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Physical Activity and Chronic Prostatitis/Chronic Pelvic Pain Syndrome

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Abstract

Purpose—Chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS) is a prevalent urologic disorder among men, but its etiology is still poorly understood. Our objective was to examine the relationship between physical activity and incidence of CP/CPPS in a large cohort of male health professionals.

Methods—We conducted a prospective cohort study among men in the Health Professionals Follow-up Study followed from 1986 to 2008. The study population included 20,918 men who completed all CP/CPPS questions on the 2008 questionnaire. Leisure-time physical activity, including type and intensity of activity, was measured by questionnaire in 1986. A National Institute of Health Chronic Prostatitis Symptom Index pain score was calculated based on the responses on the 2008 questionnaire. Participants with pain scores ≥ 8 were considered CP/CPPS cases (n=689).

Results—Higher leisure-time physical activity was associated with lower risk of CP/CPPS. The multivariable-adjusted odds ratio (OR) comparing >35.0 to ≤ 3.5 MET-h/wk of physical activity

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CONFLICT OF INTEREST

None. The results of the present study do not constitute endorsement by ACSM.

was 0.72 (95% confidence interval (CI): 0.56, 0.92, p for trend <0.001). Observed inverse associations between physical activity and CP/CPPS were similar for both moderate- and vigorous-intensity activities. Sedentary behavior, measured as time spent watching television, was not associated with risk of CP/CPPS (p for trend 0.64).

Conclusions—Findings from this study, the first large scale and most comprehensive study to date on this association, suggest that higher levels of leisure-time physical activity may lower risk of CP/CPPS in middle-aged and older men.

Keywords

exercise; epidemiology; prostate; risk factors; chronic pain; walking

INTRODUCTION

Chronic prostatitis is a prevalent urological condition among men in the U.S. and worldwide (33). In the U.S., depending on the population or method of diagnosis (e.g. physician-diagnosed vs. self-reported), prevalence of chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS) has been reported to range from 1.8% – 6.3% (6, 7, 9, 20, 33). Considering that a prevalence of 1.8% is equivalent to approximately 2 million cases (33), the substantial impairment in quality of life associated with this disease (27, 34), as well as the significant economic impact with annual total cost of \$4397 per patient (10), CP/CPPS is an important public health problem. Furthermore, unlike benign prostatic hyperplasia (BPH) which is more prevalent among elderly men, chronic prostatitis affects men of all ages and ethnicities (13). The National Institutes of Health (NIH) consensus classification of the prostatitis syndromes released in 1995 categorized prostatitis into 4 clinical entities: I. Acute bacterial prostatitis; II. Chronic bacterial prostatitis; III. Chronic prostatitis/chronic pelvic pain syndrome (CP/CPPS); IV. Asymptomatic inflammatory prostatitis (15). It has been estimated that only 5 to 10% of prostatitis patients have acute or chronic bacterial infection, whereas the majority of men with prostatitis (about 90–95%) experience chronic pelvic pain without any evidence of infection (category III) (13).

The etiology of CP/CPPS remains largely unknown. Recently a possible interplay of autoimmune, neuroendocrine and psychological factors has been implicated in the pathogenesis of CP/CPPS (25). Several authors have suggested that it is unlikely that CP/CPPS is an organ-specific condition, but should rather be conceptualized as a urogenital manifestation of a combination of systemic inflammatory pain and/or autonomic dysregulation (24, 26). One randomized controlled trial showed that aerobic exercise was superior to motion/stretching exercises in improving pain severity among CP/CPPS patients (11). Regular physical activity is related to various health benefits through its anti-inflammatory effects, positive effect on parasympathetic tone, and changes in brain neurotransmitters such as serotonin, dopamine or acetylcholine, which may decrease sensitivity to pain (21, 29). However, no study has comprehensively examined the effect of exercise on prevention of CP/CPPS. Therefore, we examined the association between total leisure-time physical activity, type, and intensity of physical activity and risk of CP/CPPS in the Health Professionals Follow-up Study.

METHODS

Study population

The Health Professionals Follow-Up Study (HPFS) is an ongoing prospective cohort study of U.S. men. At enrollment in 1986, 51,529 male dentists, pharmacists, veterinarians, optometrists, osteopathic physicians, and podiatrists between 40 and 75 years of age completed a baseline questionnaire that included questions on age, ethnicity, lifestyle assessment, and medical history. Information on medical conditions and lifestyle factors was updated through biennial follow-up questionnaires.

For the current analysis, we restricted our study population to men who completed the 2008 HPFS follow-up questionnaire that included questions assessing CP/PPS symptoms ($n = 31,214$). We additionally excluded men with cancer (other than non-melanoma skin cancer) diagnosed before 1986, incomplete dietary data (left 70 or more food items blank on the dietary questionnaire) or implausible caloric intake (<800 or >4200 kcal/day), missing year of birth, and missing information on physical activity, leaving 29,690 men available for this study.

Case ascertainment

In 1999, the National Institute of Health Chronic Prostatitis Collaborative Research Network developed the National Institute of Health Chronic Prostatitis Symptom Index (NIH-CPSI) to facilitate diagnosis and evaluation of CP/PPS (16). Questions inquiring about CP/PPS related pain (frequency, severity, location, age at start of symptoms) were included on the 2008 HPFS follow-up questionnaire. On the 2008 questionnaire, participants were asked: a) during the past month how often have you experienced pain or discomfort in any of these areas or circumstances (never, rarely, sometimes, often, usually, always): area between rectum and testicles (perineum), testicles, tip of the penis not related to urination, below your waist in your pubic or bladder area, pain or burning during urination, pain or discomfort during or after sexual climax (ejaculation); b) during the past month on a scale on 1 to 10, how would you rate your average severity of pain or discomfort on the days that you had symptoms listed (0 as no pain, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 as pain as bad as you can imagine); c) if you had pain related to the areas noted above, when did you first experience this: before 1960, 60–70, 71–85, 86–90, 91–95, 96–2000, 2001–2004, after 2004. The pain domain score was calculated by summing up the presence of pain at 6 different areas or circumstances (1 point for each), frequency of the pain (the maximum score of all locations; rarely = 1 point and always = 5 points), and average severity of the pain (scale of 1 to 10). CP/PPS cases were defined as men presenting with pain in the preceding month with intensity of 8 points or greater on the NIH-CPSI pain domain (20).

In order to rule out medical or comorbid conditions that may be misperceived as symptoms of CP/PPS, we further excluded participants with prostate, bladder and urethral cancer, inflammatory bowel diseases, and neurological diseases or disorders affecting the bladder (Parkinson's disease and multiple sclerosis during HPFS follow-up) ($n = 4839$). Due to a potential reverse causation, only participants who reported first experiencing CP/PPS related pain after 1986, i.e. after baseline, were included as a case in our analysis. Cases

reporting CP/CPPS related pain prior to 1986 (n = 124) or cases who did not complete the question on date of onset of CP/CPPS related pain (n = 42) were excluded. After excluding men who did not complete the questions assessing CP/CPPS pain on the 2008 questionnaire, 20,918 men were included in the final analysis.

Assessment of physical activity

In 1986, we asked participants to report on average how much time per week they engaged in each of ten recreational activities over the previous year: walking or hiking outdoors (including walking at golf), jogging (slower than 10 minutes per mile), running (10 minutes per mile or faster), bicycling (including stationary machine), lap swimming, tennis, squash or racquetball, and rowing or calisthenics. Information on walking pace, categorized as easy (< 2 miles/hour), normal (2 – 2.9 miles/hour), brisk (3 – 3.9 miles/hour), or striding (≥ 4 miles/hour), was also collected. To calculate total amount of leisure-time physical activity, a metabolic equivalent task (MET) score was assigned to each activity in 1986 based on its energy cost: jogging, 7.0; running, 12.0; biking, 7.0; swimming, 7.0; tennis, 7.0; racquetball or squash, 12.0; and rowing or calisthenics, 6.0 (1). Total MET-hours/week was then calculated by multiplying the time spent at each activity by its MET score and summing over all activities. Brisk walking was considered a moderate activity (3 – 6 METs) and the other 9 activities were considered vigorous activities (≥ 6 METs) (22). In 1988, participants were also asked about their average weekly time spent watching television or videotapes, as an assessment of inactivity.

The validity and reproducibility of the physical activity questionnaire have been assessed previously (5). Pearson correlations between four 1-week diaries and the questionnaire was 0.65 for total activity, 0.58 for vigorous-intensity activity, and 0.28 for non-vigorous activity. The Spearman correlation between questionnaire-derived vigorous activity and resting pulse rate was –0.45.

Assessment of other covariates

Information on dietary factors was collected from semi-quantitative food frequency questionnaires (SFFQs) and nutrient intake was calculated as the frequency of intake multiplied by the nutrient composition of each food (35). As a measure of diet quality, Alternate Healthy Eating Index (aHEI) scores were then calculated. The scoring methods and justification have been described in more detail elsewhere (18). We also collected the information on lifestyle and other health-related factors, such as body weight, height, smoking status, alcohol consumption, and hypertension. In addition, due a potential overlap in clinical symptoms between CP/CPPS and benign prostate hyperplasia (BPH), we also took into account a medical history of BPH. In HPFS, we collected information about surgically treated BPH (e.g. Transurethral resection of the prostate, TURP) every two years since 1988, using medication for BPH since 1996, and International Prostate Symptom Score (I-PSS) in 1992, 1994, 1998, 2000, and 2008(23). Participants with CP/CPPS who first experienced CP/CPPS symptoms after their BPH diagnosis were considered as developing CP/CPPS with a history of BPH.

Statistical analysis

Participants were divided into five categories of leisure-time physical activity: 0 – 3.5, 3.6 – 8.8, 8.9 – 21.0, 21.1 – 35.0, and > 35.0 MET-h/wk, based upon the distribution in the population and informative cutpoints. For example, 3.5 MET-h/wk corresponds to 1 hour of moderate or 0.5 hour of vigorous activity and 8.8 MET-h/wk to 2.5 hours of moderate or 1.25 hours of vigorous activity, which is the minimum dose of activity recommended by the federal government (22). We computed age-standardized means and percentages for demographic and lifestyle factors by categories of physical activity. To evaluate the association of leisure-time physical activity with risk of CP/CPPS, we calculated odds ratios (ORs) and corresponding 95% confidence intervals (CIs) using logistic regression models. Multivariable logistic regression models adjusted for age, ethnicity, body mass index (BMI), cigarette smoking, alcohol, BPH history, diagnosis of hypertension and aHEI score. To determine whether associations were modified by BMI or BPH history, we stratified by BMI (< 25 or ≥ 25 kg/m²) and BPH history (yes or no). In addition, we examined specific type of activities separately while adjusting for all other activities simultaneously, using categories of 0, 0.08 – 0.66, 0.67 – 1.99, and ≥ 2.00 hours/week. As a measure of inactivity, time spent in watching television was categorized into 0 – 5, 6 – 10, 11 – 20, and ≥ 21 hours/week. To test for trend, we used the median value of each physical activity category modeled as a continuous variable in multivariable models. To test for multiplicative interaction, we conducted models with and without a cross-product term for physical activity and stratifying factors. All analyses were conducted using SAS release 9.2.

This study was approved by the Institutional Review Board (IRB) of the Harvard School of Public Health. Informed consent was implied by completion of the questionnaire.

RESULTS

Among the 20,918 participants in our study population, 689 men reported experiencing CP/CPPS symptoms. Median leisure-time physical activity in the cohort was 12.9 MET-h/wk. Walking had the greatest contribution to leisure-time activity, followed by running, playing tennis, biking, and rowing or calisthenics.

Age standardized baseline characteristics of the study participants according to levels of physical activity are shown in Table 1. In general, more physically active participants led a more health-conscious lifestyle and ate a healthier diet. Men who were more physically active were less likely to smoke, were leaner, ate more vegetables and fruits, drank more alcohol and were less likely to have a history of hypertension.

The association of physical activity with risk of CP/CPPS is shown in Table 2. Total leisure-time physical activity was significantly inversely associated with risk of CP/CPPS.

Comparing > 35.0 to 0 – 3.5 MET-h/wk of physical activity, the OR for CP/CPPS was 0.72 (95% CI 0.56 – 0.92, *p* for trend <0.001). When associations between leisure-time physical activity and CP/CPPS were examined separately by intensity, inverse associations were similar for moderate- and vigorous-intensity activities (Table 2). Comparing highest and lowest categories of physical activity, ORs for CP/CPPS were 0.77 (95% CI 0.59 – 1.02, *p* for trend 0.02) for vigorous activity, and 0.69 (95% CI 0.43 – 1.10, *p* for trend 0.01) for

moderate activity. We also investigated the joint association of moderate and vigorous physical activity. Compared to men who had high physical activity levels of either moderate- or vigorous-intensity (> 8.8 MET-h/wk), those who engaged in high levels of both moderate- and vigorous-intensity activity did not demonstrate additional reduction in risk of CP/CPPS (Figure 1) (P for interaction = 0.03).

Next, we examined whether observed associations between physical activity and CP/CPPS were modified by BMI or history of BPH (Table 3). The relationship between leisure-time physical activity and CP/CPPS was similar for overweight (highest vs. lowest category: OR 0.67, 95% CI 0.47 – 0.94, p for trend 0.007) and normal weight men (OR 0.76, 95% CI, 0.53 – 1.09, p for trend 0.04; p for interaction 0.64). The inverse associations between leisure-time physical activity and risk of CP/CPPS were also comparable among men with or without medical history of BPH (for the same comparison, among men with BPH history: OR 0.67, 95% CI 0.45 – 0.99, p for trend 0.02; in men without BPH history: OR 0.75, 95% CI 0.55 – 1.03, p for trend 0.02; p for interaction 0.91).

We also investigated the association between individual activities and CP/CPPS risk (Table 4). After simultaneously adjusting for the other seven activities, brisk walking was significantly inversely associated with CP/CPPS. Brisk walking for at least 2 hours per week compared with no brisk walking had OR of 0.77 (95% CI, 0.61 – 0.97, p for trend 0.04). Rowing or calisthenics was also associated with a lower risk of CP/CPPS (p for trend 0.01), although the number of cases was small. We observed some evidence for an inverse association between other activities and CP/CPPS, although none of them reached statistical significance. Inactivity, measured as time spent watching television per week, was not significantly associated with an increased risk of CP/CPPS (p for trend 0.64).

To further limit the possibility of reverse causation, we excluded men with CP/CPPS who first experienced pain within the first 5 years (n=67) or 10 years (n=136) of HPFS follow-up and obtained similar results (Table, Supplemental Digital Content 1, Association between total physical activity and risk of CP/CPPS, Health Professionals Follow-up Study, 1991 – 2008). We also conducted stratified analyses by age (< 65 or ≥ 65 years old), smoking status (never or ever smoked) and alcohol intake (< 6g/day or ≥ 6g/day). Results were similar between stratified groups (Table, Supplemental Digital Content 2, Odds ratios (95% CI) of CP/CPPS according to categories of physical activity, stratified by age, smoking status, and alcohol intake, Health Professionals Follow-up Study).

DISCUSSION

In this large prospective study of U.S. men, we observed an inverse association between leisure-time physical activity and the risk of developing CP/CPPS. The reduction in risk was similar for vigorous and moderate activities, and did not vary substantially by BMI or BPH history. Among individual activities, brisk walking demonstrated the greatest benefit.

Data relating physical activity to the risk of CP/CPPS are scarce; nonetheless, studies have examined the role of physical activity in the management of CP/CPPS. A cross-sectional study among African-American men residing in Genesee County, Michigan found that men

with higher vigorous physical activity were 70% less likely to have a history of prostatitis (37). However, this study had several methodological limitations, including a small number of cases (n=47) and failure to adjust for potential confounding factors. In 2007, Giubilei et al. conducted a randomized prospective trial to investigate the effect of physical activity in patients diagnosed with CP/CPPS (11). They recruited 103 men, 20 to 50 years old, with CP/CPPS who were unresponsive to conventional treatments and assigned them to two treatment groups: aerobic exercise or placebo/stretching. After 18 weeks of intervention, participants in the aerobic exercise group on average demonstrated a greater reduction in NIH-CPSI pain score than those in the placebo/stretching group (aerobic exercise $-4.4 (\pm 3.4)$ vs. stretching/motion exercise $-2.5 (\pm 2.2)$, p for group difference <0.001). Although the current study focused on prevention of CP/CPPS versus management of symptoms, we found similar results in that more active participants were at lower risk of CP/CPPS. When we examined intensity of physical activity, inverse associations between physical activity and CP/CPPS were similar for vigorous and moderate activities. Walking is the most common leisure activity in the U.S. population (8) and our results suggest that in terms of risk reduction, brisk walking may offer the same beneficial effect as more vigorous activities. Furthermore, this protective effect may be independent of BMI.

Previously, using an internet survey in CP/CPPS patients, Alexander and Trisell found that approximately 37% of respondents believed their symptoms could be related to a particular behavior, such as sitting or driving (2). A study by Rabon suggested that repetitive perineal trauma resulting from occupational or recreational activities, specifically riding rough motor vehicles, could cause flare-ups of CP/CPPS (28). When we examined associations by type of physical activity, the activity with the greatest potential to directly stimulate the perineal area, bicycling, was not associated with an increased risk of CP/CPPS. With respect to sitting/inactivity, after simultaneously controlling for BMI and physical activity, we did not find an association between television watching and an increased risk of CP/CPPS. Nonetheless, we cannot exclude the possibility that these activities may aggravate symptoms once someone has already been diagnosed with CP/CPPS.

Even after decades of research, the etiology of CP/CPPS is still unknown (25). Recently, a possible interplay of inflammatory, neuroendocrine and psychological factors has been proposed in the pathogenesis of CP/CPPS (24, 26). The mechanisms through which physical activity may lower risk of CP/CPPS or improve symptoms are unclear, but physical activity can affect several biological pathways that are etiologically relevant for CP/CPPS. First, physical activity has anti-inflammatory properties (21) and higher levels of physical activity have been shown to decrease plasma levels of inflammatory markers such as CRP (17). Therefore, regular exercise may lower risk of CP/CPPS by improving localized or systemic inflammatory status.

Next, chronic pain experienced by CP/CPPS patients may also be a result of abnormal neuroendocrine function involving over-secretion of prostaglandin E_2 (PGE_2) and inhibition of β -endorphin (32). Physical activity may decrease pain sensitivity through changes in neuroendocrine and autonomic nerve function (12), in particular through an increase in endogenous endorphins and modifications to neurotransmitter systems including the dopaminergic, noradrenergic or serotonergic systems (19, 30, 39). Patients with CP/CPPS

and “central pain” syndromes, such as fibromyalgia or chronic fatigue syndrome, often present with similar or overlapping symptoms. Therefore, it has been suggested to view and treat CP/CPPS as another “central pain” syndrome instead of a prostatic disease (3, 31). Interestingly, data from intervention trials and meta-analyses suggest that exercise may reduce severity of symptoms associated with several “central pain” related syndromes and exercise is often included in the management of fibromyalgia or chronic fatigue syndrome (4, 14, 36, 38).

To our knowledge, this is the first large prospective study to comprehensively examine the relationship between leisure-time physical activity and risk of CP/CPPS. Major strengths of the HPFS cohort include its large sample size, long follow-up, high follow-up rate, prospective design, and comprehensive and valid measurements of wide spectrum of dietary and lifestyle factors.

Our study also had some limitations that should be considered. First, we used self-reported data to assess CP/CPPS symptoms and leisure-time physical activity. However, our physical activity questionnaire was validated in subset of HPFS participants (5) and, due to the prospective study design, any misclassification of exposure would be non-differential with respect to subsequent disease status and generally results in bias towards the null. As the endpoint in this study is based on self-reported symptoms, we cannot exclude the possibility of misclassification of the outcome. However, given that physical activity was measured prospectively in 1986, several years before participants reported on CP/CPPS symptoms, we believe the likelihood of this misclassification resulting in bias is minimal. Our study population, consisting of predominantly white, male health professionals, is not representative of the general population. Thus, we cannot necessarily generalize our results to other populations with different educational levels, incomes, or distributions of race and ethnicity. In addition, because of the lack of data on risk factors for CP/CPPS, we cannot exclude the possibility of residual confounding due to known and unknown confounders. Nonetheless, in most instances, age- and multivariable-adjusted estimates were similar and we adjusted for many important lifestyle factors such as BMI, smoking, alcohol intake, hypertension and overall dietary pattern. Another limitation of this study is the potential for bias due to loss of follow-up. Participants who were lost to follow-up in 2008, e.g. due to death or major illnesses, may differ with regard to lifestyle or dietary factors from those who responded to the questionnaire in 2008. However, follow-up rates for each questionnaire cycle have been around 90% in the HPFS cohort and using information from the National Death Index, next of kin or postal service, we are able to identify almost all deaths in our cohort. Further, both BMI and smoking were not associated with CP/CPPS in our cohort (data not shown) and adjustment for important lifestyle factors yielded similar results.

Findings from this study, the first large scale and comprehensive study on this association, suggest that higher leisure-time physical activity may lower risk of CP/CPPS. Raising physical activity intensity levels beyond moderate intensity levels may not provide further benefit. Thus, if confirmed in other studies, our results indicate that moderate physical activity such as brisk walking may provide a relatively easy means to prevent this debilitating disease.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Odds ratios (95% CI) for CP/PPS according to combinations of vigorous and moderate physical activity

Reference was men with low moderate (≤ 8.8 MET-h/wk) and low vigorous physical activity (≤ 8.8 MET-h/wk). P for interaction = 0.03.

Table 1

Age-standardized participant characteristics* according to physical activity levels in 1986, Health Professionals Follow-up Study

	Categories of physical activity (MET-h/wk)				
	0 – 3.5 (n = 4,909)	3.6 – 8.8 (n = 3,563)	8.9 – 21.0 (n = 5,192)	21.1 – 35.0 (n = 3,192)	> 35.0 (n = 4,062)
Total physical activity (MET-h/wk)	1.3	6.0	14.6	28.0	63.7
Vigorous activity (h/wk)	0.04	0.3	1.1	2.2	5.2
Moderate activity (h/wk)	0.07	0.4	0.9	1.5	2.5
Low activity (h/wk)	0.2	0.7	0.8	1.2	1.5
Age (years)	50.8	50.9	51.1	50.4	50.1
Race (%)					
White	95.8	95.9	96.2	96.0	95.4
African-American	0.8	0.5	0.5	0.7	0.4
Asian	1.4	1.3	1.5	1.2	1.7
Other	2.0	2.2	1.9	2.1	2.5
Smoking (%)					
Current	10.8	8.7	6.3	6.1	5.2
Past	39.1	38.8	42.1	42.8	41.4
Never	50.0	52.5	51.6	51.1	53.3
Body Mass Index (kg/m ²)	25.9	25.7	25.2	25.0	24.6
History of Hypertension (%)	17.8	16.5	16.8	14.9	13.2
Dietary intake					
Alcohol (g/day)	10.3	10.9	11.1	11.3	12.0
Vegetables (servings/day)	3.4	3.6	3.8	3.9	4.1
Fruit (servings/day)	2.0	2.2	2.4	2.6	2.8
Red meat (servings/day)	0.7	0.7	0.6	0.6	0.5
Fish (servings/day)	0.4	0.4	0.4	0.4	0.5

Abbreviation: MET, metabolic equivalent.

* All values are means for continuous variable or frequencies for categorical variables; all except age are age-standardized.

Table 2

Association between total physical activity, intensity of activity, and risk of CP/CPPS, Health Professionals Follow-up Study

Categories of physical activity (MET-h/wk)						
	0 – 3.5	3.6 – 8.8	8.9 – 21.0	21.1 – 35.0	> 35.0	P for trend
Total physical activity						
No. of cases	193	140	171	75	110	
Age-adjusted OR	1.00	1.00	0.83	0.59	0.68	
95% CI		(0.80, 1.25)	(0.67, 1.02)	(0.45, 0.77)	(0.54, 0.86)	<0.001
Multivariable-adjusted OR*	1.00	1.02	0.85	0.61	0.72	
95% CI		(0.81, 1.27)	(0.69, 1.05)	(0.47, 0.81)	(0.56, 0.92)	<0.001
Physical activity by intensity[†]						
Vigorous activity						
No. of cases	372	77	121	54	65	
Age-adjusted OR	1.00	0.99	0.81	0.68	0.73	
95% CI		(0.77, 1.27)	(0.66, 1.00)	(0.51, 0.91)	(0.56, 0.96)	0.003
Multivariable-adjusted OR*	1.00	1.01	0.84	0.71	0.77	
95% CI		(0.78, 1.30)	(0.67, 1.03)	(0.53, 0.95)	(0.59, 1.02)	0.02
Moderate activity						
No. of cases	399	157	90	24	19	
Age-adjusted OR	1.00	0.96	0.77	0.71	0.67	
95% CI		(0.80, 1.16)	(0.61, 0.97)	(0.47, 1.09)	(0.42, 1.07)	0.009
Multivariable-adjusted OR*	1.00	0.97	0.78	0.73	0.69	
95% CI		(0.80, 1.17)	(0.62, 0.99)	(0.48, 1.11)	(0.43, 1.10)	0.01

Abbreviations: CP/CPPS, chronic prostatitis/chronic pelvic pain syndrome; MET, metabolic equivalent.

* Multivariable models adjusted for age (5-year interval), ethnicity (white, African-American, Asian, other), BMI (<25.0, 25.0–27.4, 27.5–29.9, 30.0), cigarette smoking (never smoked, quit at least 10 years, quit less than 10 years, current smokers <15, 15 cigarettes/day), alcohol intake (<1.0, 1.0–4.9, 5.0–14.9, 15.0–29.9, 30.0 g/day), BPH history (yes or no), diagnosis of hypertension (yes or no), aHEI (in quintiles).

Models included vigorous- and moderate-intensity activities simultaneously.
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Table 3

Odds ratios (95% CI) of CP/CPPS according to categories of physical activity, stratified by BMI* and BPH history†, Health Professionals Follow-up Study

Physical activity MET-h/wk	BMI < 25 kg/m ²			BMI ≥ 25 kg/m ²		
	OR	95% CI	P for trend	OR	95% CI	P for trend
0 – 3.5	1.00			1.00		
3.6 – 8.8	1.00	(0.72, 1.40)		1.03	(0.76, 1.38)	
8.9 – 21.0	0.75	(0.54, 1.03)		0.94	(0.70, 1.25)	0.64
21.1 – 35.0	0.55	(0.37, 0.82)		0.66	(0.45, 0.97)	
> 35.0	0.67	(0.47, 0.94)	0.007	0.76	(0.53, 1.09)	0.04

With BPH history			Without BPH history		
Physical activity MET-h/wk	OR	95% CI	P for trend	OR	95% CI
0 – 3.5	1.00			1.00	
3.6 – 8.8	0.97	(0.69, 1.38)		1.05	(0.78, 1.40)
8.9 – 21.0	0.92	(0.67, 1.27)		0.79	(0.59, 1.05)
21.1 – 35.0	0.70	(0.46, 1.05)		0.55	(0.38, 0.79)
> 35.0	0.67	(0.45, 0.99)	0.02	0.75	(0.55, 1.03)

Abbreviations: CP/CPPS, chronic prostatitis/chronic pelvic pain syndrome; MET, metabolic equivalent; OR, odds ratio; CI, confidence interval.

* Adjusted for age (5-year interval), ethnicity (white, African-American, Asian, other), cigarette smoking (never smoked, quit at least 10 years, current smokers <15, ≥ 15 cigarettes/day), alcohol intake (<1.0, 1.0–4.9, 5.0–14.9, 15.0–29.9, ≥ 30.0 g/day), BPH history (yes or no), diagnosis of hypertension (yes or no), and aHEI (in quintiles).

† Adjusted for age (5-year interval), ethnicity (white, African-American, Asian, other), BMI (<25.0, 25.0–27.4, 27.5–29.9, ≥ 30.0), cigarette smoking (never smoked, quit at least 10 years, quit less than 10 years, current smokers <15, ≥ 15 cigarettes/day), alcohol intake (<1.0, 1.0–4.9, 5.0–14.9, 15.0–29.9, ≥ 30.0 g/day), diagnosis of hypertension (yes or no), and aHEI (in quintiles).

Table 4
Relationship between specific physical activities, inactivity and CP/CPPS, Health Professionals Follow-up Study

Activity*	Time spent in participating in physical activity (hours/week)				
	0	0.08 – 0.66	0.67 – 1.99	2.00	P for trend
Brisk walking					
No. of cases	447	67	83	92	
OR	1.00	0.86	0.97	0.77	
95% CI		(0.66, 1.12)	(0.76, 1.23)	(0.61, 0.97)	0.04
Jogging					
No. of cases	596	47	37	9	
OR	1.00	1.15	1.15	0.64	
95% CI		(0.84, 1.57)	(0.82, 1.62)	(0.33, 1.24)	0.55
Running					
No. of cases	582	33	33	41	
OR	1.00	1.32	0.77	0.91	
95% CI		(0.91, 1.90)	(0.53, 1.10)	(0.65, 1.27)	0.33
Biking					
No. of cases	521	85	60	23	
OR	1.00	0.89	1.08	0.82	
95% CI		(0.70, 1.13)	(0.82, 1.42)	(0.54, 1.26)	0.59
Swimming					
No. of cases	633	35	17	4	
OR	1.00	1.04	0.99	0.46	
95% CI		(0.73, 1.47)	(0.61, 1.63)	(0.17, 1.24)	0.20
Tennis					
No. of cases	595	16	38	40	
OR	1.00	0.73	1.22	0.89	
95% CI		(0.44, 1.21)	(0.87, 1.71)	(0.64, 1.24)	0.77
Racquetball/squash					
No. of cases	655	7	12	15	
OR	1.00	0.64	0.63	0.83	

Time spent in participating in physical activity (hours/week)					
Activity*	0	0.08 – 0.66	0.67 – 1.99	2.00	P for trend
95% CI		(0.30, 1.36)	(0.35, 1.12)	(0.49, 1.39)	0.19
Rowing/calisthenics					
No. of cases	549	83	44	13	
OR	1.00	0.91	0.79	0.51	
95% CI		(0.72, 1.16)	(0.57, 1.08)	(0.29, 0.89)	0.01
Time spent in watching television/videotapes (hours/week)					
Inactivity [†]	0 – 5	6 – 10	11 – 20	21	P for trend
No. of cases	184	177	171	59	
OR	1.00	1.00	0.96	0.95	
95% CI		(0.81, 1.23)	(0.77, 1.19)	(0.70, 1.28)	0.64

Abbreviations: CP/CPPS, chronic prostatitis/chronic pelvic pain syndrome; OR, odds ratio; CI, confidence interval;

* Adjusted for age (5-year interval), ethnicity (white, African-American, Asian, other), BMI (<25.0, 25.0–27.4, 27.5–29.9, 30.0), cigarette smoking (never smoked, quit at least 10 years, quit less than 10 years, current smokers <15, 15 cigarettes/day), alcohol intake (<1.0, 1.0–4.9, 5.0–14.9, 15.0–29.9, 30.0 g/day), BPH history (yes or no), diagnosis of hypertension (yes or no), and aHEI (in quintiles); and included all other types of physical activities simultaneously.

[†] Adjusted for all covariates in multivariate model a (except individual activities) and total physical activity (0–3.5, 3.6–8.8, 8.9–21.0, 21.1–35.0, and > 35.0 MET-h/wk).