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THE ROLE OF PHYSICAL ACTIVITY IN MANAGING UROLOGICAL HEALTH: A COMPREHENSIVE REVIEW WITH FOCUS ON PROSTATE CANCER AND OVERACTIVE BLADDER, INCLUDING RELATED CONDITIONS

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Abstract

Introduction and Purpose

This review explores physical activity's role in managing urological health, focusing on prostate cancer and overactive bladder (OAB). These conditions significantly affect quality of life globally. The review synthesizes research to identify gaps and propose future directions for clinical practice.

Materials and Methods

A literature search was conducted using PubMed, MEDLINE, and Cochrane Library databases (2010-2023). The focus was on randomized controlled trials, observational studies, and systematic reviews.

Key terms included "physical activity," "prostate cancer," "overactive bladder," and "urological health." Studies were selected based on relevance to exercise interventions in urological conditions.

Results

High-intensity exercise reduces prostate cancer risk by 10–30% and improves outcomes by enhancing cardiovascular fitness and quality of life. For OAB, low-impact aerobic exercises alleviate symptoms by improving neuromuscular control and reducing inflammation. Mechanisms include hormonal regulation, improved metabolic health, and reduced inflammation. Structured prehabilitation programs with pelvic floor muscle training optimize continence outcomes post-surgery.

Conclusions

Physical activity is a cost-effective intervention for managing urological health. Despite strong evidence supporting its benefits, gaps remain in understanding optimal exercise prescriptions and long-term effects across diverse populations. Future research should focus on tailoring interventions to patient needs, exploring innovative modalities like high-intensity interval training, and integrating exercise with other treatments to improve outcomes.

Keywords: "physical activity," "prostate cancer," "overactive bladder," "pelvic floor muscle training."

1. Introduction

Physical activity plays a crucial role in maintaining overall health, but its specific impact on urological health has gained increasing attention in recent years. This review focuses on the effects of regular physical activity on urological disorders, with particular emphasis on prostate cancer and overactive bladder (OAB). These conditions significantly affect quality of life and pose substantial healthcare challenges worldwide.

The significance of this topic lies in its potential to revolutionize preventive strategies and treatment approaches for urological disorders. As healthcare systems globally grapple with the rising incidence of prostate cancer and the debilitating effects of OAB, understanding the role of physical activity offers a promising, cost-effective intervention that could complement existing therapies and improve patient outcomes.

Urological health encompasses a wide range of conditions affecting the urinary system and male reproductive organs. Prostate cancer, the second most common cancer in men globally, and OAB, affecting millions of individuals, represent two key areas where physical activity may have profound impacts. Regular exercise has been associated with various health benefits, but its specific mechanisms and effects on urological health require further exploration. Despite growing evidence supporting the benefits of physical activity in urological health, there remains a significant gap in our understanding of the optimal exercise prescriptions, underlying biological mechanisms, and long-term effects across diverse populations. This review aims to address these gaps by synthesizing current knowledge and identifying areas for future research. The following sections will critically examine the impact of physical activity on prostate cancer prevention and management, its role in alleviating OAB symptoms, and the broader implications for general urological health.

We will explore the intensity and types of physical activity associated with the most significant benefits, the biological mechanisms underlying these effects, and the challenges in implementing exercise interventions for urological patients. By comprehensively analyzing the existing literature and highlighting emerging trends, this review seeks to provide a foundation for future research directions and inform evidence-based clinical practices in urological health management.

2. Materials and Methods

This article presents a narrative literature review synthesizing findings from peer-reviewed articles on the role of physical activity in urological health, with a specific focus on prostate cancer and OAB. A formal systematic search was not conducted; instead, a comprehensive literature search was performed to identify relevant studies and reviews.

2.1 Literature Search Strategy

The literature search was conducted using multiple electronic databases, including PubMed, MEDLINE, Embase, Cochrane Library, and Web of Science. The search utilized a combination of Medical Subject Headings (MeSH) terms and free-text keywords related to physical activity, exercise interventions, and urological disorders. Key search terms included, but were not limited to:

- Physical activity, exercise, aerobic exercise, resistance training
- Prostate cancer, prostate neoplasm, prostatic carcinoma
- Overactive bladder, urinary incontinence, nocturia
- Lower urinary tract symptoms (LUTS), benign prostatic hyperplasia (BPH)
- Urological health, urology
- Quality of life, symptom management
- Pelvic floor muscle training, Kegel exercises
- Cancer survivorship, cancer rehabilitation
- Metabolic syndrome, obesity, insulin resistance
- Inflammation, oxidative stress

The search primarily focused on studies published between January 2010 and December 2023 to ensure the inclusion of recent evidence, although seminal papers from earlier dates were also considered when relevant.

In addition to the electronic database search, reference lists of identified articles and relevant reviews were manually screened to identify additional studies of interest.

2.2 Study Selection

Studies were selected based on their relevance to the topic of physical activity and urological health, with a focus on prostate cancer and OAB. The selection process prioritized:

1. Randomized controlled trials (RCTs) and controlled clinical trials (CCTs)
2. Observational studies (cohort and case-control studies)
3. Systematic reviews and meta-analyses
4. Narrative reviews providing comprehensive overviews of the field

Studies were included if they examined physical activity or exercise interventions in adult populations (≥18 years) with urological conditions or at risk of developing such conditions. The review considered studies reporting on outcomes such as quality of life, physical function, symptom scores, and physiological parameters relevant to urological health. Every study was checked, if applicable, for its adherence to the ethical standards of the Declaration of Helsinki.

2.3 Exclusion criteria:

1. Non-English publications
2. Studies that did not provide empirical data on specified outcomes
3. Studies including participants with severe cardiovascular disease or other severe comorbidities
4. Studies involving participants who had previously received invasive therapies for the urological condition
5. Case studies, cross-over studies, and gray literature

2.4 Quality Assessment

While a formal quality assessment tool was not used due to the narrative nature of this review, the relevance and quality of studies were considered based on factors such as study design, sample size, methodology rigor, and relevance to the review's objectives. Priority was given to well-designed RCTs, large-scale observational studies, and comprehensive systematic reviews.

2.5 Data Extraction and Synthesis

Relevant information was extracted from the selected studies, including study design, participant characteristics, intervention details, outcome measures, and key findings. Given the narrative nature of this review, a formal meta-analysis was not conducted. Instead, findings were synthesized qualitatively to provide a comprehensive overview of the current state of knowledge regarding physical activity and urological health.

The synthesis focused on identifying common themes, conflicting results, and gaps in the current literature. Particular attention was paid to the biological mechanisms underlying the effects of physical activity on urological health, as well as the clinical implications for prevention and management of urological disorders.

2.6 Limitations

As this is a narrative review, it does not claim to be an exhaustive representation of all available evidence. The lack of a formal systematic review process means that there is a potential for selection bias in the included studies. However, efforts were made to include a diverse range of high-quality studies to provide a balanced and comprehensive overview of the topic.

3. State of knowledge

3.1 General Urological Health

Physical activity significantly impacts urological health, offering broad benefits for the urinary system. Regular exercise improves metabolic, cardiovascular, and musculoskeletal parameters, correlating with reduced risk of various urological diseases.

3.1.1 Impact on Urine Production and Lower Urinary Tract Function

Recent research has illuminated the effects of physical activity and body position on urine production and lower urinary tract function. A pilot study revealed that increased body movement leads to significant changes in urine output and composition. Specifically, diuresis increased during daytime, night-time, and over 24 hours ($P = .002$, $P < .001$, and $P < .001$, respectively), while urine osmolality decreased during night-time and over 24 hours ($P = .009$, and $P = .004$, respectively) (Deger et al. 2021). These findings have implications for managing conditions like OAB.

Furthermore, a prospective study demonstrated an inverse relationship between physical activity and the risk of developing LUTS. Men with the highest physical activity were 19% less likely to develop moderate or worse LUTS compared to those in the lowest activity category (HR = 0.81, 95% CI = 0.74-0.89; p trend < 0.0001). Conversely, sedentary behavior, such as prolonged television watching, increased LUTS risk by 24% (HR = 1.24, 95% CI = 1.05-1.45; p trend = 0.004) (Mondul, Giovannucci, and Platz 2020). These results underscore the potential of lifestyle interventions in both preventing and managing urological disorders.

3.1.2 Mechanisms of Physical Activity's Impact on Urological Health

Physical activity influences urological health through several key mechanisms:

1. Hormonal Regulation: Exercise modulates hormonal balance, particularly androgen levels, which are crucial for prostate health. Regular activity reduces inflammation and improves metabolic parameters, potentially alleviating symptoms associated with BPH (Kang et al. 2021).
2. Cardiovascular System Impact: Physical activity improves vascular health, reducing the risk of LUTS complications. Regular aerobic and strength exercises enhance endothelial function, decrease arterial stiffness, and increase blood flow, supporting lower urinary tract health (Kang et al. 2021).
3. Muscle Functioning: Resistance training maintains muscle mass, essential for metabolic and physical health. In patients with prostate diseases, preserving muscle mass supports weight control and improves insulin sensitivity. Structured training programs can enhance neuromuscular health and overall physical performance (Mohamad et al. 2019); (Jared M. Gollie 2022).

3.1.3 BPH and LUTS.

The connection between physical activity and prostate health is well-established. Studies indicate that increased physical activity and a plant-based diet significantly lower the risk of developing BPH and LUTS. Weight loss programs combined with regular exercise can enhance the effectiveness of pharmacological treatments, particularly 5α-reductase inhibitors in overweight patients. By improving metabolic parameters, physical activity supports standard therapeutic methods and may slow symptom progression (Raheem and Parsons 2014). As we transition to discussing specific urological conditions such as prostate cancer and OAB in the following sections, it's important to note that the general principles outlined here form the foundation for understanding how physical activity can be leveraged in prevention and management strategies.

The mechanisms described provide insight into why exercise is beneficial across a spectrum of urological disorders, setting the stage for more targeted discussions in subsequent parts of this review.

3.2 Effect of Regular Physical Activity on Prostate Cancer - Prevention and Management

The role of physical activity in the prevention and management of prostate cancer has garnered substantial interest, with evidence supporting its multifaceted benefits. Across various studies, structured exercise interventions have been shown to mitigate treatment-related adverse effects, improve physical and mental health outcomes, and potentially modulate disease progression through systemic and cellular mechanisms.

3.2.1 Intensity of Physical Activity

The intensity of physical activity plays a critical role in mitigating prostate cancer risk and its management outcomes. High-intensity exercise, such as supervised resistance training or interval aerobic sessions, provides significant physiological stimuli for muscle adaptation, improved oxygen utilization, and enhanced systemic resilience. These findings emphasize the importance of tailoring exercise intensity to patient capacities while progressively increasing intensity to maximize benefits. A meta-analysis (Andersen et al. 2022) found that exercise interventions demonstrated a moderate to large effect on cardiovascular fitness (SMD = 0.46, 95% CI: 0.34-0.59), with aerobic exercise showing the largest effect (SMD = 0.60, 95% CI: 0.29-0.90).

3.2.2 Mechanisms of Protection

Physical activity exerts protective effects against prostate cancer through various interconnected biological mechanisms:

1. Improved Hormonal Regulation: Exercise modulates systemic insulin sensitivity, reduces circulating insulin-like growth factor (IGF-1), and regulates androgen levels, which are critical factors in prostate cancer growth. Resistance training, in particular, enhances the hormone-binding globulin levels, which potentially lowers bioavailable testosterone, slowing hormone-sensitive tumor growth (Shephard 2017).
2. Reduced Inflammation: Aerobic and resistance exercises mitigate chronic inflammation by lowering inflammatory cytokines like interleukin-6 and C-reactive protein (CRP). This anti-inflammatory response reduces systemic inflammation, creating a less favorable environment for tumor proliferation (Andersen et al. 2022).
3. Enhanced Immune Function: Regular physical activity improves natural killer cell activity and enhances circulation, promoting immune surveillance and tumor suppression (Campos et al. 2018).

Mechanistically, exercise stimulates an adaptive immune response that limits tumor progression and metastasis. Moreover, physical activity has been shown to directly influence the tumor microenvironment by disrupting tumor-supporting metabolic pathways and optimizing systemic resilience. For example, vigorous physical activity is associated with lower tumor inflammation and alterations in the immune microenvironment, including reduced abundance of immunosuppressive cells such as T regulatory cells and macrophages.

These changes can enhance the body's ability to fight cancer cells and prevent tumor progression (Huang et al. 2024).

3.2.3 Impact on Prostate Cancer Progression

Emerging research highlights that physical activity serves as a therapeutic adjunct for men diagnosed with prostate cancer, with the potential to slow disease progression and improve survival rates. Programs incorporating both aerobic and resistance components have proven synergistic, effectively addressing multiple health parameters concurrently. Structured exercise interventions effectively enhance cardiovascular fitness, body composition, muscle strength, and metabolic health, reducing risk factors associated with cancer development and recurrence (Shephard 2017).

The meta-analysis by Andersen et al. (2022) reported that exercise interventions resulted in a small positive effect on cancer-specific quality of life (SMD = 0.10, 95% CI: -0.01 to 0.22) and showed a small significant overall effect on fatigue (SMD = 0.27, 95% CI: 0.13-0.40)PMID: 8776086. Additionally, for lower body strength, exercise showed a small to moderate overall effect (SMD = 0.44, 95% CI: 0.26-0.62), and demonstrated an overall significant reduction in whole-body fat mass (WMD = -1.13 kg, 95% CI: -1.92 to -0.33).

Programs combining moderate to vigorous intensity aerobic and resistance training reduce fatigue and enhance patients' quality of life by mitigating psychological stress and improving mental well-being, thereby supporting better adherence to treatment protocols.

3.2.4 Comprehensive Prehabilitation Programs

Comprehensive prehabilitation programs leverage the waiting period before surgery to deliver structured, exercise-based interventions that collectively improve physiological functional capacity. These programs have been shown to optimize continence outcomes and enhance overall quality of life post-surgery in prostate cancer patients.

For instance, pelvic floor muscle training (PFMT) has been demonstrated to significantly increase the odds of continence at three months post-surgery. This aligns with findings from a prospective study that showed men with the highest physical activity were 19% (HR = 0.81, 95% CI: 0.74-0.89; p trend < 0.0001) less likely to develop incident moderate or worse LUTS than men in the lowest activity category (Mondul et al. 2020).

3.3 OAB Management

Regular physical activity plays a crucial role in managing urological disorders, particularly OAB and prostate-related issues. This section reviews the benefits of low-impact exercises, the physiological mechanisms underlying these effects, and their integration with other treatment modalities, while also addressing the challenges faced by patients with OAB during exercise.

3.3.1 Low - Impact Aerobic Exercises

Low - impact aerobic exercises such as swimming, walking, and cycling have been shown to significantly alleviate symptoms of OAB. These activities are gentle on the joints while promoting cardiovascular health and weight management, which are essential for overall well-being.

A study indicated that structured exercise programs targeting abdominal fat reduction resulted in substantial improvements in OAB symptoms among young overweight women. Participants reported fewer voiding episodes and increased bladder capacity after engaging in a regimen that included aerobic training alongside muscle strengthening and stretching exercises (Hagovska et al. 2020).

Quantitative data from recent research supports these findings. The randomized controlled trial by Andersen et al. (2022) found that exercise interventions demonstrated a moderate to large effect on cardiovascular fitness (SMD = 0.46, 95% CI: 0.34-0.59), with aerobic exercise showing the largest effect (SMD = 0.60, 95% CI: 0.29-0.90). This improvement in cardiovascular health can indirectly benefit OAB symptoms by enhancing overall pelvic blood flow and reducing systemic inflammation.

Additionally, these low-impact exercises enhance pelvic circulation and muscle tone, contributing to better bladder control. The gradual nature of these activities makes them accessible for individuals who may be hesitant to engage in more strenuous workouts due to fear of exacerbating their symptoms.

3.3.2 Physiological Mechanisms

The effectiveness of exercise in managing OAB symptoms can be attributed to two key physiological mechanisms:

1. Morphological Adaptations: Regular physical activity and pelvic floor muscle training lead to significant changes in pelvic floor muscle anatomy, including higher bladder neck position and improved external urethral sphincter function (Bø 2024).
2. Enhanced Blood Flow: Aerobic exercises improve overall circulation, including blood flow to the pelvic region, which can support bladder and urethral health (Matsumoto and Kakizaki 2012).

3.3.3 Integration with Other Treatments

Exercise programs should be complemented with behavioral modifications for optimal results. These include establishing normal voiding intervals, implementing bladder training, and pelvic floor muscle training. The combination of behavioral interventions with exercise has demonstrated enhanced effectiveness in managing OAB symptoms. A review found that bladder training may be more effective than no treatment, though the evidence quality was rated as low to very low (Funada and Watanabe 2023).

A randomized clinical trial by (Burgio et al. 2020) investigated the effectiveness of combining behavioral and drug therapies for OAB symptoms. The study found that reductions in voiding frequency were significantly greater in those receiving combined therapy compared to drug therapy alone. Additionally, when using a stepped approach to treatment, beginning with behavioral therapy showed promising results.

3.3.4 Challenges

Despite the benefits of exercise, individuals with OAB may encounter several challenges when attempting to maintain an active lifestyle. Research shows that over half of women with OAB report physical activity limitations (Chu et al. 2016).

Common barriers include fear of urgency or leakage during physical activity, with studies showing that approximately 28% of women find urinary symptoms to be at least a moderate barrier to exercise, leading some to modify their exercise routine or stop exercising altogether (Nygaard and Shaw 2016).

To address these challenges, evidence-based strategies include:

1. Starting with mild to moderate physical activity, as studies show this level of activity actually decreases both the odds of having and developing urinary incontinence (Nygaard and Shaw 2016).
2. Focusing on habitual walking, which has been shown to decrease the odds of urinary incontinence by approximately one-half in older women (Nygaard and Shaw 2016).
3. Choosing low-impact activities that minimize repetitive jumping and bouncing, as high-impact activities show higher rates of urinary incontinence during exercise (Nygaard and Shaw 2016).

These strategies are supported by research showing that most physical activity does not harm the pelvic floor and provides numerous health benefits for women (Nygaard and Shaw 2016).

3.3.5 Broader Perspective

The impact of exercise on OAB can vary depending on patient characteristics and treatment approach. The randomized clinical trial by Burgio et al. (2020) demonstrated that combining behavioral interventions with drug therapy in men aged 40 and older led to significant improvements in voiding frequency. The study found that behavioral therapy alone or combined with medication was more effective than medication alone, suggesting the importance of behavioral interventions across different age groups.

In conclusion, exercise and behavioral interventions are instrumental in managing OAB symptoms. While the specific mechanisms underlying these benefits require further study, the evidence supports incorporating physical activity as part of a comprehensive OAB management strategy.

3.4 Exercise recommendations

Aerobic exercise has been defined as any form of physical activity that increases heart rate and tidal volume, providing oxygen to activated muscles. Studies have shown that aerobic exercise is most effective in improving cardiovascular fitness, while resistance exercise is better at increasing lower body strength and lean body mass.

All types of exercise were found to be effective in improving cardiovascular fitness, with aerobic exercise showing the strongest effects. A minimum 12-week exercise program combining aerobic and resistance training, performed twice a week, is recommended to counteract the health challenges of treating prostate cancer with anti-androgen therapy (ADT) (Andersen et al. 2022).

Stand-alone exercise has been proposed as a potential primary treatment option for men with localized prostate cancer under active surveillance, with minimal risk of adverse effects.

Interventions involving exercise, both with and without lifestyle modifications, have been shown to be effective in increasing cardiorespiratory fitness, lowering PSA levels and improving quality of life. While promising, it's important to note that this approach requires further investigation to establish its long-term efficacy and safety.

Studies have shown that higher peak VO2 is associated with lower mortality from cancer, cardiovascular disease and other causes in cancer survivors.

Some studies suggest that a program combining aerobic and resistance exercise has greater benefits than using just one type of exercise (aerobic or resistance) (Lee et al. 2024).

To prevent urological dysfunctions, such as OAB, in overweight women, it is crucial to reduce body weight through regular physical activity. Moderate-intensity exercise is beneficial for regulating various parameters of body composition.

A key component of this training program is strength training, including activation of the deep abdominal muscles and strengthening of the superficial muscles.

The results showed improvements in micturition frequency, urinary urge, nycturia, and an increase in mean urine volume. The observed effects correlated with a reduction in subcutaneous and visceral fat in the abdominal region, suggesting a relationship between the duration of the program and positive changes in urological functions.

It is crucial to individualize training plans considering age, health status, and specific urological conditions in order to maximize therapeutic benefits. (Hagovska et al. 2020)

3.5 Biological Mechanisms of Physical Activity in Preventing and Managing Urological Disorders

3.5.1 Metabolic Improvement

Metabolic dysregulation, including obesity and insulin resistance, is closely associated with urological conditions such as prostate cancer and lower urinary tract symptoms (LUTS). Regular physical activity improves metabolic health by enhancing insulin sensitivity, reducing visceral fat, and promoting a favorable lipid profile. These changes mitigate the risks associated with metabolic syndrome - a condition linked to urological disorders through systemic inflammation and oxidative stress (Obesity, Metabolic Health, and Urological Disorders, 2021) (Kim et al. 2021).

Physical activity decreases the activity of insulin-like growth factors (IGFs), which are known to promote the proliferation of prostate cancer cells. Concurrently, it increases the levels of IGF-binding proteins, further inhibiting cancer cell growth and fostering apoptosis in malignancies (Physical Activity and Prostate Cancer: An Updated Review) (Shephard 2017).

Improved glucose metabolism and reduced hyperinsulinemia diminish pro-inflammatory cytokine production from adipose tissue, thereby reducing the burden of inflammation that often exacerbates urological diseases (Park et al. 2019).

Additionally, habitual exercise mitigates the hypoxic environment of tumors, improving drug delivery and reducing disease aggressiveness (Campos et al. 2018). For OAB metabolic benefits such as reduced obesity and improved glycemic control reduce mechanical pressure on the bladder, alleviating symptoms (Dungey et al. 2013).

3.5.2 Inflammation Reduction

Chronic systemic inflammation is a pivotal mechanism linking various urological conditions, including prostate cancer, OAB, and chronic kidney disease. Physical activity is recognized for its potent anti-inflammatory effects, including reductions in circulating levels of pro-inflammatory markers such as C-reactive protein (CRP) and tumor necrosis factor-alpha (TNF-α) (Shephard 2017).

In prostate cancer, adipose tissue-derived cytokines play a role in tumor proliferation. Exercise reduces adiposity, thereby lowering the production of these cytokines and the associated tumor-promoting effects (Kim et al. 2021).

For patients with chronic kidney disease, which is often linked to urological disorders, physical activity decreases systemic inflammation markers, potentially delaying disease progression and improving overall urological health (Dungey et al. 2013) .These findings underscore the role of exercise in reducing inflammation-driven pathologies in the urinary system.

3.5.3 Elevated Testosterone Levels and Their Effect on LUTS

The relationship between testosterone levels and LUTS is complex, with evidence suggesting both protective and detrimental effects depending on the hormonal milieu. Regular physical activity modulates testosterone levels, typically lowering serum concentrations in obese individuals while improving free testosterone levels in those with hypogonadism. This dual effect contributes to a balanced hormonal environment that can alleviate LUTS and enhance prostate health (Shephard 2017).

The relationship between testosterone and prostate cancer has long been controversial, with early research associating higher testosterone levels with an increased risk of prostate cancer. However, more recent findings have nuanced this understanding. Evidence now suggests that testosterone itself does not directly increase prostate cancer risk but may, rather, play a role in the progression of existing prostate cancer. Importantly, exercise has been found to lower the risk of prostate cancer and to improve outcomes in patients with prostate cancer by potentially lowering testosterone levels through mechanisms such as weight reduction and improved metabolic health (Alibhai et al. 2019).

3.6 Special Populations

Physical activity plays a critical role in managing urological conditions across various populations. For prostate cancer survivors, exercise has been shown to improve quality of life, mitigate treatment-related side effects, and enhance physical functioning.

In men undergoing androgen deprivation therapy (ADT), resistance training helps counteract muscle loss and bone density reduction, while aerobic exercise reduces fatigue and enhances cardiovascular health (O'Neill and Alibhai 2016).

For elderly women with urinary incontinence (UI), regular physical activity significantly enhances functional performance and reduces UI symptoms. Structured exercise regimens targeting pelvic floor musculature bolster muscle strength, improve postural stability, and enhance mobility (Magaldi 2018). Low-impact activities such as yoga have also been shown to reduce total incontinence episodes by up to 76%, offering a safe and accessible non-invasive management option (Huang et al. 2019).

Participation in group exercise or community-based programs provides additional psychological benefits by alleviating feelings of isolation, depression, and anxiety. These programs create supportive environments that encourage adherence to physical activity regimens while addressing the multifactorial challenges associated with urological conditions (O'Neill and Alibhai 2016).

In prostate cancer survivors on active surveillance (AS), exercise improves cardiorespiratory fitness (VO2 peak) and may positively affect prostate-specific antigen (PSA) levels while enhancing quality of life through lifestyle modifications involving aerobic exercise and diet (Reaves et al. 2023).

4. Future Directions

The link between physical activity and urological health is gaining recognition, but more research is needed. This will help improve clinical practice and outcomes for those with prostate cancer and OAB. There is a gap in research on the biological effects of physical activity on urological conditions such as prostate cancer and OAB. Although associations are known, the precise ways that exercise affects inflammation, hormone regulation or oxidative stress are unclear. The effect of different types, intensities and durations of physical activity on urological health is not well understood (Neil-Sztramko et al. 2019).

Research often ignores specific groups, such as women with OAB, ethnic minorities, or people with other conditions. Most studies focus on advanced stages of the disease, with insufficient attention to early prevention or intervention. Long-term studies are scarce, making causal relationships and sustainability difficult to grasp. Furthermore, there is a lack of knowledge about the optimal type, frequency, and intensity of exercise. There is a lack of research on the effects of physical activity alongside other treatments for prostate cancer and OAB The potential benefits of combining exercise with other lifestyle changes and the impact of physical activity on mental health, sexual health and overall quality of life are understudied, as are the cultural and behavioural factors influencing the uptake of physical activity.

Addressing gaps in urological health research necessitates the exploration of innovative exercise methods, which can provide valuable insights into designing effective interventions. Among the most promising approaches are high-intensity interval training (HIIT) and low-intensity modalities such as yoga and tai chi, each offering distinct benefits tailored to varying patient needs (Wayne et al. 2018).

By addressing these research gaps, considering cultural and behavioral factors, and exploring innovative exercise modalities, we can enhance our understanding of how physical activity impacts urological health. This knowledge will be crucial in developing more effective, personalized interventions for preventing and managing conditions like prostate cancer and OAB.

5. Conclusions

This literature review has comprehensively examined the role of physical activity in urological health, with a specific focus on prostate cancer and OAB. The findings underscore the significant impact of regular exercise on both the prevention and management of these conditions, offering valuable insights for clinical practice and future research directions.

5.1 Key Findings

Physical activity has been shown to have multifaceted benefits for urological health:

- Prostate Cancer: Regular exercise is associated with a 10-30% reduction in prostate cancer risk, particularly when involving high-intensity activities1. It also improves outcomes for those diagnosed with prostate cancer, enhancing cardiovascular fitness, body composition, and quality of life.
- OAB: Low-impact aerobic exercises significantly alleviate OAB symptoms, with structured programs showing improvements in voiding frequency and bladder capacity.
- General Urological Health: Physical activity positively impacts urine production, lower urinary tract function, and overall urological well-being through various mechanisms including hormonal regulation, improved vascular health, and enhanced muscle functioning.

5.2 Research Gaps and Future Directions

Despite the substantial evidence supporting the benefits of physical activity in urological health, several research gaps remain:

- Biological Mechanisms: While associations between exercise and urological health are established, the precise mechanisms by which physical activity affects inflammation, hormone regulation, and oxidative stress in urological conditions require further elucidation.
- Exercise Specificity: More research is needed to determine the optimal type, frequency, and intensity of exercise for different urological conditions and patient populations.
- Special Populations: There is a lack of studies focusing on specific groups such as women with OAB, ethnic minorities, and individuals with comorbidities.
- Long-term Effects: Longitudinal studies are necessary to establish causal relationships and assess the sustainability of exercise interventions in urological health.
- Integrated Approaches: Further investigation is needed on the synergistic effects of combining physical activity with other treatments and lifestyle modifications.

5.3 Implications for Practice

The findings of this review have significant implications for clinical practice:

- Exercise Prescription: Healthcare providers should consider incorporating structured exercise programs into standard care pathways for prostate cancer and OAB management.
- Prehabilitation: Comprehensive prehabilitation programs, including pelvic floor muscle training, should be implemented to optimize post-surgical outcomes in prostate cancer patients.
- Personalized Interventions: Exercise recommendations should be tailored to individual patient capacities, considering factors such as age, health status, and specific urological conditions.
- Integrated Care: Combining exercise interventions with behavioral modifications and pharmacological treatments may yield superior outcomes in managing urological disorders.

5.4 Final Thoughts

This review highlights the critical role of physical activity in urological health, demonstrating its potential as a cost-effective, non-pharmacological approach to preventing and managing conditions like prostate cancer and OAB. As research in this field continues to evolve, it is imperative that healthcare providers, researchers, and policymakers collaborate to translate these findings into effective, personalized interventions. By doing so, we can significantly improve the quality of life and health outcomes for individuals affected by urological disorders.

Disclosure

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