DOI: 10.4025/jphyseduc.v27i1.2729

Review Article

THE BENEFITS OF PHYSICAL ACTIVITY IN MEN WITH PROSTATE CANCER – A SYSTEMATIC REVIEW

BENEFÍCIOS DA ATIVIDADE FÍSICA EM HOMENS COM CÂNCER DE PRÓSTATA – REVISÃO SISTEMÁTICA

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RESUMO

Trata-se de uma revisão sistemática cujo objetivo foi analisar estudos originais que investigaram benefícios da atividade física em homens com câncer de próstata. A busca foi realizada nas bases de dados PubMed, Web of Science, Science Direct, Biblioteca Virtual Scielo, e Biblioteca Virtual da Saúde. Para o levantamento dos artigos utilizou-se os descritores [motor activity] AND [prostate neoplasm] em inglês, espanhol e português. Foram incluídos 21 estudos publicados em inglês, entre 2004 e 2015. As investigações tiveram maior foco na atividade física com outras variáveis, relacionando-as positivamente com melhoria da qualidade de vida e diminuição da mortalidade e progressão da doença. Foram observados benefícios em variáveis como fadiga e função sexual, além da diminuição na circunferência abdominal e pressão arterial. Novos estudos são sugeridos a fim de investigar a prática de atividade física em diferentes intensidades com ensaios clínicos randomizados, permeando o diagnóstico, período de tratamento e recuperação do paciente.

Palavras-chave: Atividade motora. Neoplasia da próstata. Qualidade de vida.

ABSTRACT

This is a systematic review whose objective was to analyze original studies investigating the association of physical activity in the health of men diagnosed with prostate cancer. The databases used were PubMed, Web of Science, Science Direct, Virtual Library Scielo, and Virtual Library of Health. The descriptors used in the search were [physical activity] AND [prostate cancer] in English, Spanish and Portuguese. We included 21 studies published in English, from 2004 to 2015. The investigations had increased focus on physical activity and other variables, relating positively to improving the quality of life. Positive results were observed in the physical, fatigue and sexual function in addition to the decrease in waist circumference and blood pressure. Further studies are suggested in order to investigate the physical activity at different intensities with longitudinal methodologies, permeating the diagnosis, the treatment period and recovery.

Keywords: Prostate cancer. Motor activity. Health.

Introduction

Prostate cancer is currently a public health problem; its incidence has been increasing since the 1960s, and according to the Cancer National Institute[1] this growth is due to the remarkable developments in diagnostic techniques, including screening practices by Prostate Specific Antigen (PSA) test. Prostate cancer is the sixth most common type of cancer worldwide and the most prevalent among men in many countries, representing approximately 10% of total cancers[2]. It is estimated that, by the year 2015, there will be a 60% increase in the number of new cases in Brazil, and one in six men over the age 45 years may have the disease without knowing it[3]. Risk factors are namely being Afro-American, obesity (BMI> 30) and having a family history[4].

Patients have their life altered at the different stages of fighting the disease, with significant losses in their quality of life, caused by the disease itself or by the treatment side effects[2,5]. However, life expectancy of prostate cancer patients has significantly improved in recent years. According to recent data, the survival rate for 10 years is 99%[5]. Due to this increase in patients' longevity, there has been a growing focus on improving the health and well-being in the long-term post prostate cancer patients, especially throug physical activity[2,5].

In this sense, regular physical activity has been recognized as a strategy to promote overall health, and, in patients with prostate cancer, it can minimize the side effects as well as improve their recovery and survival in the post treatment[5]. Reduced bone density, decreased muscle mass and strength, increased body weight and body fat, and decline in physical functioning are among the adverse effects of the prostate cancer treatment, which can be heightened due to sedentary behavior[5].

Physical activity can play a positive role in cancer outcome because it generates well-being feeling that makes the patient participate more appropriately in the treatment. In this sense, the American College of Sports Medicine[6] recommends 150 minutes of moderate physical activity or 75 minutes of vigorous physical activity per week for cancer patients, as well as endurance training twice a week in order to improve the patients' general physical health[7] and well-being[8].

Therefore, through this systematic review, we aimed at answering the following research question: What are the possible benefits of physical activity in men diagnosed with prostate cancer in-treatment or post-treatment?

Methods

This study is a systematic review, using theoretical references[9] as a main tool. PRISMA model – Preferred Reporting Items for Systematic Reviews and Meta-Analysis[10,11] was chosen to carry out this review. The following databases were used for consultation and search for articles: PubMed, Web of Science, Science Direct, Scielo Virtual Library and Virtual Health Library (BVS). A combination of descriptors was used in the search, including terms from the Medical Subject Headings (MeSH) and from "Descritores em Ciências da Saúde" (Health Sciences Descriptors) (DECs): "physical activity" OR "motor activity" OR "physical activities" OR "locomotor activities "AND" prostate cancer "OR" prostatic neoplasms "OR" prostatic cancer "OR" cancer of prostate "in English, Spanish and Portuguese. The electronic search was carried out from August 1, 2014 to December 31 2015.

The inclusion criteria were: (a) studies published from 2004 to 2014, b) in English, Spanish or Portuguese, (c) use as sample men diagnosed with prostate cancer; (d) investigated physical activity with direct or indirect measures; (e) mentioned descriptors in its variables either in the title or the abstract (f) available in full and digital access, and (g) investigated physical activity practice and its benefits in men diagnosed with prostate cancer during treatment or after treatment. The exclusion criteria were: (a) those characterized methodologically as systematic or literature reviews, pilot studies, study protocols, dissertations, theses, book chapters, publisher's supplements and comments, (b) use of the term *exercise* instead of *physical activity* in the title, abstract or full article and (c) manual cross-references.

Titles and abstracts were identified on the first stage of the study, together with a secondary search in the bibliographic list of articles. After excluding articles that did not meet the inclusion criteria together with duplicate items, a book report of all selected articles was accomplished to organize their full reading. The whole search process and selection of studies was carried out by three researchers, blindly and independently, in order to achieve greater reliability, with a 95% confidence interval.

Data quality was assessed using the methodological criteria proposed by Downs and Black[12], with 27 questions of a checklist, based on methodological aspects of communication, external validity, internal validity (bias), internal validity (confounding variables) and statistical power. Only 19 of the 27 questions were used because of studies that did not include interventions in their methodology. Questions 4, 8, 13-15, 19, 23 and 24 were excluded. We graded zero if the article was not relevant to what was being evaluated, and 1 when a positive response was observed. Only question 5 had a maximum score of 2. Thus, the maximum score for each article that did not have intervention was 20 points, and those presenting it was 28 points.

Results

Figure 1 shows the strategy selection of studies flowchart according to PRISMA guidelines. After the initial search in databases, we found a total of 1,059 studies in the selected databases fitting the descriptors and the criteria established in the methodology: 429 in PubMed, 135 in Science Direct, 377 in Web of Science, 4 in Scielo, and 114 in the BVS. 12 cross-references were initially excluded, leaving 1,047 articles. 179 were excluded because they were outside the date specified in the methodology (2004-2015); 145 were systematic literature reviews, editorial, supplement, book, pilot study or protocol study; 163 used the word "exercise"; 178 were outside the established theme and did not relate to physical activity and its potential benefits; 32 were in another language; 24 were animal studies; 61 were not available in full text, and 67 did not present the descriptors in their titles and/or abstracts. The remaining 198 articles fit the inclusion criteria for full reading. After reading the full articles, 177 were excluded: 164 because they did not address the subject and 13 because they were a qualitative approach.

Thus, we were left with 21 studies at the end of the selection process that were included in the systematic review. These 21 articles are shown in Table 1, with author/year, language of publication, name of the journal, and the database they were taken from. The chosen articles were published from 2004 to 2015. The most productive year was 2011, with four publications. All articles were originally published in English, and the predominant database was Web of Science (n = 12).

Table 2 shows more detailed information of each article, such as type of study, objective, sampling, assessment tools, intervention characteristics and main results. As for the type of study, only 17 articles specified the methodology they used, especially prospective cohort studies (n = 3). The sample ranged from 33 to 293,902 patients, all male adults or the elderly, both diagnosed with prostate cancer, totaling 410,882 men involved in the studies. In all cases the patients had already performed or were in clinical treatment for prostate cancer: in Androgen Deprivation Treatment (n = 3), radiotherapy (n = 2), in the postoperative period of radical prostatectomy (n = 4), and those who had already completed the treatment (n = 12).

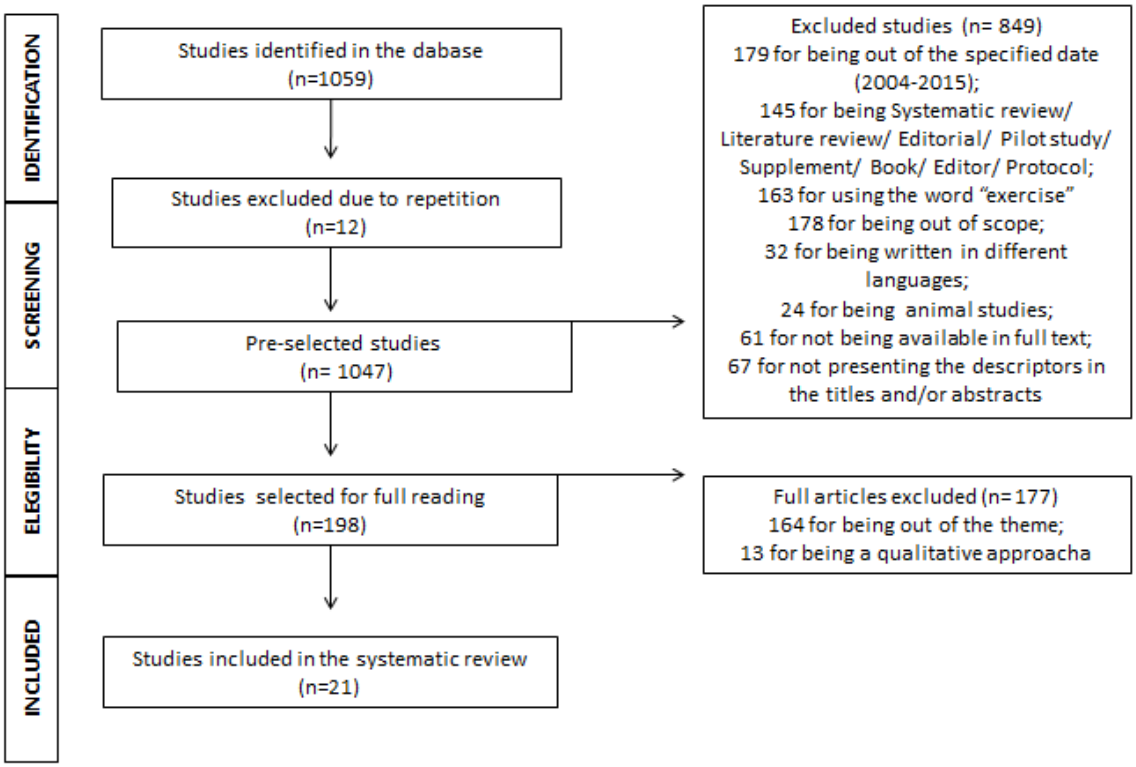

Figure 1. Flow chart of studies selection strategy according to PRISMA guidelines.
Source: The authors.

Table 1. Details of selected articles regarding title, language, journal and database.

	Author/Year	Title	Journal	Database
1.	Taylor et al., 2004	*Quality of life intervention for prostate cancer patients: design and baseline characteristics of the active for life after cancer trial.*	*Trials*	Science Direct
2.	Dahn et al., 2005	*Physical activity and sexual functioning after radiotherapy for prostate cancer: Beneficial effects for patients undergoing external beam radiotherapy.*	*Urology*	Science direct
3.	Giovannucci et al., 2005	*A prospective study of physical activity and incident and fatal prostate cancer.*	*Archives Of Internal Medicine*	Web of science
4.	Sultan et al., 2006	*Time to Return to Work and Physical Activity Following Open Radical Retropubic Prostatectomy.*	*The Journal Of Urology*	Science direct
5.	Taylor et al., 2006	*Active for life after cancer: A randomized trial examining a lifestyle physical activity program for prostate cancer patients.*	*Psycho-Oncology*	Web of science
6.	Moore et al., 2008	*Physical activity in relation to total, advanced, and fatal prostate cancer.*	*Cancer Epidemiology, Biomarkers & Prevention*	PubMed; Web of science
7.	Crespo et al., 2008	*Physical Activity and Prostate Cancer Mortality in Puerto Rican Men.*	*Journal of Physical Activity & Health*	Web of science
8.	Krishnadasan et al., 2008	*Nested case-control study of occupational physical activity and prostate cancer among workers using a job exposure matrix.*	*Cancer Causes & Control*	Web of science
9.	Orsini et al., 2009	*A prospective study of lifetime physical activity and prostate cancer incidence and mortality.*	*British Journal Of Cancer*	Bireme
10.	Mina et al., 2010	*Physical activity and quality of life after radical prostatectomy.*	*Canadian Urological Association Journal*	PubMed
11.	Reed et al., 2010	*Physical activity for men receiving androgen deprivation therapy for prostate cancer: benefits from a 16-week intervention.*	*Supportive Care in Cancer*	Web of science
12.	Kenfield et al., 2011	*Physical activity and survival after prostate cancer diagnosis in the health professionals follow-up study.*	*Journal Of Clinical Oncology*	Web of science
13.	Gjerset et al., 2011	*Effects of a 1-week inpatient course including information, physical activity, and group sessions for prostate cancer patients.*	*Journal Of Cancer Education*	Bireme; Web of science
14.	Lynch et al., 2011	*Objectively assessed physical activity, sedentary time and waist circumference among prostate cancer survivors: findings from the National Health and Nutrition Examination Survey (2003-2006).*	*European Journal of Cancer Care*	Bireme; Web of science
15.	Richman et al., 2011	*Physical activity after diagnosis and risk of prostate cancer progression: data from the cancer of the prostate strategic urologic research endeavor.*	*Cancer Research*	Web of science
16.	Hébert et al., 2012	*A diet, physical activity, and stress reduction intervention in men with rising prostate-specific antigen after treatment for prostate cancer.*	*The International Journal of Cancer Epidemiology, Detection, and Prevention*	Science direct
17.	Mungovan et al., 2013	*Relationships between perioperative physical activity and urinary incontinence after radical prostatectomy: an observational study.*	BMC Urology	PubMed
18.	Chipperfield et al., 2013	*Factors associated with adherence to physical activity guidelines in patients with prostate cancer.*	*Psycho-Oncology*	Web of science
19.	Mina et al., 2014	*The effect of meeting physical activity guidelines for cancer survivors on quality of life following radical prostatectomy for prostate cancer.*	*Journal Of Cancer Survivorship*	Web of science
20.	Phillips, et al., 2015.	*Physical activity, sedentary behavior, and health-related quality of life in prostate cancer survivors in the health professionals follow-up study.*	*J Cancer Surviv*	PubMed
21.	Bonn, et al., 2015.	*Physical activity and survival among men diagnosed with prostate cancer.*	*Cancer Epidemiol Biomarkers Prev.*	PubMed

Souce: The Authors.

Most studies related physical activity to another variable, such as sexual functioning, diet, time required to return to work, type of occupation, mortality, social interaction, waist circumference, sociodemographic variables, urinary incontinence, and the side effects from androgen deprivation therapy. The majority (n = 6) used quality of life as a second variable.

The instruments used to assess physical activity were mostly (n = 19) questionnaires sent by mail, self-administered or collected through interviews. The following validated questionnaires are among the most frequently cited: Self-Administered Physical Activity Questionnaire for Male Health Professionals; Yale Physical Activity Survey; Framingham Physical Activity Index; Total Lifetime Physical Activity; International Physical Activity Questionnaire; Godin Leisure Time Exercise Questionnaire, Self-Reported Physical Activity Total Differences by Relative Weight. Only one study used the accelerometer, and one study used The Canadian Aerobic Fitnesse Test besides the questionnaire. Only six studies investigated the benefits of physical activity through interventions, mainly through support groups and stimulation to physical activity.

Most studies related a positive outcome for physical activity in improving quality of life and the lifestyle of men with prostate cancer (n = 5). Improvements were also observed for the following variables: physical, fatigue and sexual function (n = 3), as well as a decrease in abdominal circumference (n = 2) and blood pressure (n = 1). A significant improvement was also found regarding anxiety and depression (n = 1), as well as a delay in the progression and reduction in mortality related to prostate cancer in the studied patients (n = 5).

As for the scores obtained through Downs & Black Methodological Scale[12], the articles obtained an average of 16.4 points, given a maximum score of 20 points. One of the questions with the lowest score was no description of the characteristics of patients lost during the study. The scoring average was 21.16 points for articles that presented intervention in their methodologies, with a maximum score of 28 points. These presented flaws in their internal validity, specifically in the blinding of patients regarding the intervention and control groups as well as between patients and researchers.

Table 2. Details of selected articles regarding type of study, objectives, sample, instruments, intervention and results.

	Ref.	Type of study	Objective	Sample	instruments	Intervention	Main results	#
1.	Taylor et al., 2004	Controlled Case study	Investigate a PA intervention and the lifestyle quality of life in PC patients.	134 PC patient (69-year-old).	*Exercise Self-Efficacy Questionnaire; Processes of Change for Exercise Questionnaire; Decisional Balance for Physical Activity Questionnaire;* SF-36; CESD; STAI; BPI; 6-minute walking test	Groups: Lifestyle; Educational support; control. 6 months.	PA related positively with improvements of LQ (life quality)	23**
2.	Dahn et al., 2005	Cross sectional study	Assess the relation PA, sexual functioning and treatment of PC men.	111 men treated with radiotherapy for PC localized.	*YPAS-TASI*; *Expanded Prostate Cancer Index Composite; Fatigue Symptom Inventory;*	-	PA related positively with sexual functioning and age.	14*
3.	Giovannucci et al., 2005	Prospective cohort study	Assesess the relationship between PA and PC in fatal cases.	47.620 men.	*Health Professionals Follow-up Study*, questionnaties of alimentar frequence given every 4 years.	-	PA positively associated with delay in PC progression in men ≥ 65 years old.	18*
4.	Sultan et al., 2006	Prospective study	Assess the factors to return to work and resuming PA of prostatectomized men.	537 prostatectomized men.	HCT in pre- and post-surgery Post-surgery interview (1 and 3 months) to know if patients had resumed their work and PA.	-	Associated factors influencing resuming work and PA: age, marital status, work, HCT level and cateter removal.	16*
5.	Taylor et al., 2006	Controlled study	Assess the QL improvement in a PA program with PC patients - 6 months	134 PC patients under Androgenic deprivation therapy continuous treatment	*Exercise Self-Efficacy Questionnaire; Processes of Change for Exercise Questionnaire; Decisional Balance for Physical Activity Questionnaire*; SF-36; CESD; STAI; BPI; 6-minute walking test.	Groups: Lifestyle, Educational support and control. 6-month Intervention for each group and 12-month-follow-up	No significant improvements in QL in 6 or 12 months. The participants' lifestyle improved improved in the assessments made	24**
6.	Moore et al., 2008	Epidemioloical study	Examine PA in fatal, total advanced PC in men at NIH-AAR.	293.902 men (50-71 years old).	Questionnaires on PA (ACSM 1990) and general information on cancer. Databank of the Diet and Health study fromNIH-AARP.	-	PA was not significant as a risk factor for PC development.	20*
7.	Crespo et al., 2008	Prospective cohort study	Investigate the association between PA and PC mortality in men from Puerto Rico Health Program.	9824 mens (35-79 years old).	Multidimensional questionnaire on lifestyle, diet, body composition, exercises, address, and smoking habits. PA - F*ramingham Physical Activity Index*.	-	No association between PC death risk and PA.	18*
8.	Krishnadasan et al., 2008	Case control study	Examine the association between PA at work and the incidence of PC in nuclear engineers in California.	362 nuclear engineers.	Incidence of cancer (*California Cancer Registry*). Questionnaires on previous PA and other demographic and anthropometric variables, sent by mail ou via telephone.	-	Adult men who are more continuously active at the workplace may have a decrease in their PC risk	18*
9.	Orsini et al., 2009	Prospective cohort study	Investigate total PA throughout life related to the incidence and mortality of PC	45.887 men (45-79 years old).	Selfapplied questionnaire of PA, Family history of PC, lifestyle; *Swedish National Cancer Register and the Regional Cancer Register*.	-	The decrease in PC incidence was influenced by factors as: not staying sitting for most part of the time at the workplace, wlking, bicycling more than 30 min/day.	18*

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	Ref.	Tipo de estudo	Objetivo	Amostra	Instrumentos	Intervenção	Principais resultados	#
10.	Mina et al., 2010	-	Observe PA levels before and after surgery and QL in prostatectomized men.	60 patients (radical prostatectomyl).	Questionnaire before and after surgery; LTPAQ; VO_2max; *The Canadian Aerobic Fitness;* Body Composition; PORPUS; IPSS.	-	Patients with higher levels of PA before surgery had a lower loss in their QL after the surgery.	14*
11.	Reed et al., 2010	-	Investigate the effects of PA da AF in the behavior and QL of men in ADT	100 PC men receiving ADT (6 months).	LSI; EORTC QLQ C30; EPIC; FSS; CES-D; *Canadian physical activity fitness and lifestyle appraisal protocol*; anthropometric measures; laboratorial data.	Aerobic and resistance training program, at home. Weekly group sessions	Increase in PA was positively associated to improvement in the abdominal circumference and lower blood pressure.	23**
12.	Kenfield et al., 2011	Prospective study	Determine if PA post PC decreased death risk	2.705 men with non metastatic PC.	Questionnaire on PA; patient's records, and lab tests to confirm PC diagnosis	-	PA was associated to lower PC general mortality. Men with 3h/week of PA had 61% less death risk by PC.	18*
13.	Gjerset et al., 2011	Exploratory study	Explore the effects of a one-week course on PA	51 men.	Questionaires; Demographic and medical selfreported variables; GLTEQ; FQ; MAX-PC; EORTC QLQ-C30;	6-day multidisciplinar course, with lectures, PA.	Decrease in general fatigue, physical fatigue and anxiety during pre and post intervention	21**
14.	Lynch et al., 2011	Cross-sectional study.	Assess PA and its association with sedentariness, wais circumference in PC survivors	103 PC survivors.	Accelerometer (model 7164; chart, LLC, Fort Walton Beach, Florida); wais circumference.	-	Inverse relationship between wais circumference and moderate to vigorous PA.	14*
15.	Richman et al., 2011	Prospective study.	Examine PA, walking pace after diagnosis and risk of PC progression	2.134 PC men.	Sociodemographic questionnaire, symptoms; Gleason Biopsy test; BMI, questions about PA.	-	Walsking fast ≥3 hours/weekly after diagnosis may inhibit or delay PC progression	15*
16.	Hébert et al., 2012	Randomized study.	Compare changes with diet intervention and PAF in men after PC related to ADT	47 PC men	Medical records - *24-h recall interviews*; CHAMPS; anthropometric measures; PSA.	Individual sessions on diet and PA, 12 weekly sessions; 45 minutes of PA.	Increae of moderate to vigorou PA after 3 months of interventon with decrease in BMI	20**
17.	Mungovan et al., 2013	Perspective observational study.	Investigate changes in PA in prostatectomized men and post-operative urinary incontinence.	33 PC men after radical prostatectomy.	IPAQ; Aceelerometer (*SenseWear Pro3 Armband*; *International Consultation on Incontinence Questionnaire;* ICIQ; submited before, right after, 3 weeks and 6 weeks after prostatectomy.	In the week prior to the prostectomy, they received treining for the pelvic floor, and were encouraged to walk at least 10,000 steps a week.	There was no reationship between pre-surgery PA levels and post-operative urinary incontinence, although the participants had high levels of PA before surgery.	16**
18.	Chipperfieldet al., 2013	-	Estimate the proportion of PC patient who meet the National Guidelines of PA in Australia and determine medical and demoraphic factors associated with the implementation of recommendations.	356 PC men.	IPAQ; FACT-P; *The Hospital Anxiety and Depression Scale* (HADS).	-	41,9% reached the PA recomendations. Low education e QL, depression and anxiety symptoms were associated with PA.	14*

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	Ref.	Type of study	Objective	Sample	Instruments	Intervention	Main results	#
19.	Mina et al., 2014	Retrospective longitudinal cohort analysis.	Investigate the effect of guidelines on PA, QL, sexual diyfunction and urinary incontinence (UI) in PC.	242 men (60 years old) submitted to radical prostatectomy.	GLTEQ; PORPUS; IPSS; IIEF; Questionaires before surgery, and 6 and 26 weeks after surgery.	-	The amount of PA as a marker in QL recovering and UI. Patients should follow pre-surgery PA guidelines to minimize the drop in QL.	16*
20.	Phillips, et al., 2015.	Prospective cohort study.	Examine the relationships between activity types and intensities and sedentary behavior related to PC.	1917 men diagnosed with non metastatic PC.	PA was assessed every two years through a questionaire validated by TABER et al., (1996).	-	The increase in non-vigorous PA and walking duration after the diagnosis was positively associated with improvement in hormonal issues and functional vitality, more specifically, ≥ 5 h of non-vigorous activity or ≥ 3 h of walking a week may be beneficial.	17*
21.	Bonn, et al., 2015.	-	Investigate the PA effect after PC diagnosis over general mortality and due to the disease.	4.623 men diagnosed with PC from 1997 to 2002 and followed up until 2012.	PA time "after diagnosis" was estimated using a PA questionaire validated by the authors. The total energy intake was validated using food frequency also by a previously validated questionaire.	-	Higher levels of PA were associated with reduced rates of general and specific mortality for PC.	16*

Remarks: # – Scores related to Downs & Black Scale[12]. * Score of articles with no intervention: maximum of 20 points. **Score of aticles with intervention: maximum of 28 points. #Qualitative studies, excluded from the methodological assessment. CESD - *Centers for Epidemiologic Studies-Depression*; STAI - *State/Trait Anxiety Inventory*; BPI - *Brief Pain Inventory-Short Form*; SF36 - 36-*Item Short-Form Health Survey*; YPAS-TASI - *Yale Physical Activity Survey-Total Activity Summary Index*; HCT –Hematocrit; LTPAQ - *Lifetime Total Physical Activity Questionnaire*; PORPUS - *The Patient-Oriented Prostate Utility Scale*; IPSS - *The International Prostate Symptom Score;* LSI - *Godin's Leisure Score Index;*EORTC QLQ-C30 - *The European Organization for Research and Treatment of Cancer Core Quality of Life Questionnaire C30;* EPIC - *Expanded Prostate Cancer Index Composite;* FSS - *Fatigue Severity Scale;* GLTEQ - *Leisure Score Index from The Godin Leisure Time Exercise Questionnaire*; FQ - *The Fatigue Questionnaire;* MAX-PC - *The Memorial Anxiety Scale for Prostate Cancer;* HADS - *The Hospital Anxiety and Depression Scale;* CHAMPS - *Community Health Activities Model Program for Seniors;* IPAQ - *International Physical Activity Questionnaire;* ICIQ - *International Consultation on Incontinence Questionnaire – Urinary Incontinence Short Form;* FACT- *Functional Assessment of Cancer Therapy Prostate*; IIEF- *International Index of Erectile Function.*
Source: Developed by the authors themselves.

Discussion

The main objective of this systematic review was to analyze studies investigating the benefits of physical activity in men with prostate cancer. Thus, the studies standing out are those addressing the association of physical activity with a decreased risk in the incidence, progression or mortality due to prostate cancer[2,4,13-17], followed by those that investigated the prevalence of physical activity[18,19] or the time required to resume physical activity after surgery[20]. Some studies associated physical activity to quality of life[21-23] and sexual functioning for men who underwent radiation treatment[24]. There were also studies addressing interventions and their possible benefits to men with prostate cancer[25-30].

Walking has been associated to the decreased risk of incidence, progression or mortality due to the disease. A study in a population of adult and elderly men in Sweden pointed out that any daily increase of 30 minutes was associated with a 7% reduction in the incidence of total prostate cancer, 8% of localized prostate cancer and 12% of advanced cancer, having as reference 30-minute-walk a day[2]. Another study found a significant relationship and inversely proportional between walking pace and progression of prostate cancer[16]. Those who walked faster, at a pace $\geq$3 miles per hour (equivalent to approximately $\geq$ 4.828km), for three or more hours per week, showed 57% reduction in progression of prostate cancer after the diagnosis when compared to men who walked slowly, at a pace of $\leq$ 2 miles (> 3.21km) per hour, for less than 3 hours per week, thus, revealing positive results in the progression and incidence of prostate cancer. In this sense, Kenfield et al.[14], when analyzing just the practice of walking by men after the diagnosis, observed significant benefits in the reduction of the overall death risk or due to prostate cancer, when men had over 7 hours of weekly walking practice when compared with only 20 minutes per week. Also, Bonn et al.[17] found lower mortality rates for prostate cancer in men who walked or rode bicycles for more than 20 minutes a day.

Giovannucci et al.[31], studying vigorous physical activity, showed the relationship between vigorous physical activity and the delay in prostate cancer progression in American health professional, over 65 years, who practiced it at least 3 hours a week. This corroborated other studies associating the possible inhibition or delay in the prostate cancer progression as the result of vigorous physical activity[14,16]. A correlation between total physical activity practice (moderate + vigorous) and the reduction of overall mortality rate in the men investigated[14] was also found. Those who practiced 3 hours/week of vigorous physical activity obtained a 49% reduction in overall mortality when compared to 1 h/week. Similarly, men with 3h/week of vigorous physical activity had 61% lower risk of death from prostate cancer compared to men with less than 1h/week. This fact shows that moderate to vigorous physical activity may be associated with lower incidence of prostate cancer, as it may also be associated with decreased progression of the disease[14,16,31].

Some authors such as Moore et al.[15] observed no relationship between physical activity (PA) and the prostate cancer development, progression and mortality. They only found that an increase in PA during adolescence has a minimizer effect of 3% on the risk of developing prostate cancer and that the increase in PA also reduces the risk of mortality in patients under 65 years. In the study by Crespo et al.[13], PA did not have grounds to predict the mortality of Puerto Rican men with prostate cancer. Given the studies selected in this systematic review, the relationship between physical activity and the benefits associated with

decreased prostate cancer mortality showed different results, characterizing it as an inconsistent theme to this date[13,15].

Other studies have investigated the benefits of PA in the period prior to surgery in mitigating the treatment effects and reducing the time required to resume occupational practices after surgery or medical treatment[18,22,27]. Patients who had a muscle training for the pelvic floor intervention as well as PA before a radical prostatectomy surgery reduced their PA level three weeks after surgery, but they returned to their previous levels after 6 weeks[27]. Mina et al.[22] claim that patients with higher levels of PA preoperatively showed less decrease of quality of life in the postoperative period, about 30 days after their radical prostatectomy surgery. The same study found that PA reduced the symptoms of urinary incontinence, and that it is essential for these patients. Similarly, Phillips et al.[23] showed in their study that walking, at a pace ≥ 3 miles per hour (≥ 4,828km), resulted in improvements in urinary incontinence. Chipperfield et al.[18] also found a significant relationship between physical activity during leisure time and quality of life improvement, noticing also that patients treated with androgen deprivation therapy (ADT) were significantly less active than those treated only with radiation therapy. Similarly, Phillips et al.[23] found that men who walked at a pace higher than 2 miles (> 3,21km) per hour for 90 minutes per week had scored better on vitality when compared to those who walked at a pace lower than 2 miles (<3,21km) per hour, for less than 90 minutes a week.

Studies investigating the prevalence of physical activity of men diagnosed with prostate cancer, such as Chipperfield et al.[18], reported that only 41.9% of the participants met the recommendations of the National Guidelines for physical activity in Australia, which is based on 150 minutes of moderate to vigorous physical activity per week. This low adherence to physical activity is justified in the study as a result of the treatment, the environment and the cancer itself[18]. The men studied by Lynch et al.[19], who were assessed by accelerometer, presented themselves mostly as sedentary (69%), with low intensity activities (30%) and only 1% in moderate to vigorous physical activity.

Six studies showed results after interventions[25-30], with an average of 3 to 12 months and, in most cases, during the treatment or the post-treatment period. The interventions consisted mainly of proposals of mild to vigorous physical activity, and were mostly triggered by support groups or discussion on physical activity. As for the time required to obtain benefits, the studies emphasized the need of 30 minutes of moderate physical activity a day, for most days of the week[29]. Another study reported that patients who attended a one-week-intensive course, with a support group and physical activity sessions, lowered their levels of general fatigue, physical fatigue and anxiety[25]. Positive results were also found with support groups in educational debates on physical activity, in which the increase on physical activity was associated with a significant improvement in abdominal circumference, blood pressure, fatigue and depression in patients treated with ADT[28].

In another aspect, studies showed that, despite reductions in fatigue and anxiety, interventions lasting only one week did not substantially influence on most health issues[25], as seen in Taylor et al[29], in which after a 6-month intervention found no significant improvement in quality of life. However, in this same study, the intervention did not propose practical activities, only educational support groups and lifestyle incentives, which can be seen as a limiting factor. Similarly, another study that only had a support group did not present

significant results in relation to physical activity in patients after clinical treatment of radiotherapy or radical prostatectomy[26].

According to the literature studied, the accumulation of 150 minutes of moderate to vigorous physical activity per week together with walking are sufficient for a clear improvement in the quality of life of prostate cancer patients. It also improves vitality and decreases depressive symptoms, anxiety and other comorbidities[18,23]. Resistive training should also be added along with educational group sessions on the benefits of physical activity, thus, suggesting that programs like this will lower public health costs and even improve the patients' quality of life.

Conclusion

When analyzing the studies that make up this review regarding physical activity and prostate cancer, we noticed the men's age range (over 60 years) as well as the presence of side effects due to the treatment (androgen deprivation therapy, radiotherapy or radical prostatectomy), due to their advanced age and the consequences of cancer in general. Investigations were more focused on physical activity with other variables, relating them positively to quality of life improvement. Positive results were observed in variables such as fatigue and sexual functioning, along with to the decrease in waist circumference and lower blood pressure. The importance of physical activities needs to be emphasized since it minimizes damages to health and improve the patients' quality of life. Further studies are necessary to investigate specific physical activities in longitudinal studies, at different times covering the diagnosis, the treatment, as well as the time to resume their previous activities. The studies should be based both in focus groups and in practical interventions through randomized clinical trials in order to substantiate the results of physical activity in the lives of men with prostate cancer.

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Received on Jul, 30, 2015.
Reviewed on Oct, 13, 2015.
Accepted on Mar, 02, 2016.

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