



Associations of obesity, physical activity and diet with benign prostatic hyperplasia and lower urinary tract symptoms

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Purpose of review

Epidemiological and clinical data indicate that modifiable lifestyle factors – including obesity, physical activity, and diet – significantly influence the risks of symptomatic benign prostatic hyperplasia (BPH) and lower urinary tract symptoms (LUTS).

Recent findings

Modifiable factors associated with significantly increased risks of symptomatic BPH and LUTS include obesity and consumption of meat and fat. Factors associated with decreased risks include increased physical activity, vegetable consumption, and moderate alcohol intake. Obesity potentially attenuates the clinical efficacy of 5 α -reductase inhibitors (5-ARI). Randomized clinical trials of lifestyle alterations – such as weight loss, exercise, and diet – for the prevention or treatment of BPH and LUTS have yet to be performed.

Summary

Obesity, physical activity, and diet substantially alter the risks of symptomatic BPH and LUTS. 5-ARIs exhibit diminished efficacy in obese patients. Although clinical trials of lifestyle modifications have yet to be undertaken, it is reasonable to promote weight loss, exercise, and healthy diet within the context of standard treatments for symptomatic BPH and LUTS.

Keywords

benign prostatic hyperplasia, diet, lower urinary tract symptoms, obesity, physical activity

INTRODUCTION

Symptomatic benign prostatic hyperplasia (BPH) and lower urinary tract symptoms (LUTS) are highly prevalent conditions among older men with substantial adverse effects on the public health. In the USA, the estimated prevalence of BPH among men aged 60–69 years exceeds 70% [1]. By 2018, an estimated 612 million men will have BPH globally [2]. Estimated annual costs of LUTS treatment in the USA alone totals upwards of \$3.9 billion dollars [1,3]. Despite widespread medication use, the incidence of acute urinary retention secondary to BPH has significantly increased in a large, ethnically diverse population of US men [4[¶]]; in addition, hospitalizations for BPH secondary to acute renal failure in the USA have increased over the last decade [5^{¶¶}]. LUTS have been associated with an increased risk of falls, reduced quality of life, depression, and increased mortality [6–9].

A relatively recent development in the understanding of BPH and LUTS is the observation that

modifiable lifestyle factors – including adiposity, physical activity, and diet – influence the natural history of these conditions. Accumulating data suggest that many of the same metabolic disturbances and lifestyle factors associated with cardiovascular disease also alter the risks of BPH and LUTS. These observations are important because they suggest targets for prevention and treatment. Herein, we review associations of adiposity, exercise, and diet life with BPH and LUTS.

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KEY POINTS

- Obesity, physical activity, and diet substantially alter the risks of symptomatic BPH and LUTS.
- Although clinical trials of lifestyle modifications have yet to be undertaken, it is reasonable to promote weight loss, exercise, and healthy diet within the context of standard treatments for symptomatic BPH and LUTS.
- Comprehensive literature review focused on epidemiological and clinical associations of adiposity, physical activity, and diet with BPH and LUTS.

METHODS

We performed a detailed, comprehensive literature review identifying peer-reviewed articles focused on epidemiological and clinical associations of adiposity, physical activity, and diet with BPH and LUTS. The search was conducted through the MEDLINE database, the Cochrane Library Central Search, and the Web of Science. A summary of selected modifiable risk factors is provided in Table 1.

Definitions of benign prostatic hyperplasia and lower urinary tract symptoms

Research studies have utilized many different definitions for BPH, including but not necessarily limited to histological diagnosis, decreased urinary flow rates, urodynamic studies consistent with bladder outlet obstruction, radiologic evidence (i.e., ultrasound or MRI) of benign prostate enlargement, need for BPH surgery, acute urinary retention, physician-diagnosed BPH, and LUTS.

LUTS describes a distinct phenotype of a group of disorders affecting the prostate and bladder that

share a common clinical manifestation. LUTS has recently evolved into the preferred term for studying urinary symptoms – including those secondary to symptomatic BPH – because it allows for a broad phenotypic description without the identification of specific causes. However, the terms ‘BPH’ and ‘LUTS’ remain connected in the contemporary treatment and study of lower urinary tract disorders in older men. Therefore, in the remainder of this review, we will consider factors associated both with BPH and LUTS.

OBESITY

Increased adiposity has been consistently associated with increased ultrasound-determined and MRI-determined prostate volume. Increased body weight [10,11], BMI [10,12–15], and waist circumference are associated with increased prostate volume [10,13]. In the Baltimore Longitudinal Study of Aging (BLSA) cohort, for instance, each 1 kg/m² increase in BMI corresponded to a 0.41 cc increase in prostate volume. In addition, obese (BMI ≥ 35 kg/m²) participants had a 3.5-fold increased risk of prostate enlargement compared to nonobese (BMI < 25 kg/m²) participants (*P*-trend = 0.06) [10].

Obesity was also associated with increased risks of both symptomatic BPH and LUTS in several different international study populations, including the US Health Professionals Follow-up Study (*n* = 26 000) [16], a case control study in China (*n* = 500) [17], a 7-year prospective analysis of the US Prostate Cancer Prevention Trial (PCPT) (*n* = 4770) [18], the US National Health and Nutrition Examination Survey (NHANES III) (*n* = 2800) [19], the second Nord-Trøndelag Health Study (HUNT-2) (*n* = 21 700) [20], and the Prostate Study Group of the Austrian Society of Urology (*n* = 1500)

Table 1. Selected modifiable risk factors for benign prostatic hyperplasia and lower urinary tract symptoms

Increased risk	Decreased risk	No change
Obesity	Physical activity and exercise	Herbs: Saw palmetto
Diet	Diet	
Macronutrients: red meat, fat, milk and dairy products, cereals, bread, poultry, and starch	Macronutrients: vegetables (tomatoes and carrots) and fruits	
Alcohol (LUTS)	Micronutrients: lycopene; selenium, carotene; Vitamins A, C, D and E; polyunsaturated fatty acids; linoleic acid, and zinc	
	Moderate alcohol consumption (symptomatic BPH)	

BPH, benign prostatic hyperplasia; LUTS, lower urinary tract symptoms.

[21]. Other studies have observed that obesity increases the risks of BPH surgery, initiation of BPH medical therapy, and LUTS [22–24].

Obesity and 5 α -reductase inhibitors

5ARIs (finasteride and dutasteride) decrease serum concentrations of dihydrotestosterone [25], prevent clinical progression of BPH and LUTS [26], and prevent incident symptomatic BPH [27^{*}]. A recent analysis of the PCPT observed that obesity diminishes the efficacy of finasteride for the prevention of symptomatic BPH [27^{*}]. Similarly, a secondary analysis of the Reduction by Dutasteride of Prostate Cancer Events (REDUCE) trial concluded that obesity enhanced prostate volume growth and attenuated prostate volume reduction by dutasteride. These investigators speculated that the effect of obesity on men treated with dutasteride is likely a balance between dutasteride-driven prostate volume reduction and obesity-driven prostate volume growth [28^{**}].

PHYSICAL ACTIVITY AND EXERCISE

Increased physical activity and exercise have been robustly and consistently linked with decreased risks of BPH and LUTS [29,30]. A meta-analysis of 11 published studies ($n=43\,083$ men) combined eight studies that observed inverse, two studies null, and one study equivocal associations of physical activity with BPH or LUTS. This study stratified the physical levels of activities into light, moderate, and vigorous categories, with a sedentary category for reference. When compared with the sedentary group, the pooled odds ratios (OR) for BPH or LUTS were 0.70 (95% confidence interval, CI 0.44–1.13, $P=0.14$), 0.74 (95% CI 0.60–0.92, $P=0.005$), and 0.74 (95% CI 0.59–0.92, $P=0.006$) for men engaging in light, moderate, and heavy physical activity, respectively [29]. These investigators concluded that moderate-to-vigorous physical activity was associated with up to a 25% decreased risk of BPH or LUTS, with the magnitude of the protective effect increasing with the higher levels of activity [29].

A study in Italy investigated the association between physical activity and the risk of developing histological BPH over different lifetime periods in 1369 men. Multivariate OR for BPH for heavy/strenuous level were 0.6 (95% CI, 0.4–0.8) at age 15–19 years, 0.6 (95% CI, 0.4–0.8) at age 30–39 years and 0.7 (95% CI, 0.5–0.9) at age 50–59 years. Interestingly, compared with less than 2 h/week of recreational physical activities, the odd ratios for BPH for the highest level ($>$ or $=5$ h/week) were 0.5 (95% CI, 0.4–0.7) at age 15–19, 0.6 (95% CI, 0.5–0.8) at age

30–39, and 0.7 (95% CI, 0.5–0.8) at age 50–59 years [30].

DIET

There are indications that both macronutrients and micronutrients may affect the risk of BPH and LUTS.

Macronutrients

For macronutrients, increased total energy intake, energy-adjusted total protein intake, red meat, fat, milk and dairy products, cereals, bread, poultry, and starch potentially increase the risks of symptomatic BPH and BPH surgery [31]. In contrast, vegetables (particularly carotenoids such as tomatoes and carrots), and fruits potentially decrease the risks of BPH [32]. One potential explanation is that vegetables and fruits contain high levels of antioxidants, polyphenols, vitamins, minerals, and fiber that may play important roles in altering inflammatory pathways associated with the pathogenesis of BPH.

Micronutrients

For micronutrients, higher circulating concentrations of vitamin E, lycopene, selenium, and carotene have been inversely associated with symptomatic BPH and LUTS [33–35], zinc and vitamin C have been associated with both increased and decreased risk [33,34,36] and polyunsaturated fatty acids, linoleic acid, Vitamin A, and Vitamin D have been associated with decreased risks [34,36].

Alcohol

Previous studies have shown that moderate alcohol intake appears to be protective against BPH [18,32]. However, the same protective effect does not appear to apply to LUTS. In a meta-analysis of 19 studies that incorporated 120 091 men and divided total alcohol intake (grams per day) into six strata, alcohol intake was associated with a significantly or marginally significantly decreased likelihood of BPH in all six strata (P values 0.08, 0.01, <0.001 , 0.02, 0.001, and <0.001 , respectively). In addition, compared to no alcohol intake, an alcohol intake of 36 g per day or greater was associated with a 35% decreased likelihood of BPH (OR 0.65, 95% CI 0.58–0.74, $P < 0.001$). However, of the four studies that used LUTS as the primary outcome, three demonstrated a significantly increased likelihood of LUTS with alcohol consumption [37].

Serenoa repens

Early Cochrane systematic reviews and meta-analyses of randomized clinical trials of the herb

Serenoa repens (Saw palmetto) for the treatment of BPH and LUTS in 2000 and 2002 concluded that it diminished LUTS and improved urinary flow parameters [38,39]. However, updated reviews in 2009 [40] and 2012 [41], which included more randomized trials and higher quality clinical evidence, concluded that *Serenoa repens* did not decrease LUTS, diminish nocturia, improve urinary flow parameters, or reduce prostate size. The most common commercialized extract of Saw palmetto used in these trials was Permixon (Pierre Fabre Médicament, Castres, France) [42–46].

CONCLUSION

Obesity, physical activity, and diet substantially alter the risks of symptomatic BPH and LUTS. 5ARIs exhibit diminished efficacy in obese patients. Multiple trials of saw palmetto have demonstrated no significant efficacy in the treatment of symptomatic BPH or LUTS. Although clinical trials of lifestyle modifications have yet to be undertaken, it is reasonable to promote weight loss, exercise, and healthy diet within the context of standard treatments for symptomatic BPH and LUTS.

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Conflicts of interest

J.K.P. is a speaker for American Medical Systems and consultant for Sophiris.

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- of special interest
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