EFFECT OF STRENGTH TRAINING ON PAIN REDUCTION AND PHYSICAL FUNCTION IMPROVEMENT IN POSTOPERATIVE PROSTATE CANCER PATIENTS

Wisnu Guntur Prakoso[1*], Tadi[2], Achmad Fauzi[3], Navy Sealsi Adinda Prisca Marina[4], Tintin Sukartini[5]

[1-3]Faculty of Nursing, Airlangga University

Email Korespondensi: wisnuprakoso61@gmail.com

Disubmit: 24 April 2025 Diterima: 18 Januari 2026 Diterbitkan: 01 Februari 2026
Doi: https://doi.org/10.33024/mahesa.v6i2.20410

ABSTRACT

Nursing has an important role in improving the health and prevention of complications of post-surgical patients. One of the nursing interventions that can be provided is Pelvic Floor Muscle Exercise (Kegel) which aims to strengthen the muscles that support the bladder and intestines, which are often affected after prostate surgery. To systematically explore the effect of strength training on reducing pain and improving physical function in postoperative prostate cancer patients. The method uses a search through 4 major databases namely PubMed, Scopus, Sciencedirect and ProQuest with a range of 5 years from 2020 to 2025. The literature search used keywords namely "strength training", "pain intensity", "physical function", "postoperative prostate cancer". The critical appraisal guidelines of the Joanna Briggs Institute were used for the appraisal review of the journal. Twelve articles were extracted regarding the effect of strength training on reducing pain and improving physical function in postoperative prostate cancer patients. Overall, the articles yielded several findings regarding differences in pain and physical functional ability with different types of strength training implemented using varying duration, frequency and intensity. Strength training has significant benefits in helping postoperative prostate cancer patients. It is effective in reducing pain, especially pelvic pain and pain related to urinary incontinence, as well as improving the physical function of patients

Keywords: Pain Intensity, Physical Therapy, Prostate Cancer, Strength Training.

INTRODUCTION

Prostate cancer (Carsinoma Prostate) generally affects middle-aged men, between the ages of 45 and 60 years which is the leading cause of cancer death in Western countries. The mortality rate is higher in individuals with low socioeconomic levels due to late diagnosis of the disease (Sekhoacha et al., 2022) in (Chen et al., 2024). The onset of pain and the occurrence of Urinary Incontinence (UI) is one of the main problems experienced by prostate cancer patients after Radical Prostatectomy (RP) surgery, thus causing a negative impact on the patient's psychosocial condition and quality of life. (Chitre & Kulkarni, 2023).

Prevalence of urinary incontinence after robotic prostatectomy: 1–87% (Chitre & Kulkarni, 2023). Urinary incontinence is one of the most

common complications. Statistics from large prostate cancer and multicenter databases abroad show that the incidence of urinary incontinence within 1 month after surgery reaches 87%,4 associated with intraoperative urinary sphincter injury and nerve injury, bladder neck resection, and machine-assisted bladder and urethral reconstruction (Chen et al., 2024). However, some of the unwanted effects of RP include erectile dysfunction and lower urinary tract symptoms (LUTS), especially Urinary Incontinence (UI) (Azevedo et al., 2024). According to the International Continence Society (ICS), it is estimated that 57% of men may experience post-radical prostatectomy UI (PRPUI) within one year postoperative (Cardozzo et al., 2023).

The main factors affecting the degree of continence are based on the patient's profile (age, body mass index (BMI), and pre-existing urinary symptoms), the surgeon's experience, and the surgical techniques used (Bernardes et al., 2019) in (Azevedo et al., 2024). Other symptoms of lower urinary tract (LUTS) experienced by post-RP patients were nocturia (15%), urgency of urination (8%), increased frequency of urination (5%), and incomplete bladder emptying (5%) (Fujimura et al., 2019; D'ancona et al., 2019) in (Azevedo et al., 2024).

Treatment has an important role in improving the health and prevention of post-operative complications of patients. One of the nursing interventions that can be provided is the Pelvic Floor Muscle Exercises (Kegels) which aim to strengthen the muscles that support the bladder and intestines, which are often affected after prostate surgery (Chen et al., 2024; Chitre & Kulkarni, 2023; Hutchison et al., 2024). Progressive Resistance Training involves the use of weights or resistance gradually to increase overall muscle strength. Functional Exercises that mimic daily movements to improve the patient's functional abilities, such as walking, climbing stairs, or lifting objects (Mardani et al., 2021). Based on the description above, the researcher is interested in conducting a more detailed research study related to the effect of strength training on pain reduction and improvement of physical function in postoperative prostate cancer patients.

LITERATURE REVIEW

Postoperative pain is one of the most common complications experienced by patients after undergoing a surgical procedure (Ding et al., 2023). This pain occurs as a result of tissue damage induced by the surgical procedure, which triggers an inflammatory response and activation of pain nerve fibers. Postoperative pain is multidimensional, including sensory, affective, and cognitive aspects, so it not only causes physical discomfort but can also affect the patient's psychological conditions such as anxiety and depression (Jin et al., 2022). The intensity of pain experienced can vary depending on the type of surgery, surgical technique, location of the wound, as well as individual factors such as age, gender, and previous pain experience. Effective postoperative pain management is essential to speed up the healing process, reduce the risk of complications such as infection and thrombosis, and improve the patient's quality of life. A multimodal approach that combines pharmacological and non-pharmacological analgesics is often used to optimally manage pain (Nowak et al., 2020).

Physical function refers to an individual's ability to perform daily physical activities that involve mobility, muscle strength, balance, and endurance (Sharifi et al., 2021). Good physical function is a key indicator of a person's health and independence, especially after undergoing medical procedures such as surgery. In postoperative patients, physical function often decreases due to pain, immobilization, and muscle weakness that occurs during the recovery period (Liu et al., 2019). This decline in physical function can negatively impact quality of life, increase the risk of falls, and slow down the rehabilitation process. Therefore, evaluations and interventions aimed at maintaining or improving physical function are essential in postoperative care. These interventions include structured physical exercise, physical therapy, and patient education to optimize functional abilities and speed recovery (Singh et al., 2023).

Strength training is a method of physical exercise that aims to increase strength and muscle mass through activities that involve resistance, such as weight lifting, the use of resistance bands, or self-weight training (Chitre & Kulkarni, 2023). This exercise plays an important role in the rehabilitation of postoperative patients because it can help reduce muscle atrophy caused by immobilization and pain, improve joint stability, and increase the body's functional capacity. In addition to physical benefits, strength training also contributes to improved metabolism, bone health, and hormonal balance (An et al., 2021). Strength training programs tailored to the patient's condition and ability can speed recovery, reduce the risk of complications, and improve overall quality of life. In a clinical context, strength training is often combined with aerobic exercise and flexibility to achieve optimal rehabilitation outcomes .

Prostate cancer is one of the most common types of cancer that affects men, especially in old age. This cancer originates from the growth of malignant cells in the prostate gland, a small organ that functions to produce semen fluid (Gerlegiz et al., 2025). Prostate cancer usually develops slowly and in the early stages often does not cause specific symptoms, so diagnosis is often late. The main risk factors for prostate cancer include age over 50, family history of prostate cancer, genetic factors, and certain lifestyle and diet (Ma et al., 2024). Symptoms that may appear in advanced stages include difficulty urinating, pelvic pain, and weight loss. Prostate cancer diagnosis is usually made through prostate specific antigen (PSA) level examination, prostate tissue biopsy, and imaging examination. Treatment of prostate cancer can be surgical (prostatectomy), radiotherapy, hormonal therapy, or a combination approach, depending on the stage of the disease and the patient's condition (Hutchison et al., 2024).

Strength training is known to speed up muscle recovery, prevent atrophy due to lack of movement, and improve patients' stability and physical abilities so that they can return to their daily activities better. In addition, this exercise also helps reduce pain, which in turn can reduce the need for pain medication use and reduce the risk of complications due to prolonged pain. This study makes an important contribution by providing scientific evidence supporting the application of strength training as part of the rehabilitation program of postoperative prostate cancer patients, which has not been widely

considered in standard treatment procedures. Therefore, these findings can be the basis for the development of more comprehensive and effective rehabilitation programs, thereby improving the quality of life as well as the long-term clinical outcomes of patients.

RESEARCH METHODOLOGY

This study is a systematic review that explores the Effect of Strength Training on Pain Reduction and Improvement of Physical Function in Postoperative Prostate Cancer Patients. The articles used were obtained from four main databases, namely Scopus, PubMed, Science Direct, and ProQuest. The systematic review process includes searching, analyzing, and drawing conclusions from various studies that have been published in a structured manner (Brink et al., 2006). This study follows the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to ensure the quality and transparency of the analysis (Bolan et al., 2021).

Literature searches were conducted on articles published in the range of 2020 to 2025 using keywords based on Medical Subject Headings (MeSH), including: ("strength training" OR "resistance training" OR "weight training" OR "exercise") AND ("postoperative" OR "surgery" OR "post-surgery" OR "recovery") AND ("prostate cancer" OR "prostate carcinoma" OR "prostate neoplasm" OR "prostate disease") AND ("patients" OR "individuals" OR "survivors" OR "men") AND ("rehabilitation" OR "physical therapy" OR "fitness" OR "wellness").

This study uses inclusion and exclusion criteria in the selection of articles. Inclusion criteria include articles from scientific journals or open access proceedings available in full text, written in English or Indonesian, published between 2020–2025, sourced from Scopus, PubMed, Science Direct, and ProQuest databases, and discussing the effects of strength training on pain and physical function in postoperative prostate cancer patients with RCT or experimental study designs. Articles that do not meet any of the inclusion criteria are excluded. The selection was carried out using the PICOS approach to clarify the scope of the research. P (Population) Male patients with postoperative prostate cancer (radical prostatectomy), I (Intervention) Strength training which includes resistance training, body weight training, or weight exercises, C (Comparison) Patients who did not do strength training or who underwent conventional interventions (e.g. passive physical therapy or without exercise intervention), O (Outcome) Pain reduction based on the Visual Analog Scale (VAS) or Numeric Rating Scale The selection process began with identify articles from all four databases using keywords that have been adapted to MeSH.

Researchers independently screened based on inclusion criteria, resulting in 193 articles, with the following distributions: Scopus (n = 42), PubMed (n = 44), Science Direct (n = 82), and ProQuest (n = 23). After removing duplicate articles (n = 31), the next process is to review the titles and abstracts to exclude irrelevant studies (n = 19). Articles that had full text but did not discuss the effect of strength training on pain reduction and improvement of physical function in postoperative prostate cancer patients were also excluded (n = 72). Finally, a total of 12 articles were selected for analysis in this systematic review (Figure 1).

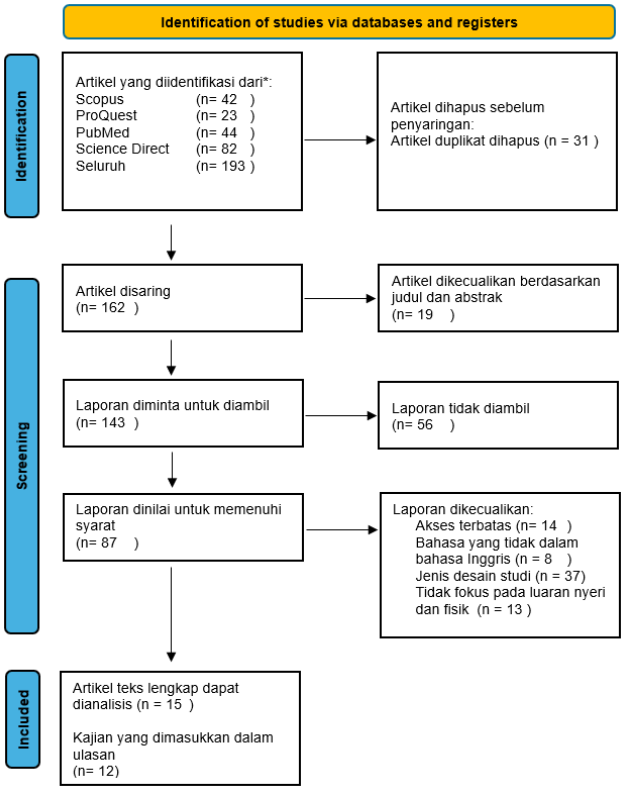

Figure 1. PRISMA Flowchart

Article quality assessment was carried out by considering the risk of bias through methodological evaluation using critical appraisal tools from the Joanna Briggs Institute (JBI), in accordance with the research design. Two reviewers (NSAPM and WGP) independently assessed the methodological validity of articles that passed the inclusion criteria before they were extracted. For RCT and quasi-experimental studies, JBI critical appraisal was used with nine questions that assessed similarity in characteristics, measurement methods, potential bias, reporting results, follow-up time, and statistical analysis. JBI's critical appraisal is used to assess the quality of research with a number of specific questions. For the quasi-experimental study, there were 9 questions related to exposure, bias, results, follow-up, and analysis. Meanwhile, for RCTs, there are 13 questions covering the process of randomization, blinding, intervention, and statistical analysis. Each answer is scored "yes" (1 point) or "no/unclear/none" (0 points). The research is considered passed if it reaches a minimum of 50% score. Bias risk assessment includes aspects of theory, design, sample, variable, instrument, and data analysis.

RESEARCH RESULTS

Of the nine articles with RCT research design with criteria of 1-13 questions, eight articles received a "no" answer of 3 points with a score of 10/13 (77%) but were still categorized as good quality and one article received one "no" answer with a score of 11/13 (85%) but both were still in the good quality category. Three articles with a quasi-

experimental study design with criteria of 1-9 questions, the third question has 1 answer of "no" with a score of 8/9 (89%) but is still categorized as good quality. The results of the review of a total of 12 articles achieved a score of >50%, thus meeting the critical appraisal assessment, which will then be used to analyze the data. JBI's critical appraisal is used to assess the quality of research with a number of specific questions. For the quasi-experimental study, there were 9 questions related to exposure, bias, results, follow-up, and analysis. Meanwhile, for RCTs, there are 13 questions covering the process of randomization, blinding, intervention, and statistical analysis. Each answer is scored "yes" (1 point) or "no/unclear/none" (0 points). The research is considered passed if it reaches a minimum of 50% score. Bias risk assessment includes aspects of theory, design, sample, variable, instrument, and data analysis.

Table 1. Result of Literature Reseach

Yes	Title, Author, and Year	Sample	Design	Country	Intervention	Duration	Instrument	Results	Key Findings Related To pain and physical function
1	Application of Kegel Motion Combined with Warming Acupuncture at the Eight Acupuncture Points in Patients with Urinary Incontinence After Radical Prostatectomy .(Chen et al., 2024)	200 patients with post prostatectomy	Experimental Study	China	Strength training in the form of Kegel exercises combined with acupuncture	Starting 1 to 6 months postoperative	Quality of Life Incontinence Questionnaire	Significant differences began to be seen at three months and six months postoperatively (P < 0.05), with the experimental group showing better improvements in urine control, pain when urinating and	Warming acupuncture at eight acupuncture points may provide an analgesic effect (pain relief). Kegel exercises aim to strengthen the pelvic floor muscles, which can improve physical function related to urine control.

								quality of life.	
2	Effects of Biofeedback Combined With Pilates Training on Post-prostatectomy Incontinence .(An et al., 2021)	42 patients with urinary incontinence after radical prostatectomy	RCT	China	Kegel strength exercises and muscle strengthening with pilates	40 minutes per day for 8 weeks	International Consultation Incontinence Questionnaire (ICIQ-SF), Oxford Grading Scale	Increased ICIQ-SF score (64.7% vs 29.4% in group A and 50% in group B). Increased pelvic floor muscle strength based on the Oxford Grading Scale (50% in groups C and B vs 33.3% in group A).	The combination of Pilates and kegels with biofeedback provides the best results in the restoration of urine control as well as physical function and pain management in daily activities.
3	Supported progressive resistance exercise training to counter the adverse side effects of robot-assisted radical prostatectomy: a randomised controlled trial .(Ashton et al., n.d.)	40 patients post robot-assisted radical prostatectomy	RCT	UK	Resistance exercises abdominal muscles, legs, back, chest, shoulders and arms.	Three training sessions per week for 6 months	Flow-mediated dilatation (FMD), Sit-to-stand test, FACT-P QoL Questionnaire, Brief Fatigue Inventory	Muscle strength of the upper arms (P < 0.01) and lower limbs (P = 0.01). Weight loss (P = 0.04) and body fat percentage (P = 0.02). Increase in HR-QoL based on FACT-P in 3rd and 6th months (P < 0.01).	Increased muscle strength of the upper arm and lower limbs suggests that RET is effective in improving physical function and minimizing pain in post-RARP patients.

4	Effects of supervised high-intensity interval training on motivational outcomes in men with prostate cancer undergoing active surveillance: results from a randomized controlled trial .(Kang et al., 2022)	52 men with prostate cancer who underwent active surveillance were put into a HIIT exercise group or regular care group (UC).	RCT	Canada	Strength training program with aerobic HIITsupervised	Three times a week for 12 weeks	Motivation questions	After the intervention, the HIIT group reported being more fun ($p<0.001$; $d=1.38$), more motivated ($p=0.001$; $d=0.89$), more controlled ($p<0.001$; $d=0.85$), and more confident ($p=0.004$; $d=0.66$), compared to UC. HIIT participants had higher control ($p=0.006$; $d=0.68$) and more specific plans ($p=0.032$; $d=0.67$)	Men with prostate cancer who undergo active surveillance are largely motivated and expect significant benefits from a supervised HIIT program
5	Effect of the exercise programme on the quality of life of prostate cancer survivors: A randomized controlled trial .(Mardani	80 Ca prostate patients were divided into 2 groups (n = 40 control groups	RCT	Iran	The exercise program is in the form of strength training based on the self-manage	A 12-week training program consisting of one group training session and	European Organization for Research and Treatment of Cancer Quality of	The intervention group showed statistically significant improvements in physical, role, emotional, social,	The exercise program significantly reduced pain and improved physical function in the intervention group.

	et al., 2021)	) and (n = 40 intervention groups)		ment approach (SMA)	three individual training sessions per week	Life Questionnaire-Core 30 Version 3 (EORTC QLQ-C30), European Organization for Research and Treatment of Cancer Quality of Life Questionnaire	and sexual function. Patients in the intervention group reported a decrease in pain, fatigue, insomnia, constipation, diarrhea, urinary-related symptoms.	
6	Prehabilitative versus rehabilitative exercise in prostate cancer patients undergoing prostatectomy .(Singh et al., 2023)	38 patients	RCT	Australia	A combination of resistance and aerobic exercises. Resistance training: Involves major muscle groups (leg press, chest press, etc.) with an intensit	6-week pre-rehabilitation or rehabilitation training program. Pre-rehabilitation involves resistance and aerobi	1-RM (One-Repetition Maximum), Chair rise, stair climb, 400-m walk, 6-m walk, EORTC QLQ-C30 user.	In the pre-surgical phase, pre-rehabilitation increased muscle strength (leg press: 17.2 kg; chest press: 2.9 kg; p≤0.001), Rehabilitation showed a decrease in this outcome	There was no significant difference between groups in terms of pain. Prerehabilitation improves physical function before surgery and helps minimize deterioration after surgery.

				y of 6-12 RM (Repetition Maximum). Aerobic exercise: Treadmill, bicycle, or rowing at 60-80% intensity	c training three times a week before surgery, while rehabilitation includes the same starting 6 weeks after surgery		after surgery with postoperative improvement (leg press: 14.6 kg, p<0.001; chest press: 6.8 kg, p<0.001; 400 m walk: -12.0 seconds, p=0.005)	
7	Effect of a Home-based Walking Intervention on CardiopulmonaryFitness and Quality of Life Among Men with Prostate Cancer onActive Surveillance: The Active Surveillance Exercise RandomizedControlled Trial .(From Blarigan et al., 2024)	51 Patients	RCT	USA	A streght program or non-linear aerobic exercise that is tailored to the patient's fitness level in the strength of performing the exercise.	16 Weeks	VO2peak measurement, quality of life (QOL) surveys, anxiety scales, Expanded Prostate Cancer Index Composite (EPIC-26)	Increased VO2peak, reduced fear of recurrence and urinary obstruction/irritation and decreased urinary pain complaints.	Improved cardiopulmonary fitness, reduced urinary obstruction/irritation, and improved overall health-related quality of life.

8	Efficacy of Preoperative-Guided Pelvic Floor Exercises on Urinary Incontinence and Quality of Life After Robotic Radical Prostatectomy .(García-Sánchez et al., 2025)	62 Patients	RCT	SPAIN	Pelvic floor muscle strength training is guided by a physiotherapist that involves progressive contractions.	The exercise is done for an average of 48 to 51 days before surgery. Evaluation of outcomes was performed at 1, 3, 6, and 12 months after surgery	Pad test, SF-36, King's Health Questionnaire (KHQ), 3-day voiding diary questionnaire	There were no significant differences in quality of life, decreased pain and urinary incontinence complaints were reported.	SF-36 scores showed no significant differences in the "physical function" or "pain" domains between the two groups before the intervention
9	Effectiveness of Auricular Acupuncture and Pelvic Floor Muscle Training in the Management of Urinary Incontinence Following Surgical Treatment for Prostate Cancer .(Azevedo et al., 2024)	60 PATIENTS	RCT	BRAZIL	Pelvic floor muscle training (PFMT) and atrial acupuncture	8 Weeks	International Consultation on Incontinence Questionnaire - Short Form (ICIQ-SF) and King's Health Questionnaire (KHQ)	Reduced severity of urinary incontinence, significant improvements in emotional well-being and pain dooamin that improves sleep	Reduction of nocturia and urinary urgency, improving physical function, as well as improving sleep quality and emotional well-being. Higher effectiveness than pelvic floor exercises alone

10	Effect of early pelvic floor muscle exercises (Kegel's) after Robotic Prostatectomy in Prostate cancer patients .(Chitre & Kulkarni, 2023)	69 patients undergoing robotic prostatectomy	Experimental Study	India	early pelvic floor muscle exercises (Kegel exercises) after robotic prostatectomy in prostate cancer patients	3 months	Pelvic floor muscle grading, 24-hour pad test, International Prostate Symptom Score (IPSS), Time to return of continence, Improvement in quality of life	94.20% of patients showed an improvement in the ability to hold urination within 3 months after robotic prostatectomy after undergoing routine exercises in the form of Kegel exercises .Early Kegel exercises after robotic prostatectomy resulted in increased pelvic floor muscle strength and reduced urinary incontinence.	Effects of early pelvic floor muscle (Kegel) exercises after robotic prostatectomy in prostate cancer patients. Increased pelvic floor muscle strength can contribute to improved overall physical function.
11	Lifestyle recommendations and pelvic floor muscle training with Knack maneuver	71 patients with post prostatectomy	RCT	Turkey	Skillful maneuvers and comprehensive lifestyle recom	The assessment was carried out at the begin	International Consultation on Incontinence	showed significant improvement in all primary and	The additional effect of Knack's lifestyle recommendations and

	for postprostatectomy urinary incontinence: a randomized controlled trial .(Gerlegiz et al., 2025)	urinary incontinence			mendations for pelvic floor muscle training (PFMT) in individuals with post-prostatectomy urinary incontinence (PP-UI).	ning and end of the 8th week.	Questionnaire-Short Form (ICIQ-UI SF), 1-h pad test, King's Health Questionnaire (KHQ), Patient Global Impression of Severity Scale, the Turkish-International Physical Activity Questionnaire-Short Form (IPAQ-SF)	secondary outcomes at eight weeks. The group of patients who underwent the PFMT Knack Comprehensive Lifestyle Recommendations had the greatest improvement on all outcome measures (p<0.001). while Knack's PFMT showed superiority in terms of subjective UI severity and UI effects on daily life, compared to PFMT alone (p<0.001),	maneuvers on pelvic floor muscle exercises for post-prostatectomy urinary incontinence suggests that the combination of these exercises significantly improves the patient's physical function.
12	Comparison of In-person Versus Online Comprehensive Pelvic	41 patients	Experimental Study	USA	In-person pelvic floor muscle training (iPFMT)	This intervention was given after a	ICIQ-MLUTS SUI domain score (SDS)	The online pelvic floor muscle training and	A live and online pelvic floor muscle rehabilitation

Floor Rehabilitation Program Following Prostatectomy.(Hutchison et al., 2024)	, Online pelvic floor muscle training and pelvic floor education (oPFMT/PFE)	robotic, robotic-assisted laparoscopic prostatectomy and the outcome was assessed at 12 months.	and the secondary outcomes were pads per day (PPD), PPD cure (0 PPD at 12 months), SUI cure (12-month SDS = baseline score), and quality of life score (IIQ-7 Sum).	education (oPFMT/PFE) program resulted in lower urinary incontinence domain (SUI) scores compared to the in-person program (iPFMT) at most time points, but the rate of improvement was similar between the two groups.	program after a prostatectomy showed that both rehabilitation methods were effective in improving the physical function of postoperative patients.

Types of Prostate Cancer Surgery

Extraction data showed that most of the studies reviewed involved patients undergoing radical prostatectomy, which is a surgical procedure with the removal of the entire prostate gland and surrounding tissue. Some studies also included patients who underwent prostatectomy with different techniques (e.g., laparoscopy or robotic-assisted surgery) (An et al., 2021; Chen et al., 2024; Chitre & Kulkarni, 2023). Accompanied by several symptoms of postoperative indications, including weakness of the internal urethral sphincter and damage to the mechanism of the external sphincter during prostate resection, it can cause stressful urinary incontinence (SUI). Some patients experience chronic pelvic pain after prostectomy. Postoperative periods of inactivity and side effects of hormonal therapy (if used) can lead to muscle weakness and decreased overall physical function (Ashton et al., 2021.; Chitre & Kulkarni, 2023).

Types of Strength Training Interventions Implemented

Extraction data show different types of strength exercises used in the reviewed studies, including Pelvic Floor Muscle (Kegel) exercises aimed at strengthening the muscles that support the bladder and

intestines, which are often affected after prostate surgery (Chen et al., 2024; Chitre & Kulkarni, 2023; Hutchison et al., 2024). Progressive Resistance Training involves the use of weights or resistance gradually to increase overall muscle strength. Functional Exercises that mimic daily movements to improve the patient's functional abilities, such as walking, climbing stairs, or lifting objects (Mardani et al., 2021).

Duration and Frequency of Strength Training and Exercise Interventions

Specific details regarding exercise protocols (e.g., number of reps, sets, and weights) varied between studies. Most studies had an intervention duration of between 8 to 12 weeks. Some studies had shorter durations (e.g., 6 weeks) or longer durations (e.g., 16 weeks). The frequency of exercise is generally 2 to 3 times per week (Azevedo et al., 2024; Gerlegiz et al., 2025; Kang et al., 2022). Some studies may have different frequencies, depending on the type of exercise and the patient's condition. The intensity of the exercise is usually increased gradually as the patient's strength increases. For example, the load or resistance can be increased, or the number of reps and sets can be increased.

Effects and Impacts of Interventions on Pain Intensity and Physical Function

Extraction data showed that strength training had a positive effect on pain and physical function in postoperative prostate cancer patients. Some studies reported significant reductions in the level of pelvic pain after exercise interventions. Pain was measured using an analog visual pain scale (VAS) or other pain questionnaires such as pelvic floor muscle pain. Pelvic floor muscle exercises can help reduce pain related to urinary incontinence. Progressive resistance training effectively increases the strength of large muscles such as leg muscles, back muscles, and chest muscles (Chen et al., 2024; Chitre & Kulkarni, 2023). Muscle strength is measured using a manual muscle strength test or other physical performance test. Some studies suggest that strength training can improve a patient's aerobic capacity, which is measured using a 6-minute walk test or other cardiopulmonary test. Strength training can improve a patient's quality of life by improving functional ability, reducing pain, and boosting confidence. Quality of life Pelvic floor muscle exercises have been shown to be effective in reducing urinary incontinence after prostate surgery. The level of urinary incontinence is measured using a urinary diary, a pad test, or a urinary incontinence questionnaire. measured using quality-of-life questionnaires specific to prostate cancer patients (Azevedo et al., 2024; Gerlegiz et al., 2025).

DISCUSSION

Based on the results of this review, several key themes emerged that need to be addressed in the context of strength training interventions in prostate cancer patients, especially those undergoing treatment therapies such as radical prostatectomy and

androgen deprivation therapy (ADT). Radical prostatectomy, as the main procedure for prostate cancer treatment, is often accompanied by side effects such as urinary incontinence and pelvic pain, which affect the patient's quality of life (Tian et al., 2022; Zdravkovic et al., 2020). Although various surgical techniques can affect the recovery rate, the postoperative effects experienced by patients remain similar. This suggests that physical rehabilitation interventions through strength training are indispensable to support patient recovery (Zdravkovic et al., 2021). Other research has also shown that strength training is effective in overcoming impaired physical function due to side effects of prostate cancer treatment (Kempin et al., 2024; Tian et al., 2022).

Speaking of strength training interventions, the types of exercises applied in this study were diverse, ranging from pelvic floor muscle exercises (Kegels) to progressive resistance exercises and functional exercises. Pelvic floor muscle exercises have been shown to be effective in reducing postoperative urinary incontinence, which is often a problem after radical prostatectomy (Tian et al., 2022). Meanwhile, progressive resistance training, which involves the use of weights and functional exercises, has been shown to increase the strength of large muscles and the body's overall functional capacity (Zdravkovic et al., 2020). These results reinforce the finding that strength training can help patients cope with the decline in muscle mass and physical function due to cancer therapy, especially ADT, which leads to muscle mass loss and increased fat mass (Tian et al., 2022). Strengthening the upper and lower body, through resistance training, is also effective in improving the patient's quality of life (Kempin et al., 2024; Zdravkovic et al., 2021).

In addition to the type of exercise, the duration and frequency of exercise interventions also play an important role in the effectiveness of physical rehabilitation. Exercise durations ranging from 8 to 12 weeks with a frequency of 2 to 3 times per week show optimal results in improving muscle strength and quality of life of patients (Zdravkovic et al., 2021). Research by Tian et al. (2022) also showed that interventions that started immediately after ADT resulted in a more significant improvement in the patient's body composition. This is consistent with findings from other studies that emphasize the importance of exercise of longer duration and appropriate intensity to improve physical outcomes in prostate cancer patients (Kempin et al., 2024).

The benefits of strength training are not only limited to improving physical function, but have also been shown to have a very significant positive effect in reducing pain and improving quality of life in postoperative prostate cancer patients. Some studies reported significant reductions in pain intensity, especially in patients who followed pelvic floor muscle exercises, which helped reduce postoperative urinary incontinence. In addition, progressive resistance training also increases aerobic capacity, reduces fatigue, and improves overall physical function, which contributes to improving patients' quality of life (Tian et al., 2022; Zdravkovic et al., 2020). These exercises not only focus on the physical aspect, but also have significant psychosocial impacts for patients after cancer therapy, such as increasing self-confidence and reducing treatment-related anxiety (Kempin et al., 2024).

Overall, the results of this review suggest that strength training is a highly effective intervention for physical rehabilitation in prostate cancer patients, especially those undergoing treatment therapies such as radical prostatectomy and ADT. Strength training can reduce side effects such as decreased physical function, urinary incontinence, and pelvic pain, as well as improve the patient's quality of life. These findings are supported by evidence from the aforementioned studies, which show that the combination of strength training and the right duration of intervention is essential for optimal outcomes (Kempin et al., 2024; Zdravkovic et al., 2021). However, more research is needed to explore the most effective exercise protocols and evaluate the long-term impact of these interventions, especially in patients with more complex conditions, such as bone metastases or cardiovascular problems associated with ADT (Kempin et al., 2024; Zdravkovic et al., 2020).

CONCLUSION

The results of the systematic analysis of the review showed that strength training had significant benefits in helping postoperative prostate cancer patients. This exercise is effective in reducing pain, especially pelvic pain and pain related to urinary incontinence, as well as improving the patient's physical function, such as muscle strength and the ability to carry out daily activities. The different types of strength exercises used, such as pelvic floor muscle (Kegel) exercises, progressive resistance exercises, and functional exercises, showed positive results with an average intervention duration of 8–12 weeks, performed 2–3 times per week. This intervention also contributes to improving the patient's quality of life by addressing postoperative complications such as urinary incontinence and decreased physical capacity. Overall, strength training is an effective rehabilitation approach to improve the physical and psychosocial condition of postoperative prostate cancer patients.

BIBLIOGRAPHY

An, D., Wang, J., Zhang, F., Wu, J., Jing, H., Gao, Y., Cong, H., Hu, C., Fang, R., & Liao, L. (2021). Effects Of Biofeedback Combined With Pilates Training On Post-Prostatectomy Incontinence. *Urology*, *155*, 152–159. Https://Doi.Org/10.1016/J.Urology.2021.04.057

Ashton, R. E., Aning, J. J., Tew, G. A., Robson, W. A., & Saxton, J. M. (N.D.). *Supported Progressive Resistance Exercise Training To Counter The Adverse Side Effects Of Robot-Assisted Radical Prostatectomy: A Randomised Controlled Trial*. Https://Doi.Org/10.1007/S00520-021-06002-5/Published

Azevedo, C., Ferreira Da Mata, L. R., Cristina De Resende Izidoro, L., De Castro Moura, C., Bacelar Assis Araújo, B., Pereira, M. G., & Machado Chianca, T. C. (2024). Effectiveness Of Auricular Acupuncture And Pelvic Floor Muscle Training In The Management Of Urinary Incontinence Following Surgical Treatment For Prostate Cancer: A Randomized Clinical Trial. *European Journal Of Oncology Nursing*, *68*. Https://Doi.Org/10.1016/J.Ejon.2023.102490

Chen, H., Wang, C., Zhang, Z., Hao, L., Qiu, X., Xu, L., Zhuang, J., & Guo, H. (2024). Application Of Kegel Motion Combined With Warming Acupuncture At The Eight Acupuncture Points In Patients With Urinary Incontinence After Radical Prostatectomy. *International Surgery*, *107*(3), 136–143. Https://Doi.Org/10.9738/Intsurg-D-22-00013.1

Chitre, A., & Kulkarni, J. N. (2023). Effect Of Early Pelvic Floor Muscle Exercises (Kegel's) After Robotic Prostatectomy In Prostate Cancer Patients. *Journal Of Robotic Surgery*, *17*(3), 1065–1070. Https://Doi.Org/10.1007/S11701-022-01506-6

Ding, Y., Wang, H.-W., Chen, H.-X., Lü, P., Wang, D., & Xue, Y.-F. (2023). The Application Of Multidimensional Nursing Intervention In Postoperative Patients With Benign Prostatic Hyperplasia. *Zhonghua Nan Ke Xue = National Journal Of Andrology*, *29*(9), 837–841. Https://Www.Scopus.Com/Inward/Record.Uri?Eid=2-S2.0-85191106304&Partnerid=40&Md5=88db8ac3b9e2ddc886b8b7b4303d2907

García-Sánchez, C., García-Obrero, I., Muñoz-Calahorro, C., Rodríguez-Pérez, A. J., & Medina-López, R. A. (2025). Efficacy Of Preoperative-Guided Pelvic Floor Exercises On Urinary Incontinence And Quality Of Life After Robotic Radical Prostatectomy. *Actas Urologicas Espanolas*. Https://Doi.Org/10.1016/J.Acuro.2025.501702

Gerlegiz, E. N. A., Akbayrak, T., Gürşen, C., Yazici, M. S., Bolat, N. M., Akdoğan, B., Nakip, G., & Özgül, S. (2025). Lifestyle Recommendations And Pelvic Floor Muscle Training With Knack Maneuver For Post-Prostatectomy Urinary Incontinence: A Randomized Controlled Trial. *Supportive Care In Cancer : Official Journal Of The Multinational Association Of Supportive Care In Cancer*, *33*(2), 132. Https://Doi.Org/10.1007/S00520-025-09197-Z

Hasenoehrl, T., Keilani, M., Sedghi Komanadj, T., Mickel, M., Margreiter, M., Marhold, M., & Crevenna, R. (2015). Pengaruh Latihan Resistensi Terhadap Kinerja Fisik Dan Kualitas Hidup Terkait Kesehatan Pada Pasien Kanker Prostat: Tinjauan Sistematis. *Perawatan Pendukung Dalam Kanker* , *23* (8), 2479-2497.

Hutchison, D., Jones, M. K., Ghosal, S., Lawton, J., Greene, K. L., & Rapp, D. E. (2024). Comparison Of In-Person Versus Online Comprehensive Pelvic Floor Rehabilitation Program Following Prostatectomy. *Urology*, *190*, 90–96. Https://Doi.Org/10.1016/J.Urology.2024.05.033

Jin, S., Liu, Z., Liu, Y., Wu, J., & Yu, Q. (2022). Analysis Of Risk Factors And Nursing Strategies For Postoperative Hemorrhage Of Benign Prostatic Hyperplasia. *Evidence-Based Complementary And Alternative Medicine*, *2022*. Https://Doi.Org/10.1155/2022/4205015

Kang, D. W., Boulé, N. G., Field, C. J., Fairey, A. S., & Courneya, K. S. (2022). Effects Of Supervised High-Intensity Interval Training On Motivational Outcomes In Men With Prostate Cancer Undergoing Active Surveillance: Results From A Randomized Controlled Trial. *International Journal Of Behavioral Nutrition*

And Physical Activity, *19*(1). Https://Doi.Org/10.1186/S12966-022-01365-2

Liu, X., Tamminen, S., Korhonen, T., & Röning, J. (2019). How Physical Exercise Level Affects Sleep Quality? Analyzing Big Data Collected From Wearables. *Procedia Computer Science*, *155*(2018), 242–249. Https://Doi.Org/10.1016/J.Procs.2019.08.035

Ma, Z.-Z., Yang, D.-D., Niu, M.-E., Lu, X.-M., Du, Y.-T., Chin, P., Ding, Y.-H., & Qian, C.-Y. (2024). Construction Of Early Warning Classification Of Risk In Bladder Spasm And Its Intervention Plans Guided By The Rate Adjustment Card Of Continuous Bladder Irrigation After Transurethral Resection Of The Prostate (Turp): Development And Usability Study. *Translational Andrology And Urology*, *13*(5), 802–811. Https://Doi.Org/10.21037/Tau-24-150

Mardani, A., Pedram Razi, S., Mazaheri, R., Haghani, S., & Vaismoradi, M. (2021). Effect Of The Exercise Programme On The Quality Of Life Of Prostate Cancer Survivors: A Randomized Controlled Trial. *International Journal Of Nursing Practice*, *27*(2). Https://Doi.Org/10.1111/Ijn.12883

Nowak, H., Zech, N., Asmussen, S., Rahmel, T., Tryba, M., Oprea, G., Grause, L., Schork, K., Moeller, M., Loeser, J., Gyarmati, K., Mittler, C., Saller, T., Zagler, A., Lutz, K., Adamzik, M., & Hansen, E. (2020). Effect Of Therapeutic Suggestions During General Anaesthesia On Postoperative Pain And Opioid Use: Multicentre Randomised Controlled Trial. *The Bmj*, *371*. Https://Doi.Org/10.1136/Bmj.M4284

Nilsen, Ts, Raastad, T., Skovlund, E., Courneya, Ks, Langberg, Cw, Lilleby, W., ... & Thorsen, L. (2015). Efek Latihan Kekuatan Pada Komposisi Tubuh, Fungsi Fisik, Dan Kualitas Hidup Pada Pasien Kanker Prostat Selama Terapi Deprivasi Androgen. *Acta Oncologica* , *54* (10), 1805-1813.

Sharifi, A., Arsalani, N., Fallahi-Khoshknab, M., & Mohammadi-Shahbolaghi, F. (2021). The Principles Of Physical Restraint Use For Hospitalized Elderly People: An Integrated Literature Review. *Systematic Reviews*, *10*(1), 129. Https://Doi.Org/10.1186/S13643-021-01676-8

Van Blarigan, E. L., Kenfield, S. A., Olshen, A., Panchal, N., Encabo, K., Tenggara, I., Graff, R. E., Bang, A. S., Shinohara, K., Cooperberg, M. R., Carroll, P. R., Jones, L. W., Winters-Stone, K., Luke, A., & Chan, J. M. (2024). Effect Of A Home-Based Walking Intervention On Cardiopulmonary Fitness And Quality Of Life Among Men With Prostate Cancer On Active Surveillance: The Active Surveillance Exercise Randomized Controlled Trial. *European Urology Oncology*, *7*(3), 519–526. Https://Doi.Org/10.1016/J.Euo.2023.10.012