

Determinants Associated with Participation in Physical Activity Among Patients with Prostate Cancer

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Research Article

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Abstract

Purpose

Physical activity (PA) has been evaluated for reducing side effects of cancer treatment and improving quality of life. Understanding the factors that affect participation in PA is essential to improve strategies for health promotion. We evaluated the determinants of PA among prostate cancer patients.

Methods

Ninety patients were divided into 'inactive or minimally active' or 'health enhancing physical activity' groups, based on their PA levels measured using the International Physical Activity Questionnaire (IPAQ). IPAQ score was used as the dependent variable. Clinical characteristics, including demographics, difficulties in urination or defecation, socioeconomic status, physical status and functions were used as the independent variables. Univariate and multivariate logistic regression analyses were performed.

Results

Univariate logistic regression analyses identified that urination and defecation difficulties were associated with lower PA. Multivariate logistic regression analyses revealed that urinary difficulties were associated with lower PA.

Conclusion

Knowledge of the factors that influence PA will allow physicians to identify patients who are expected to have less PA and intervene early. Urinary difficulties had a statistically significant association with lower PA, representing a barrier to PA. Early intervention is needed to overcome urinary difficulties considering the importance of PA in achieving optimal health outcomes.

Introduction

Prostate cancer has a higher 5-year survival rate after surgery compared to other cancers [1]. It is the second most commonly diagnosed cancer among men worldwide. It is also the most frequently diagnosed cancer in high-income countries of North and South America, Oceania, and Northern, Western, and Southern Europe. The incidence and survival rates for prostate cancer are improving because of advances in detection and treatment [2]. Considering the high survival rates, several studies have focused on methods to mitigate the complications of prostate cancer [3]. Several studies demonstrated that exercise was effective in reducing side effects of cancer treatment and improving the quality of life of patients with prostate cancer [3–5]. Other studies demonstrated that moderate or vigorous recreational physical activity (PA) improved the overall health and cancer outcomes, such as cancer-specific mortality, through improved

cardiovascular health [6]. In 2009, the American College of Sports Medicine organized an expert panel that recommended 150 min of moderate-intensity aerobic exercises (achieving 50–80% of maximum heart rate) per week for cancer survivors [7].

Recent studies have investigated the relationship between physical activity and sarcopenia. Several groups, including the European Society of Parenteral and Enteral Nutrition Special Interest Group [8], the International Working Group on Sarcopenia [9], the European Working Group on Sarcopenia in Older People [10], and the Asian Working Group for Sarcopenia [11], have proposed diagnostic criteria for sarcopenia. However, there is no universally accepted definition for sarcopenia.

The number of individuals with sarcopenia is increasing. Sarcopenia is associated with functional limitations (falls, disabilities, or fractures), increased mortality in older adults, and high medical expenditure. There are various causes of sarcopenia, including genetics, small body size, and reduced anabolic hormones. PA is important in older individuals because reduced physical activity with advancing age is a major cause of sarcopenia [12, 13].

Patients receiving androgen deprivation therapy (ADT) for prostate cancer lose approximately 2–4% of lean body mass in the first year of therapy because of marked reduction in testosterone levels. This decrease in lean body mass, known as sarcopenia, is often accompanied by increased fat mass. Low testosterone levels in prostate cancer patients receiving ADT are also associated with metabolic syndrome [14].

Despite evidence-based recommendations for PA in cancer survivors, recent studies have suggested that the majority of cancer patients, including prostate cancer survivors, have inadequate PA [15]. It is essential to understand the factors that affect participation in PA to improve strategies for health promotion. The aim of this study was to investigate the determinants of PA in prostate cancer patients. The data collected from prostate cancer patients included the International Physical Activity Questionnaire (IPAQ) for PA and information regarding demographics and socioeconomic, physical, and functional status.

Methods

Study design

We retrospectively analyzed the data from a previous study. The study design and eligibility criteria have been published previously [16]. This study was approved by the institutional review board, and written informed consent was obtained from all participants.

Participants

We enrolled 100 patients aged ≥ 50 years with histologically confirmed prostate adenocarcinoma treated with radical prostatectomy, radiation therapy, or ADT.

We excluded patients with (1) history of treatment for any other malignancy within the past month, (2) severe cardiopulmonary disease, (3) pain or risk for pathologic fracture due to bone metastasis, (4) inability to perform a 2-minute walking test (2MWT), (5) total knee or hip replacement, or (6) inability to participate in PA based on a physician's judgment.

The difference from the previous study was that those within 6 weeks of surgery were excluded, because PA levels were significantly decreased at six weeks after radical prostatectomy and recovered quickly to approximately baseline levels from that time according to a previous study [17].

Outcome measures

Self-reported data on demographics (e.g., age, smoking, and alcohol use), socioeconomic status (currently working), and education were collected.

Physical status (including height, weight, body mass index [BMI], appendicular skeletal muscle mass (ASM)) and physical functions (including maximal grip strength, gait speed, and five times sit to stand test) were recorded. ASM was defined as the sum of arm and leg skeletal muscle mass measured using a direct segmental multi-frequency bioelectrical impedance analysis system (InBody S10; InBody Co. Ltd., Seoul, South Korea). Relative skeletal muscle mass index (RSMI) was calculated by dividing ASM with the square of body height in meters [18]. Maximal handgrip strength was measured using a hand-held dynamometer. Patients applied maximal grip strength for three seconds with the shoulder adducted, elbow extended, and wrist and forearm in neutral position. The best score of three attempts for each hand was recorded. Gait speed was recorded during a 4-m walk at normal pace. Five times sit to stand test was recorded as the time taken for patients to rise five times from a chair to an upright position as quickly as possible without using their arms.

Functional disability was measured using the Functional Assessment of Cancer Therapy-Prostate (FACT-P) questionnaire (version 4) provided by the Center on Outcomes, Research, and Education (CORE) at Evanston Northwestern Healthcare (Evanston, IL, USA) [19]. FACT-P was previously translated and validated in Korean (<http://www.facit.org>) [20]. Responses to the following FACT-P statements about defecation and urination difficulties were recorded: 1) I have trouble moving my bowels; and 2) My problems with urinating limit my activities.

Background variables

Demographic variables included age (< 70 or \geq 70 years), basic education (bachelor's degree or lower qualification), and employment (employed or unemployed). Lifestyle variables included smoking (smoke/non-smoker), alcohol consumption (no/yes), and BMI (< 25 kg/m² or \geq 25 kg/m²).

Statistical analyses

Statistical analyses were performed using SPSS Statistics software (version 24.0; IBM Inc., Armonk, NY, USA). Categorical variables were expressed as frequencies, proportions, and medians, while continuous

variables were expressed as ranges, means, and standard deviations (SDs). PA measured by IPAQ was used as the dependent variable to identify its determinants. Patients were divided into 'inactive or minimally active' and 'health enhancing physical activity (HEPA)' groups based on the IPAQ results. Independent variables included demographics, difficulty in urination or defecation, socioeconomic status and physical status. Logistic regression analyses were used to identify factors associated with PA. Statistically significant ($p \leq .1$) and clinically relevant variables identified from the univariate logistic regression analyses were included in the multivariate logistic regression analyses.

Differences were considered statistically significant at p -value $< .05$ using two-tailed testing.

Results

Participant characteristics

Out of the 100 patients identified, 90 were included in this study. Among the excluded patients, four were not assessed at baseline and six had undergone surgery within the past 6 weeks.

Means were calculated for age (69.43 ± 7.30 years), BMI (24.33 ± 2.57), maximal grip strength (31.07 ± 6.40 kg), gait speed (4.47 ± 0.95), and five times sit to stand tests (9.09 ± 3.01) for all participants (Table 1).

PA levels

Participants were dichotomized into 'inactive or minimally active' ($n = 59$) or 'HEPA' ($n = 31$) groups based on their IPAQ scores.

Determinants of PA

Univariate logistic regression analyses demonstrated that urination and defecation difficulties, detected using FACT-P, were associated with lower PA. Multivariate logistic regression analyses demonstrated that urination difficulties were associated with lower PA (Table 2).

Discussion

In 2020, the World Health Organization updated the 2010 Global Recommendations on Physical Activity for Health [21]. They reaffirmed the fact that PA is required for optimal health outcomes, and provided new recommendations for reducing sedentary behavior, especially in patients with chronic diseases such as cancer [21].

PA has been demonstrated to improve quality of life and mitigate complications of cancer treatment. Knowledge of the factors that influence PA may allow physicians to identify the patients expected to have less PA and intervene early. Our findings are consistent with a previous study by Ottenbacher *et al.*, which demonstrated that disruption of activities due to urinary difficulties reduced PA among recently diagnosed prostate cancer patients in the United States and Canada [22]. It is important to manage urinary difficulties

because they adversely affect PA. A study in Korean prostate cancer survivors reported that patients with incontinence had a greater interest in Kegel and pelvic floor exercises [23]. Early identification of urinary difficulties is crucial for early interventions, such as educating and motivating patients for Kegel and pelvic floor exercises.

Bøhn *et al.* demonstrated that bowel symptoms had a statistically significant association with PA levels in patients treated with a radiotherapy and ADT, but not in patients treated with radical prostatectomy or ADT alone [5]. However, our study did not demonstrate a statistically significant association between bowel symptoms and PA levels. Ottenbacher *et al.* also did not observe an association between bowel symptoms and PA levels [22]. We did not categorize the patients on the basis of their treatments because of the small number of patients treated with radiotherapy. Further studies are needed that include patients treated with radiotherapy.

In contrast to previous studies that reported old age as a barrier to PA among prostate cancer survivors [24], we did not observe a statistically significant association between PA and age using univariate logistic regression (Table 2). Bøhn *et al.* demonstrated a significant association between PA and age in prostate cancer patients treated with radical prostatectomy, but not in those treated with ADT or radiotherapy and ADT [5]. In our study, the patients had ability to perform a 2-minute walking test and those who wanted to participate in exercise were included. Therefore, the age could not be related to PA.

In Asian populations, prostate cancer has a different epidemiology compared to Western populations [25]. Therefore, the factors affecting PA after prostate cancer treatment may also be different. However, only a few studies have been conducted in East Asian populations, including Koreans. One study investigated the PA levels and barriers and preferences regarding PA in 111 Korean prostate cancer survivors. That study demonstrated that the greatest barriers to exercise in prostate cancer survivors were poor health, lack of time, and lack of facilities. However, the questionnaire used in that study did not evaluate complications of prostate cancer, such as urination or defecation difficulties. Therefore, the effects of these complications were not studied [23].

The main strength of this study was that we studied all the factors that lead to sarcopenia [8–10]. Cancer is associated with severe muscle wasting due to decreased calories and protein intake, reduced endocrine signaling, and increased pro-inflammatory activity [26]. Sarcopenia is common in prostate cancer patients, especially those treated with hormonal therapy. In a previous study, sarcopenia was determined to be independently associated with cancer-specific survival among patients with metastatic, hormone-sensitive prostate cancer [27]. Various studies have reported that PA decreases the risk of sarcopenia in older patients [12, 13, 28]. However, few studies have investigated the association between PA and sarcopenia in prostate cancer patients, especially in Asian populations.

In our study, RSMI, maximal grip strength, and physical performance (gait speed and five times sit to stand test) did not influence PA; however, given the small cases of components of sarcopenia, it could be statistically insignificant due to lower statistical power.

There were a few limitations to our study. All of the study participants were enrolled from a single hospital. Therefore, our results may not be generalizable to the entire population. The sample size was small and could not be categorized based on the treatments (surgical, hormonal, or radiation therapy). A previous study investigated multiple aspects of PA, including those related to occupation, sports, household, transport, leisure-time, and sedentary activities. Urinary incontinence after radical prostatectomy significantly affected the household PA levels [17]. Conversely, our study only evaluated one aspect of PA. Lastly, comorbidities that affect patient health, such as hypertension and diabetes mellitus, were not evaluated. Patients with severe cardiopulmonary diseases were excluded from the study. A previous study found no significant association between PA and comorbidities in prostate cancer patients [29]. So, comorbidities which might introduce bias would not affect result in our study

Conclusions

With advances in diagnosis and treatment, the number of prostate cancer survivors is expected to increase. Knowledge of factors affecting PA is required to encourage PA in cancer survivors. Urinary difficulties had a statistically significant association with lower PA levels and may be a barrier to PA. Early intervention is needed to overcome urinary difficulties because PA is essential for optimal health outcomes. Multi-center studies with large sample sizes are required to elucidate the determinants of PA in prostate cancer patients on the basis of treatment provided.

Declarations

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Conflicts of interest/Competing interests

All authors declare that they have no conflict of interest.

Availability of data and material

All the data used in this study will be available upon request.

Code availability

Not applicable

Authors' contributions

S Kim and JI Lee contributed to the conception, literature search, analysis, and manuscript writing; KE Nam performed the statistical analysis and provided advice on the manuscript writing. JY Lee and YH Park provided advice on research concept and analysis. All authors reviewed and approved the final manuscript.

Ethics approval

The study was approved by the Ethics Committee of the Catholic University of Korea (Approval number: KC19RESI0732). The study was performed in accordance with the Declaration of Helsinki.

Consent to participate

We retrospectively analyzed the data from a previous study. Informed consent was obtained from all participants in a previous study.

Consent for publication (include appropriate statements)

All authors have read and approved the final manuscript.

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Tables

Table 1 Patient characteristics and general demographics (n = 90)

general demographics	(N=90)
Age (year)	69.43±7.30
Weight (kg)	67.25±8.06
Height (cm)	166.12±4.91
Body mass index (BMI)	24.33±2.57
Relative skeletal muscle mass index (RSMI)	7.55±0.64
Maximal grip strength (kg)	31.07±6.40
Gait speed(4m)	4.47±0.95
Five times sit to stand test	9.09±3.01

Table 2 Determinants associated with participation in physical activity

n (%)	Physical activity			Unadjusted analyses			Adjusted analyses		
	inactive or minimally active	HEPA* active	Total	cOR	95%CI	<i>P</i>	aOR	95%CI	<i>P</i>
Age									
<70 years	24(61.5)	15(38.4)	39						
≥70 years	35(68.6)	16(31.3)	51	0.731	0.305- 1.755	0.484			
body mass index									
<25 kg/m ²	33(62.2)	20(37.7)	53						
≥25 kg/m ²	26(70.2)	11(29.7)	37	0.698	0.285- 1.713	0.432			
Work force participation									
Yes	25(73.5)	9(26.4)	34	0.497	0.193- 1.281	0.148			
No	29(58)	21(42)	50						
Education									
With Bachelor's degree	25(64.1)	14(35.8)	39	0.824	0.335- 2.023	0.672			
Without Bachelor's degree	25(59.5)	17(40.4)	42						
Relative skeletal muscle mass index (RSMI)									
<7.0	13(84.6)	3(15.3)	16						
≥7.0	46(62.3)	28(37.6)	74	3.323	0.687- 16.061	0.135			
Maximal grip strength (kg)									
<28	18(72.0)	7(28.0)	25						

≥28	41(63.0)	24(36.9)	65	1.505	0.549-4.124	0.426			
Gait speed(4m)									
<1.0	38(67.8)	18(32.1)	56						
≥1.0	21(61.8)	13(38.2)	34	1.307	0.536-3.184	0.556			
Five times sit to stand test (sec)									
<12	50(65.7)	26(34.2)	76						
≥12	9(64.3)	5(35.7)	14	1.068	0.325-3.517	0.913			
Current smoker									
Yes	8(88.8)	1(11.1)	9	0.224	0.023-1.900	0.170			
No	43(64.1)	24(35.8)	67						
Current drinker									
Yes	25(67.5)	12(32.4)	37	0.960	0.368-2.501	0.933			
No	26(66.6)	13(33.3)	39						
Urinary difficulty									
Yes	41(80.3)	10(19.6)	51	0.209	0.082-0.533	0.001	0.137	0.037-0.506	0.003
No	18(46.1)	21(53.8)	39						
Defecation difficulty									
Yes	23(82.1)	5(17.8)	28	0.301	0.101-0.896	0.031			
No	36(58.0)	26(41.9)	62						

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