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Towards establishing a comprehensive yoga therapy protocol for addressing hip disorders in women - reviewing the literature

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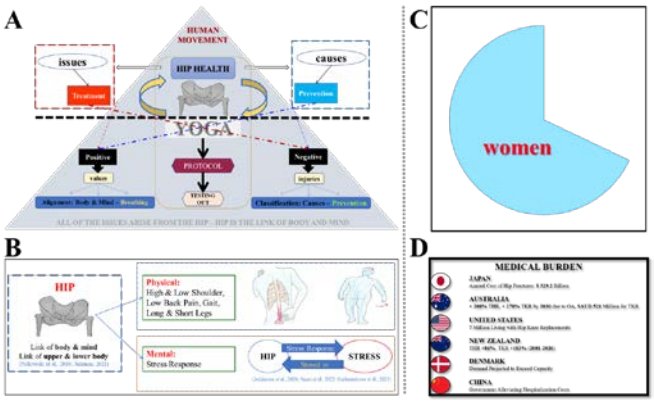
Abstract
The review was initiated by the lead author asking 1) why is the hip considered a central component in holistic health; 2) what is the current research evidence regarding yoga as a therapeutic intervention for hip disorders; 3) how does yoga differ from other interventions in terms of mechanisms and outcomes. The purpose of this literature review is to provide an overview of the existing research related to women's hip health, including its (hip disorder) causes, treatments and prevention strategies, as well as the role or perception/s of utilizing yoga as a therapeutic intervention. A narrative review of 82 research papers identified using databases such as PubMed, Google Scholar, and ScienceDirect, with search terms related to hip disorders, women's health, and yoga therapy. The findings are categorized into five major themes: 1) the significance of hip health in women and gender-specific considerations; 2) common hip disorders and their physical and psychological impacts; 3) current prevention and rehabilitative treatment approaches; 4) yoga as a unique integrative therapy, and 5) safety considerations and the need for standardized yoga protocols. Results indicate a growing body of research supporting yoga's therapeutic potential, particularly due to its holistic nature, accessibility and mind-body integration. However, gaps remain in the standardization of yoga protocols and in studies focused specifically on women's hip health. This review lays the foundation for developing a yoga protocol for women's hip health.

Keywords: Hip, women, health, disorder, treatment, prevention

1. Introduction
The review was initiated by a deep-seated question in the mind of the lead author, asking what is the position of yoga in solving women's health issues. Further discussions among the co-authors and narrowing down on the interest and concerns in women's health led to the key concern of hip health and women (Fig. 1). The hip area is considered a central link between the body and mind. While stress can cause tension anywhere, the deep hip flexor muscle (the iliopsoas) is especially important. This is because of its primary role in our survival instinct, which prepares the body to react to threat, and its close physical connection to the adrenal glands, which release stress hormones. Therefore, chronic hip tension is not just a symptom of stress, but may also be a key factor in keeping the body's stress response active, making it an important focus for holistic healing (Polkowski and Clohisy, 2010; Ishler, 2021) [63, 43]. Women, in particular, are more susceptible to hip-related health concerns compared to men (Temkin *et al*., 2022; Carneiro, 2024) [76, 18], highlighting the urgent need for effective prevention and treatment strategies. A growing body of evidence suggests that functional and psychological factors may be fundamental to understanding and addressing hip health (Pert *et al*., 1998; Gudmundsson *et al*., 2021; Auais *et al*., 2022) [62, 34, 6]. While diverse influences exist, this review argues that body alignment, posture, and mental well-being are closely linked,



creating a powerful connection.

Fig 1: Overall conceptual structures behind designing a therapeutic yoga protocol targeting hip health in women. (images self-drawn by the lead author).

Among the available interventions, yoga appears to be a particularly promising approach due to its unique advantages: 1) Cost-effectiveness - Yoga is accessible and does not require expensive equipment or medical interventions. 2) Holistic approach - It addresses both physical and mental aspects, targeting the root causes of hip health issues (Wieland *et al*., 2021) [81]. 3) Popularity among women - As a widely practiced discipline, yoga offers a feasible and engaging method for improving hip health. To validate yoga's effectiveness, a structured yoga protocol will be developed based on previous research and expert recommendations. This protocol will also account for potential yoga-related injuries and will be tested for efficacy to ensure its practical applicability in hip health management (Fig. 1A). The hip is central to the human body, serving as a crucial link between the upper and lower body. Physically, hip imbalances can contribute to conditions such as high or low shoulders, lower back pain, gait abnormalities, and leg length discrepancies. Emotionally, the hips are a common storage site for stress, as they play a key role in the body's fight-or-flight response, linking hip disorders to anxiety and depression (Ishler, 2021) [43] (Fig. 1B). 'Clinic and Surgery' for hip among women comprise two-thirds of the whole population (Powers, 2010) [64] (Fig. 1C). Hip disorders contribute significantly to global healthcare costs, underscoring the necessity for effective prevention and treatment strategies (Fig. 1D). Japan: The total annual medical expenditures for fragility-related hip fractures are estimated at 329.2 billion yen (Mori *et al*., 2022) [54]. Australia: The incidence of total knee replacements (TKR) and total hip replacements (THR) due to osteoarthritis (OA) is projected to rise by 276% and 208%, respectively, by 2030. Additionally, the increasing prevalence of obesity is expected to result in 24,707 additional TKRs, costing an estimated $AUD 521 million (Ackerman *et al*., 2019) [2]. United States: Rising obesity rates are significantly contributing to an increase in hip and knee surgeries. Currently, around 7 million Americans live with hip or knee replacements, with many maintaining mobility despite advanced arthritis (Maradit *et al*., 2015) [51]. New Zealand: THR and TKR surgeries are expected to increase by 86% and 183%, respectively, between 2001 and 2026 (Hooper *et al*., 2014) [40]. Denmark: The demand for total hip arthroplasty (THA) procedures is anticipated to exceed the current healthcare system's capacity due to an aging population and an independent increase in surgical activity (Pedersen *et al*., 2005) [61]. China: To address the rising number of hip surgeries and their associated financial burden, the Chinese government has introduced new policies to alleviate hospitalization costs for patients (Fan *et al*., 2024) [22]. These statistics highlight the growing demand for hip healthcare services and the urgent need for preventive measures to mitigate both medical and economic burdens (Fig. 1D).

This literature review focuses on the existing research related to women's hip health, and examines the research on this subject including its causes, treatments and prevention. Moreover, as yoga is a keyword in this topic, the role of yoga as a therapeutic intervention for hip disorders was investigated. By analyzing key studies, this review identifies research trends, highlights gaps, and explores the potential role of yoga in addressing hip health in women. To better understand the multifaceted nature of hip health and its connection to women's overall well-being, this review is organized into three key themes: 1) An exploration of 'Hip health and Women', including its significance, common disorders, and unique challenges; 2) What are the 'Hip Disorders and Impacts' (Body & Mind); 3) What are the 'Current Treatment and Prevention' strategies, focusing on limitations in existing approaches; and 4) How or what is the role of 'Yoga as Therapy', emphasizing its potential to bridge the physical and mental aspects of hip health; and 5) What are the 'Protocol and Safety Considerations'. Each section synthesizes findings from the reviewed studies, highlighting both consensus and gaps in the literature.

2. Methodology

A narrative review of 82 research papers identified (screened) using the keywords - Hip Health, Women Health, Hip Disorders, Hip Instability, Treatment, Prevention, Therapy, Body and Mind, Mental Health, Yoga, Yoga Injuries, Yoga Therapy, Iyengar Yoga, Yoga Protocol for Hip, Breathing, Breathing Pattern, Breathing and Stress - (GOOGLE: https://www.google.com/; PubMed: https://pubmed.ncbi.nlm.nih.gov/; ScienceDirect: https://www.sciencedirect.com/; Google Scholar: https://scholar.google.com/; SpringerLink: https://link.springer.com/; Research Gate: https://www.researchgate.net) was conducted to identify hip and hip-related disorders and injuries in women. Concurrent to the aim of the study authors analyzed the current treatment and prevention approaches for hip and hip-related disorders, and assessed the role and value of alternative approaches such as yoga in particular. The reviewed literature was categorized into the following themes: as illustrated in the pie chart titled "Reviews in Women's Hip (66 Papers)" (*The total number of reviewed papers is 66; however, some papers appear under multiple themes, so the subtopic counts may exceed the total*). The (Fig. 2) organizes the literature into three main themes, each represented by a distinct color: 1) Theme 1: Hip, Health, and Women (shown in red, total 21 papers) includes: Importance of Hip Health (5 papers), Medical Burden (6 papers), and Women-Specific Considerations (10 papers); 2) Theme 2: Hip Disorders, Causes, and Impacts (shown in green, total 33 papers) consists of: Hip Structure: Anatomy and Biomechanics (3 papers), Common Hip Disorders (10 papers), Impacts of Hip Disorders (9 papers), and Causes of Hip Disorders (11 papers); Theme 3: Treatment and Prevention (shown in blue, total 23 papers) encompasses: Key Considerations for Hip Disorders (4 papers), Treatment (9 papers), Prevention (4 papers), and Alternative Treatment & Prevention (6 papers).

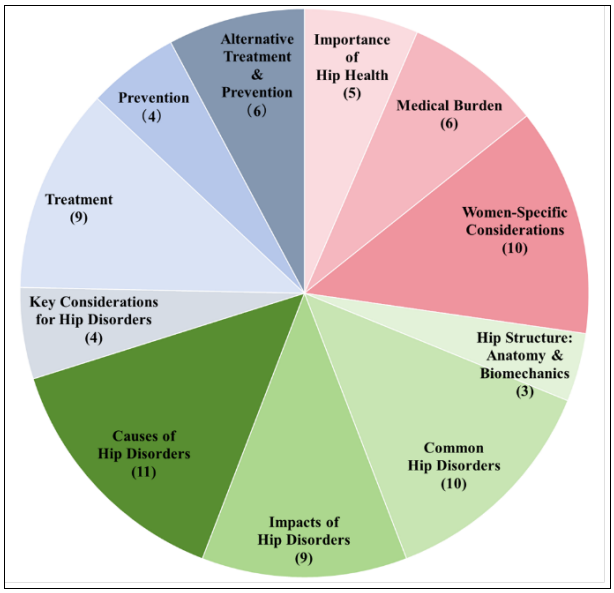


Fig 2: Review of the literatures on women's hip.

3. Findings from the Literature

Hip, Health, and Women

Importance of Hip Health

The hip is one of the largest and most structurally complex joints in the human body, serving as the central link between the upper and lower body. It plays a crucial role in weight-bearing, movement, and overall body stability. Beyond its biomechanical function, the hip also has significant implications for emotional well-being (see Fig. 1B). Physically, hip imbalances can contribute to conditions such as high or low shoulders, lower back pain, gait abnormalities, and leg length discrepancies. Hip disorders can influence other parts of the body, particularly the knees. Research has shown that individuals with knee pain exhibit significantly weaker gluteus medius and gluteus maximus muscles compared to those without knee pain, highlighting the close interconnection between hip strength and knee stability (Rowe *et al*., 2007) [69]. The hips are often viewed as a common site for storing emotional stress due to their involvement in the body's fight-or-flight response. The psoas muscle, a deep hip flexor, plays a central role in this process through its connections with the autonomic nervous system (Pulvermacher, 2021; Eldemire and Goto, 2025; Siccardi *et al*., 2023) [66, 59, 72]. Situated near the kidneys and adrenal glands-key regulators of hormonal stress responses-the psoas shares neurological pathways that influence stress regulation and bodily balance. Dysfunction in this system can contribute to emotional instability. Neuroscientific and somatic research suggests that chronic stress and trauma may manifest as tension or dysfunction in the hip region, linking hip health to anxiety and depression (Polkowski and Clohisy, 2010; Ishler, 2021) [63, 43]. Additionally, hip instability is a primary cause of hip osteoarthritis (OA), which further exacerbates emotional distress (Gambling and Long, 2019) [26]. Notably, approximately 15% of newborns exhibit some degree of hip instability, emphasizing the need for early intervention and preventive care (Bakarman *et al*., 2023) [8].

Medical Burden

Hip disorders contribute significantly to global healthcare costs, underscoring the necessity for effective prevention and treatment strategies. As elaborated in the Introduction and (Fig. 1D), Japan, Australia, United States, New Zealand, Denmark, and China have a large financial burden costing billions of dollars, thus highlight the seriousness of the issue (hip-health/-related) globally (Mori *et al*., 2022; Ackerman *et al*., 2019; Maradit *et al*., 2015; Hooper *et al*., 2014; Pedersen *et al*., 2005; Fan *et al*., 2024) [54, 2, 51, 40, 61, 22].

Women-Specific Considerations

Women are particularly vulnerable to hip-related health issues due to distinct anatomical, hormonal, and biomechanical factors. Compared to men, women experience a greater impact of hip disorders on overall health and well-being.

Anatomical and Biomechanical Differences

Several structural and physiological differences contribute to a higher prevalence of hip disorders in women: 1) Femur and Pelvic Structure - Women have a wider pelvis and greater femoral anteversion, which can affect hip alignment and stability. 2) Hormonal Influence - Fluctuations in estrogen levels, particularly during puberty, pregnancy, and menopause, impact joint laxity and bone density. 3) Puberty and Maturation Timing - Women undergo skeletal maturation earlier than men, influencing hip development. 4) Hypermobility - Increased ligamentous laxity in women contributes to a higher risk of hip instability. 5) Activity Levels and Movement Control - Women often exhibit different movement patterns and loading mechanics, affecting hip health (Lewis and Shefelbine, 2024) [49]. Furthermore, Developmental Dysplasia of the Hip (DDH) is significantly more common in women, with up to 20% of children and adolescents affected. Among them, 80% are girls and young women. Unlike hip OA in men, which is often linked to trauma, DDH is the leading cause of early-onset hip OA in women. Young adults with DDH frequently experience pain that disrupts sleep, work, sports, exercise, and social activities (Bruder *et al*., 2024) [15].

Gender Disparities in Hip Health Research and Treatment

Despite comprising nearly half of the global population, women's health issues, including hip disorders, receive disproportionately less research funding and attention compared to men's health (Merone *et al*., 2022) [53]. Women account for two-thirds of patients undergoing hip-related treatments and surgeries (Fig. 1C) (Powers, 2010) [64], yet they often experience poorer post-treatment outcomes than men. Additionally, women are at higher risk of chronic conditions such as osteoporosis, which further affects hip stability and quality of life over time. These disparities underscore the urgent need for increased investment in women's hip health research and treatment strategies.

Pregnancy and Pelvic Floor Disorders

Pregnancy exerts a significant impact on hip and pelvic health (Fig. 3).

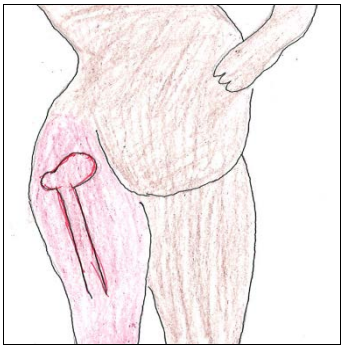


Fig 3: Hip pain during pregnancy.

In pregnancy, one of the most significant and noticeable

changes in a woman's body occurs in the hips (Carneiro, 2024) [18]. Many pregnant women experience hip pain and a decrease in bone density, which can contribute to pelvis floor dysfunction, including conditions such as urinary incontinence (National Institutes of Health, 2008) [68]. Research highlights the importance of addressing hip health during pregnancy to prevent discomfort and support overall musculoskeletal function (Garcia *et al*., 2023; Galanis *et al*., 2023; Carneiro *et al*., 2024) [28, 25, 18]. The pelvic floor muscles, which are closely linked to the hip joint, play a crucial role during pregnancy and childbirth. Approximately 24% of women in the U.S. suffer from pelvic floor disorders, with the prevalence increasing with age. These disorders, which often result from muscle weakening or injury during childbirth, include: 1) Urinary incontinence -Loss of bladder control. 2) Fecal incontinence - Inability to control bowel movements. 3) Pelvic organ prolapse - Descent of pelvic organs due to weakened support structures (National Institutes of Health, 2008) [68]. Furthermore, nearly half of all pregnancies are unplanned, and many pregnant women do not receive adequate prenatal care, exacerbating the risk of hip and pelvic complications. Given these concerns, proactive screening, education, and preventive interventions are crucial in promoting long-term hip health for women. Women's hip health is a critical yet often overlooked area of medicine, with significant physical, emotional, and economic implications. The rising prevalence of hip disorders worldwide calls for urgent healthcare strategies to address both the structural and psychosomatic aspects of hip health. More research and targeted interventions are needed to improve outcomes for women, who face unique challenges due to their anatomical and physiological differences. Addressing these issues will not only enhance quality of life but also reduce the long-term medical burden associated with hip disorders.

Hip Disorders, Causes and Impacts

Hip Structure: Anatomy & Biomechanics

The hip is a ball-and-socket joint, where the femoral head articulates with the acetabulum of the pelvis. Its primary function is to provide dynamic support for body weight while facilitating force transmission from the axial skeleton to the lower extremities, allowing for mobility (Fig. 4). Given the complex interplay between bones, ligaments, and muscles, diagnosing hip pain can be challenging, as multiple conditions may present with similar symptoms (Bowman *et al*., 2010) [13]. The hip joint is a ball-and-socket joint where the head of the femur meets the acetabulum of the pelvis. Its main function is to support the body's weight while enabling the transfer of forces between the upper body and lower limbs, allowing movement and stability.

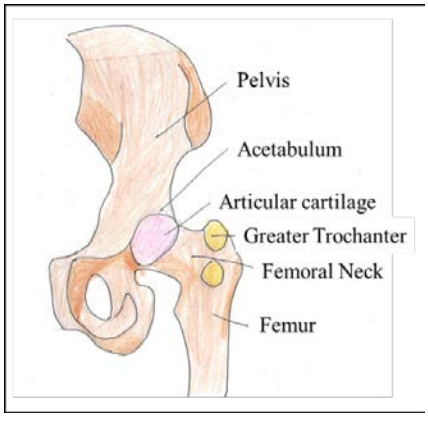


Fig 4: Hip anatomy

Muscle Functions of the Hip Joint (Fig. 5)

- **Flexion:** Psoas, iliacus, pectineus, rectus femoris, sartorius
- **Extension:** Gluteus maximus, hamstrings
- **Internal rotation:** Tensor fascia latae, gluteus medius (anterior fibers), gluteus minimus
- **External rotation:** Obturator muscles, quadratus femoris, gemelli, gluteus maximus, sartorius, piriformis
- **Adduction:** Adductor longus, brevis, magnus, gracilis, pectineus
- **Abduction:** Gluteus medius, gluteus minimus, tensor fascia latae, sartorius (Gold *et al*., 2023) [7].

The coordination between pelvic and hip motion is essential, as spinopelvic imbalance or stiffness can significantly affect movement. Proper whole-body alignment is crucial to maintaining hip stability and function (Heckmann *et al*., 2021) [38]. The flexion, extension, abduction, adduction, internal rotation, and external rotation.

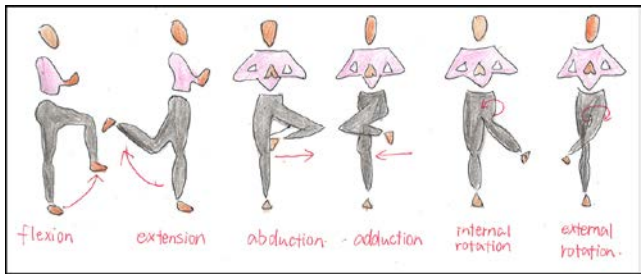


Fig 5: Hip functions

Common Hip Disorders

Hip disorders arise from a combination of biomechanical, genetic, and environmental factors. The most common conditions include:

- **Hip Osteoarthritis (HOA):** Degenerative joint disease leading to cartilage deterioration (Sandiford *et al*., 2020; Murphy *et al*., 2016) [70, 57].
- **Femoroacetabular Impingement (FAI):** Abnormal contact between the femoral head and acetabulum (Fortier *et al*., 2022; Grant *et al*., 2012) [23, 32].
- **Hip Dysplasia:** Insufficient acetabular coverage of the femoral head, leading to instability (Bakarman *et al*., 2023) [8].
- **Hip Labral Tears:** Damage to the cartilage rim surrounding the hip socket (Groh *et al*., 2009) [33].
- **Hip Instability:** Excessive movement due to ligamentous laxity or bony abnormalities (Kraeutler *et al*., 2016) [46].
- **Hip Fractures:** Common in older adults, often linked to osteoporosis (Cannada and Hill, 2014) [16].
- **Avascular Necrosis (AVN):** Loss of blood supply to the femoral head, causing bone death (Matthews *et al*., 2023) [52].
- **Hip-Spine Syndrome:** Interdependent pathology affecting both the hip and spine (Morimoto *et al*., 2023) [55].

Impacts of Hip Disorders

Musculoskeletal Consequences

Hip pathology affects overall biomechanics, often leading to compensatory mechanisms in the spine and lower limbs. For instance, patients with severe osteoarthritis (SOA) exhibit altered global sagittal alignment due to pelvic shifts and thoracic hypokyphosis, compensating for limited hip

extension (Day *et al*., 2018) [19]. Similarly, proximal hip dysfunction influences tibiofemoral and patellofemoral joint mechanics, highlighting the importance of hip joint control in knee rehabilitation (Kurtz *et al*., 2005; Powers, 2010) [47, 64]. Patients with HOA often develop compensatory changes in spinopelvic alignment, which may not necessarily be linked to the pathogenesis of low back pain but can impair mobility and posture (Weng *et al*., 2015) [79]. Acetabular bony deficiencies, particularly in the anterior and lateral regions, contribute to anteroposterior hip instability and chronic pain (Fujiwara *et al*., 2024) [24].

Psychological and Mental Health Effects

Hip disorders are strongly associated with psychological distress. Patients frequently experience pain catastrophizing, anxiety, and depression, which can negatively impact recovery and treatment outcomes (Gudmundsson *et al*., 2021) [34]. Notably, individuals with pre-existing mental health conditions tend to report inferior post-surgical outcomes following hip arthroscopy for Hip arthroscopy for femoroacetabular impingement syndrome (FAI), underscoring the need for preoperative psychological screening (Dick *et al*., 2020) [20]. Studies show that improvements in hip function correlate with reduced psychological distress, reinforcing the connection between musculoskeletal health and mental well-being (Gudmundsson *et al*., 2021) [34]. Health systems could benefit from integrating early psychological assessments into orthopedic care to enhance recovery outcomes (Auais *et al*., 2022) [6].

Causes of Hip Disorders

Biomechanical and Structural Factors

Posture and Alignment: Proper hip and spinal alignment are crucial for hip health. Studies indicate that 62.3% of patients with hip disorders have pelvic-spinal imbalance (Carender *et al*., 2020) [17]. Pelvic Incidence (PI): High PI is a risk factor for spondylolisthesis and knee osteoarthritis, whereas low PI is associated with degenerative disc disease (Van *et al*., 2020) [77]. In younger individuals, high PI may contribute to the development of HOA later in life due to anterior acetabular uncovering (Yoshimoto *et al*., 2005) [82].

- **Femoral Head Positioning:** Improper alignment is a key factor in hip osteoarthritis. Superolateral migration of the femoral head and atrophic bone response are strong prognostic indicators of HOA (Bierma-Zeinstra *et al*., 2007) [10].
- **Spinopelvic Mobility:** Limited mobility, as seen in conditions like ankylosing spondylitis, increases the risk of hip dislocations (Harrer *et al*., 2023) [37].

Lifestyle and Environmental Factors

Physical Workload & Sports: High-intensity sports and heavy physical workloads increase the risk of hip and knee osteoarthritis (Bierma-Zeinstra *et al*., 2007) [10].

- **Obesity:** Excess weight contributes to cartilage wear and accelerates degenerative changes (Gebhart *et al*., 2016)[29].
- **Occupation & Daily Activities:** Repetitive movements and prolonged weight-bearing can predispose individuals to hip pathologies.

Psychological and Mind-Body Interactions

Psychosocial Stress: Increasing evidence supports the role of mental health in disease progression and healing. Stress, for example, is a known risk factor for obesity, which in turn contributes to joint degeneration (Brower, 2006) [14].

Mental Health in Recovery: Patients with hip fractures often experience psychological barriers to recovery. Early screening and intervention could prevent mental health disorders from hindering physical rehabilitation (Pert *et al*., 1998; Hampton *et al*., 2019) [62, 36].

Psychological and Mind-Body Interactions Genetic and Developmental Factor

- **Genetics & Neuromuscular Diseases:** Some individuals have a genetic predisposition to weaker cartilage or structural abnormalities.
- **Hip Dysplasia & Congenital Deformities:** Developmental abnormalities can predispose individuals to early-onset osteoarthritis and instability (Alhaddad *et al*., 2023) [4].

Hip disorders result from a combination of biomechanical, psychological, and lifestyle factors. Whole-body alignment plays a crucial role in hip stability and function, while mental health significantly impacts pain perception and recovery. Understanding these multidimensional factors can lead to more effective prevention and treatment strategies, emphasizing the importance of both physical and psychological aspects of hip health.

Treatment and Prevention

Key Considerations for Hip Disorders

Early Awareness & Diagnosis

Early detection of hip disorders is crucial; as minor hip pain can be an early warning sign. Hip osteoarthritis, if left unaddressed, can progress to the point of requiring total hip replacement, with the average age for surgery being 69 years. Despite this, early osteoarthritic changes are often overlooked. Non-traumatic hip disorders may cause mechanical pain of varying onset and severity, which can be difficult to localize (Wenger *et al*., 2021; Ingvarsson *et al*., 1999) [80, 42]. Osteonecrosis of the hip is frequently asymptomatic in early stages, leading to delayed diagnosis. Common symptoms in later stages include hip and groin pain, often accompanied by referred pain in the buttock and thigh (Matthews *et al*., 2023) [52].

Restoring Hip Alignment

Improper positioning of the femoral head can lead to chronic joint friction and necrosis. Restoration to its natural position is crucial, except in congenital cases. Moreover, altered gait patterns are often observed in hip disorders. Prognostic factors in hip osteoarthritis (OA) include anterior spinal inclination while standing, reduced thoracolumbar spine mobility, and excessive cumulative hip loading from daily walking (Tateuchi, 2019) [74].

Treatment

Surgery: Total Hip Replacement (THR)

Surgery should only be performed when the expected benefits outweigh the risks. A worse preoperative condition is associated with poorer surgical outcomes (Kurtz *et al*., 2009; Günther *et al*., 2021) [48, 35]. Many patients report dissatisfaction post-surgery, with three in four experiencing functional limitations (Jochimsen *et al*., 2024) [44]. Dislocated hips lead to functional impairment and reduced quality of life. Prevention strategies involve optimal patient selection, appropriate surgical approaches, and careful component positioning (Weber *et al*., 2015; Bota *et al*., 2021) [78, 12].

Side Effects of Hip Surgery

- Hip instability.
- **Altered spinal and hip kinematics:** A stiff spine can limit hip motion, and lumbar spine diseases affect lumbar-pelvic-femoral alignment. Addressing spinal flexibility is crucial in rehabilitation (Heckmann *et al*., 2018) [39].
- **Risk of hip dislocation (Esposito *et al*., 2018)[21]. Post:** surgical changes in pelvic orientation can unpredictably affect acetabular anteversion, increasing the risk of posterior dislocation (Sariali *et al*., 2009) [71].

Non-Surgical Treatment (American Hip Institute & Orthopedic Specialists, n.d.) [5]

- Conservative Approaches
- **Physical therapy:** Strengthening exercises, guided passive movements, manual therapy, and treatments using physical stimuli (e.g., heat, cold, electrical currents, ultrasound).
- **Medication:** Pain management and joint preservation.
- Minimally invasive treatments: Corticosteroid injections and Platelet-Rich Plasma (PRP) therapy.

Prevention

1) **Education & Self-Management:** Teaching patients how to manage joint stress and avoid overuse.
2) **Rehabilitation Programs:** Focused on joint-specific exercises, aerobic conditioning, and assistive devices when necessary (Patel *et al*., 2007; Bijlsma and Knahr, 2007) [60, 11].
3) **Early Disease Detection:** 90% of adult patients with acetabular dysplasia remain undiagnosed, particularly in underdeveloped areas (Price and Ramo, 2012) [65]. As most patients with non-traumatic osteonecrosis of the femoral head (NONFH) are asymptomatic in early stages, early imaging and screening are critical (George *et al*., 2022) [30].

Alternative Treatment & Prevention

1) Yoga & Mind-Body Techniques: Address both physical and mental aspects, reducing stress and reinforcing physical activity. Recommended by the (*American Hip Institute* & Orthopedic Specialists, n.d.) [5].
2) Exercise Therapy: Proven effective for managing hip OA symptoms, with strong evidence supporting its benefits for pain reduction and function improvement (Teirlinck *et al*., 2023) [75].
3) Key objectives of physical therapy: Improve joint function and movement; -Enhance circulation and metabolism; -Relieve pain and strengthen surrounding muscles; -Prevent long-term disability (InformedHealth.org, 2024) [41]. However, evidence suggests that yoga may be more effective than physical therapy as it incorporates additional elements such as breath control, mindfulness and posture awareness which distinguish it from other forms of physical exercise (Ross and Thomas, 2010; Govindaraj *et al*., 2016) [67, 31].
4) Acupuncture & Chiropractic Care: Complementary methods for pain relief and mobility enhancement.
5) Lifestyle Modifications: Maintaining a healthy weight, engaging in low-impact exercise, proper ergonomics, adequate rest, hydration, and mindful movement.

Non-surgical options should be prioritized whenever possible to prevent deterioration and avoid the long-term complications of surgery. True disease prevention should be widely accessible, affordable, and integrated into healthcare systems (Price and Ramo, 2012) [68]. Yoga, as a holistic practice, plays a valuable role in both the prevention and rehabilitation of hip disorders by improving mobility, reducing pain, and enhancing overall well-being (Fig. 6).

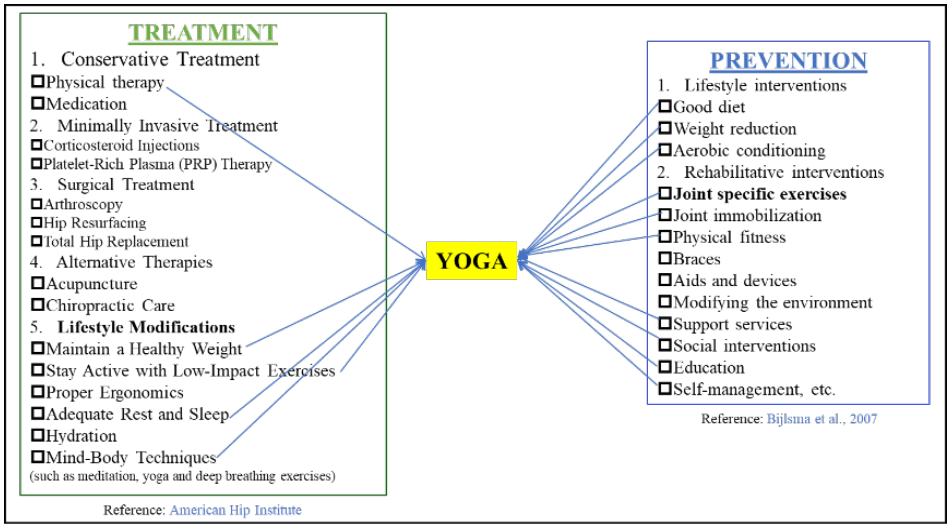


Fig 6: Yoga: bridging treatment and prevention. Among all the features of treatment and prevention, yoga stands out as a highly suitable and integrative solution.

4. Towards Developing a Yoga Protocol: The Gap

Research on women's health remains underfunded and less studied compared to men's health (Temkin *et al*., 2022; Carneiro, 2024) [76, 18]. There is a strong need for increased investment in hip health research for women (Lewis and Shefelbine, 2024) [49]. Since the 1940s, yoga has been incorporated into India's healthcare system, as many diseases stem from imbalances and stress. Yoga addresses the root causes of ailments both mentally and physically, making it a valuable tool for prevention and rehabilitation. Yoga has been shown to be beneficial for individuals with osteoarthritis (OA), helping to alleviate joint pain and stiffness while improving flexibility and overall quality of life. Yoga postures have been found effective among various exercises in strengthening major muscle groups (Wieland *et al*., 2021) [81]. Additionally, yoga may contribute to increased bone

mineral density (BMD) in the hip, femur, and spine (Lu *et al*., 2016) [50]. While yoga is often perceived as a gentle or purely flexibility-oriented practice, its therapeutic potential goes far deeper, especially in relation to bone health. Yoga asana is not merely about achieving a beautiful posture; it is an internal discipline where practitioners engage their muscles, ground themselves with intention, and create mechanical stress on the bones and therefore contributes to increased bone density (Sivaramakrishnan *et al*., 2019; Motorwala *et al*., 2016) [73, 56]. However, some existing studies do not provide detailed analysis regarding the selection of specific yoga poses for these benefits. Yoga asanas are not merely simple body movements, each body movement, and in the case yoga, each breath that accompanies the precise movement, has to be described and explained, especially when the patient (undergoing the intervention) is involved. To optimize the effectiveness and safety of yoga interventions for hip health, it is crucial to establish evidence-based yoga protocols by reviewing existing research and consulting with yoga experts. Moreover, the lack of standardization in the yoga field including protocols, teaching methods, and research frameworks, creates a need for clearer guidelines to support both practitioners and scientific studies (Karri *et al*., 2023) [45]. Therefore, the next step is to create a review (of practices)-based yoga protocol for addressing women's hip disorders.

There is limited research on developing yoga protocols and systematically evaluating their effects particularly protocols targeting hip health. The author would like to acknowledge two notable studies as comparable studies. The first is *"Āsana for Back, Hips and Legs to Prevent Musculoskeletal Disorders among Dental Professionals: In-Office Yóga Protocol"* by Gandolfi and co-workers (Gandolfi *et al*., 2023) [27]. This study developed a yoga protocol for both prevention and treatment of physical stress among dental professionals, addressing issues such as lower back, hip, and leg pain. This study offers detailed protocol while not specifically look at hip issues. The second study, "*Twelve-Minute Daily Yoga Regimen Reverses Osteoporotic Bone Loss*" by Lu and co-workers, focused on increasing bone mineral density in the spine, hips, and femur (Lu *et al*., 2016) [50]. The protocol consisted of a 12-minute DVD featuring 12 yoga poses. This study offers yoga protocol for hip while not offering detail explanations on why and how the protocol is developed, and details on each step of the protocol.

5. Conclusion

Yoga has a more or less 5,000-year history and has been extensively examined for its benefits in both physical and mental health. Research on women's hip health began gaining prominence in 1970s, particularly following the feminist movement (Nichols, 2000; Al-Gailani and Davis, 2014)[58, 3]. By the 2000s, funding for women's health research increased, expanding into a wider range of topics. Around the same time, studies on yoga's impact on women's hip health also began to emerge. Since 2010, research on hips, women's health, and the intersection of yoga with these areas has continued to grow. However, studies specifically focusing on women's hip health and the use of yoga as an intervention remain significantly limited compared to the broader fields of hip and women's health research, highlighting a critical gap in the current literature. This review concludes that the hip is a central component of holistic health for two primary reasons, biomechanical and holistic. Firstly, from a biomechanical perspective, the hip functions as the pivotal junction linking the upper and lower body; its mobility and stability are fundamental to human movement, posture, and the prevention of injuries throughout the kinetic chain. Secondly, and more profoundly from a holistic standpoint, the hip, particularly the hip flexors muscles, is the tissue that at the first instance reacts to stress response causing accumulation of tension and emotional patterns. Therefore, hip health is central to an individual's integrated well-being, affecting physical structure, neurological tone, and emotional regulation. Holistic theory, which emerged in the late 19th and early 20th centuries, emphasizes that analyzing and addressing human health issues from a single perspective is fundamentally insufficient. As a holistic discipline, yoga therefore offers a unique and powerful approach to promoting hip health. Why yoga? To maintain both physical and mental well-being, a comprehensive approach is essential, which yoga stands out as both a preventive and therapeutic tool. Yoga has been shown to effectively prevent and manage musculoskeletal and mental health disorders, making it a valuable addition to sports medicine. Notably, yoga emphasizes on holistic lifestyle including eating habit as it influences the body's ability to heal and regenerate tissues such as bone. Among various functional foods, Jerusalem artichoke has been reported to increase bone density and it is effective in assisting in the healing of pelvic and upper femoral fractures, particularly in women (Bakku *et al*., 2022; Abrams *et al*., 2005; Genboku Takahashi, personal communication, 2025) [9, 1]. Unlike traditional exercise, which primarily enhances cardiovascular fitness and muscular function, yoga adopts a holistic approach, influencing multiple body systems, including the mind.

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