

Fiber/Flaxseed/Omega-3/Soy or Soy Protein

Food products that contain fiber may reduce all-cause mortality [51], are generally heart healthy, and provide protection against a vast array of aging conditions [52–58]. An ability to lower blood pressure, cholesterol, glucose, inflammation, and weight simply suggests it may be an ideal BPH preventive agent, but there is minimal research for fiber in this area of medicine. Preliminary clinical evidence suggests that fiber may lower PSA and slow the growth of proliferative benign prostate tissue [59, 60].

Perhaps the potential positive clinical data for fiber can be found in the low-cost food product flaxseed, which has generated preliminary positive data. Flaxseed is high in fiber and plant estrogens (lignans), is one of the largest sources of plant omega-3 fatty acids (alpha-linolenic acid), and has a history of favorably impacting lipid levels [61–63]. A preliminary clinical trial that examined tissue from BPH patients before and after three rounded tablespoons of ground flaxseed (30 g total per day for 6 months) daily along with a low-fat diet found significant reductions in PSA, cholesterol, and proliferation rates [64]. A subsequent randomized trial from this same group found that proliferation rates were impacted more by flaxseed alone compared to a low-fat diet in men with prostate cancer [65]. It is also of interest that a recent flaxseed-derived supplement made of purified lignan extract (secoisolariciresinol diglucoside, or SDG) at 300 or 600 mg/day showed favorable and significant results compared to a placebo in a clinical trial of 87 participants over a 4-month period [66]. IPSS were reduced by approximately 7 points in the intervention arms compared to 3.5 points in the

placebo group with additional improvements in quality of life. Similar SDG derivatives of a variety of doses have also now been found to preliminarily and significantly reduce cholesterol and glucose values [67, 68]. Whether or not ingesting low-cost flaxseed as well as an SDG supplement will reduce BPH symptoms has not been studied, but it is worth an attempt for some patients.

It should be of some interest that dietary soy products have a somewhat similar characteristic to flaxseed because they contain fiber and omega-3 from plants and are one of the largest food concentration sources of phytoestrogens (isoflavones) [69]. Older laboratory studies have found that genistein, one of soy's principal isoflavones, could reduce the growth of BPH and prostate cancer tissue in histoculture [70]. Otherwise, the overall medical literature in the area of BPH and soy is minimal, based on a lack of research with some scant positive data from case-control studies [71]. A 40-mg soy isoflavone supplement given for 1 year ($n = 1,670$) did not perform much better than placebo, but the groups (control and intervention) in this trial experienced significant within-group positive effects on BPH parameters [72]. In the meantime because of the heart-healthy properties of dietary soy, it should be encouraged for BPH patients, which is why I recommend it. It is an outstanding source of high-quality protein that can help improve lipid values and cardiovascular outcomes and be utilized with pharmacologic agents. Only 15–30 g/day of soy protein is needed for some tangible numerical results [73]. The American Heart Association provided an earlier recommendation of 25–50 g of soy protein per day for cholesterol reduction [74]. Perhaps the addition of a high-quality protein powder to a patient's diet as a substitute for calories or unhealthy food sources may be just as effective [75]. Regardless, if fiber or flaxseed or even soy protein is recommended to your patients with or without BPH, the good news is that past studies have not found any clinically relevant or profound negative changes in androgen levels in men with these healthy foods [64, 65, 76], but, in some rare cases, a potential slight reduction in testosterone level [77].

Fruits and Vegetables

There are only a minimal number of studies examining the relationship between fruit and vegetable consumption and the risk of BPH [14, 71, 78, 79]. The totality of the evidence thus far demonstrates a consistent pattern of BPH reduction with increasing vegetable intake only [14]. One of the largest prospective epidemiologic studies in the world to evaluate the impact of fruit, vegetable, and nutrient consumption with the risk of BPH is the Health Professionals Follow-Up Study (HPFS) [78]. The average age of the men was 52–54 years, and every 2 years the health status of the participants was determined by questionnaires and medical records for a period of over 14 years. BPH cases were men that reported having surgery or who had an AUASI of 15–35, which included 6,092 men compared to 7,800 men without BPH with an AUA score of 7 or less ($n=18,373$). Men with an AUASI of 8–14 were not included in this study ($n=7,800$). Vegetable consumption is significantly (p trend=0.03) and inversely correlated with BPH, with the highest consumption being associated with 11 % reduction in risk. However, fruit intake was not associated with the risk of BPH. The most significant reduction in the risk of BPH was found for increasing vitamin C intake from food (p for trend=0.009). Vitamin E intake from foods was not associated with the risk of BPH. Thus, a diet high in vegetable intake may lower the risk of BPH. Still, the highest intake of fruits and vegetables was almost ten servings a day in this study! However, I find it most interesting that men with the highest intake of healthy foods also were less likely to smoke, more likely to drink in moderation, more physically active, and had the highest intake of dietary fiber per day. In other words, this study sends a very important message, which is the sum of what one does in moderation provides a bigger benefit than one or two healthy behavioral changes in extreme.

A case–control study from Milan, Italy, of 1,369 patients compared to 1,451 controls utilizing trained interviewers found a 59 % reduction

in BPH in the highest category of intake of Allium vegetables, specifically onion and garlic intake, even after controlling for confounding factors and utilizing a multivariate odds ratio [79]. An earlier study from this same research group supported the findings that vegetables may reduce the risk of BPH [21]. Again, the epidemiologic research dating back over a period of over 30 years continues to suggest that vegetable consumption reduces the risk of BPH [80, 81].

Physical Activity/Exercise

Perhaps one of the greatest lifestyle changes that has been consistently documented to prevent BPH/LUTS or the progression of this condition is regular physical activity. A meta-analysis of 11 studies involving over 43,000 men found that moderate to vigorous physical activity reduced the risk of BPH or LUTS by approximately 25 % compared to sedentary lifestyle [82]. Men would have to engage in at least 30 min of light to moderate physical activity per day, approximately 6–7 days a week, to potentially maximize their benefits in this area.

A past study of obesity and BPH in the HPFS found that physical activity was correlated with a lower risk of BPH possibly by maintaining a healthy weight and through other heart-healthy mechanisms [83]. A follow-up retrospective study to the HPFS identified 1,890 men who had BPH surgery or 1,853 men who scored 15 or more points out of 35 on the seven questions from the American Urological Association Symptom Score (AUASS) [84]. A total of 21,745 men were considered controls because they scored 7 points or less on the same symptom score. Researchers controlled for age, race, alcohol intake, and smoking status. Greater physical activity was significantly and inversely related to total BPH (25 % reduction), surgery for BPH (24 % reduction), and symptomatic BPH (25 % reduction). Interestingly, walking was the most prevalent physical activity, and men who walked 2–3 h a week had a 25 % reduction in risk for total BPH. Men that were more physically active were also

less likely to smoke, were leaner, less likely to have diabetes, and more likely to consume alcohol and more calories. In the Physicians' Health Study, men who exercised had a reduced risk of BPH surgery compared to sedentary men [85]. However, men who exercised experienced an increased risk with increasing amount of exercise that may have resulted because of the small number of men ($n=320$) studied or because men in this cohort who exercise regularly are more likely to be treated for BPH compared to men who do not exercise as much. The Massachusetts Male Aging Study included 1,709 men followed for 9 years, and increasing levels of physical activity was associated with a reduced risk of BPH [86]. Men in the highest level of physical activity had an odds ratio of 0.5 (50 % reduction) compared to men in the lowest levels of physical activity.

Perhaps the first of its kind randomized trial of an exercise regimen demonstrated a benefit for men with BPH [87]. This study from Korea investigated the impact of regular tai chi exercise on LUTS, quality of life, and sex hormone levels in men with BPH. A total of 56 participants (mean age of approximately 70 years) were randomized into the tai chi or control group. The tai chi intervention consisted of 11 basic and 9 combination movements for a total of 20 overall movements. The first 15 min consisted of warm-up stretching exercises, the next 40 min involved the 20 primary movements, and there was a 5-min cool-down stretching exercise. Men in the tai chi group attended classes three times per week for a total of 12 weeks. Participants were also asked to practice their exercises two times per day at home (morning and evening). The control group members were contacted twice by phone over 12 weeks to confirm their inactivity levels. No significant baseline differences were found between the tai chi and control group in terms of marriage status, education, employment, income, perceived health status, surgical prostate history, medication use for prostate issues, or exercise status. IPPS decreased significantly in the tai chi group compared to control (-4.14 vs. $+0.71$) after 12 weeks, and quality of life also significantly improved with this exercise intervention, including specific reductions in urination discomfort,

worry and concern (significant difference), and interference with daily activities. There was no impact of tai chi on insulin or glucose, but a significant increase in testosterone in the exercise group. Two serious limitations of this novel clinical trial were the 50 % dropout rate that occurred in both the intervention and the control group, which the researchers attributed to the older age of the participants and compliance enforcement issues and a lack of monitoring other heart-healthy parameters to provide other potential mechanisms of action, such as blood pressure responses, in the intervention compared to the control group. It should not be surprising that tai chi or other forms of exercise or even meditation and stress reduction techniques could improve BPH symptoms via a variety of diverse heart-healthy mechanisms. For example, a systematic review of 26 past tai chi studies that included nine randomized trials found that in 22 past studies there were blood pressure reductions with tai chi of 3- to 32-mm Hg systolic and 2- to 18-mm Hg diastolic [88]. A recent randomized trial of 96 elderly participants without BPH and a mean age of 69 years found a significant improvement in sleep quality, cognitive performance, and balance compared to the control group after 6 months of twice-a-week 60-min tai chi sessions [89]. However, the dropout rate was 19 %, which again demonstrates that a commitment to exercise is not a simple task. Hence, multiple healthy beneficial changes could translate into tangible changes for BPH patients that can be used with or without other conventional options.

Thus, when considering the totality of the data, there is a striking reduction in the risk of BPH and outcomes with regular physical activity, which is attributed to a variety of mechanisms from lower sympathetic tone, reduction in weight gain, glucose normalization, favorable lipid profile, and so forth [90].

Smoking/Tobacco

There are no strong positive or negative associations with tobacco utilization and BPH, with some studies reporting reductions [15, 91, 92]

and others an increased risk in heavy smokers, for example, 35 or more cigarettes/day [11], which could be due to sympathetic overload with excessive tobacco utilization [93]. Overall there is no strong association with tobacco and risk of BPH [93], but the impact of tobacco on morbidity and mortality is enough of a reason to promote immediate smoking cessation [94, 95].

Weight/Waist Circumference/BMI

Prostate volume and an increase in the severity of obstructive urinary symptoms appear to be correlated with an increase in adipose tissue [44, 45, 96]. Estimates of up to 1.0 mL/year growth in prostate tissue have emerged from past studies of obese patients that harbor multiple other heart-unhealthy parameters [44, 45]. Data from the Baltimore Study of Longitudinal Aging (prospective community cohort) found prostate volume increases with each single point increase in BMI and a striking 3.5 times higher risk of prostate enlargement in obese compared to non-obese participants [42]. Another study of 409 consecutive men in the United States analyzed for waist circumference (WC) differences and outcomes found that WC was correlated significantly with a greater prostate volume, PSA, and IPSS and a greater likelihood of other metabolic syndrome issues [97]. It is of interest that 10 % body weight loss in just 8 weeks led to a significant mean

reduction in IPSS scores of over 6 points in non-diabetic obese men and just over 2 points in diabetic men [98], which should encourage clinicians to promote weight loss as early as possible to potentially improve urinary function with or without conventional medicine.

Conclusion

BPH/LUTS has a multifactorial etiology, but patients need simplistic advice apart from just medical intervention on how to prevent and slow the progression of this disease, which can have such profound effects on quality of life. The plethora of evidence continues to point toward heart disease risk factors as initiating and promoting BPH [1, 2, 99], and clinicians need to embrace the concept that heart health is tantamount to prostate health.

Table 2.1 is a summary of the major findings of this review on lifestyle factors and BPH that can be easily explained to patients. Trying to explain how to combat this condition in any other fashion is much too time-consuming and confusing, in my opinion. There is no question that certain non-lifestyle factors beyond the clinician’s control, such as socioeconomic status and genetics, also play some role in promoting BPH [100], but the vast majority of the evidence points toward positive heart-healthy lifestyle changes as a potential method to combat this condition right now!

Table 2.1 A review of lifestyle factors that may or may not prevent BPH/LUTS and/or the progression of this condition

Lifestyle factors that could affect the risk and progression of BPH	Does it impact BPH/LUTS? Commentary
Alcohol	Yes Associated with a reduced risk with regular consumption, and source and quantity of alcohol do not appear to matter (moderation is the rule). HDL increase, reduced androgen levels, and reduced sympathetic tone may be part of the reason. Keep in mind that excessive alcohol consumption can increase sympathetic tone/blood pressure
Aging, genetics, and family history	Yes Consistent data suggest that BPH is profoundly increased with genetic/family history of BPH. Obviously these are not lifestyle factors, but patients need to be aware of these non-lifestyle influences
Blood pressure	Yes Hypertension appears to increase the risk of BPH via sympathetic overdrive and other factors

(continued)

Table 2.1 (continued)

Lifestyle factors that could affect the risk and progression of BPH	Does it impact BPH/LUTS? Commentary
Caffeine/coffee	No Caffeine from a favorite beverage in moderation should still be encouraged because of overall healthy benefits
Caloric intake (fat, protein, etc.)	Yes Larger caloric intakes that cause heart-unhealthy changes appear to increase risk of BPH via weight gain and other metabolic disturbances. Greater caloric intakes without weight gain or without heart-unhealthy parameter changes may not increase BPH (so-called Olympic athlete effect)
Cardiovascular disease	Yes Lower cardiovascular disease risk is associated with lower risk of BPH via multiple heart-healthy parameters
Cholesterol/lipid levels/ inflammatory markers	Yes Lower HDL, higher triglycerides, and high LDL and CRP increase the risk of BPH, and the prostate itself is highly sensitive to cholesterol disturbances
Diabetes/glucose intolerance/ metabolic syndrome	Yes Higher insulin and glucose levels appear to act as a mitogen or growth factors for prostate tissue. Every abnormal metabolic syndrome parameter (dyslipidemia, waist size, glucose, blood pressure) can increase the risk of BPH
Fiber/flaxseed/soy/ omega-3 intake	Yes All of these dietary factors now have ample evidence that they are heart healthy and may reduce the risk of BPH
Fruit and vegetable consumption	Yes for vegetables and no for fruit Increasing vegetable intake appears protective against BPH, but fruit consumption does not. Most of the evidence suggests any type of vegetable consumption may be protective, and the caloric content of most vegetables tends to be low, but the fiber and healthy nutritional content is excellent for many vegetables
Glucose (fasting)	Yes Higher insulin and glucose levels appear to act as a mitogen or growth factors for prostate tissue
Physical activity/exercise/ stress reduction/tai chi or other stress-reducing exercises (yoga, pilates, meditation, etc.)	Definitely Multiple mechanisms from improving HDL and cholesterol, blood pressure and glucose normalization, sympathetic signal reduction, androgen stability, and a reduction in adipose tissue
Smoking/tobacco	No Not a consistent positive or negative impact, but the profound data on early morbidity and mortality rates from smoking-related diseases (bladder, kidney, lung, etc.) should be sufficient impetus to begin some form of smoking cessation immediately
Weight/waist size/BMI	Yes Increased aromatase activity, higher blood pressure, glucose, lipid, and inflammatory markers also may stimulate prostate tissue growth. A 5–10 % reduction in weight may improve a variety of urologic parameters, including urinary and quality-of-life symptom scores

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