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Yoga's Biophysiological Effects on Lower Urinary Tract Symptoms: A Scoping Review

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Abstract

Background and objectives: Yoga is a mind and body practice that includes relaxation, meditation, breathing exercises, and body postures. It can be effective in enhancing the functioning of several body systems, including the lower urinary tract. Normal lower urinary tract functioning depends in part on the coordination of the bladder, urethra, pelvic floor and other muscles, and the nerves that control them. Lower urinary tract dysfunction can lead to symptoms, that is, stress urinary incontinence (UI), urinary frequency, nocturia, urinary urgency with and without incontinence, and mixed UI. Recent evidence suggests that yoga can improve lower urinary tract symptoms (LUTS). Thus, we performed a scoping review of the literature with regard to the evidence for the effects of yoga on LUTS and factors that may mediate yoga's effects on LUTS with the goal to identify gaps in knowledge regarding the relationship between yoga practice and LUTS.

Methods: The authors employed the PRISMA extension for Scoping Reviews (PRISMA-ScR) methodological approach, proposed by Tricco et al., by searching the electronic databases, PubMed, Embase, and PsycINFO, for articles using the following keywords: *yoga*, *urinary incontinence*, *urinary tract*, *bladder*, and *urethra*. We assessed the quality of the studies using the Joanna Briggs Institute Critical Appraisal Checklist.

Results: Of the 172 articles we found, 8 articles met the inclusion criteria and were reviewed. We found that, despite the use of different protocols, yoga may reduce certain LUTS by increasing the strength of pelvic floor muscle and/or regulating the autonomic nervous system and activating the central nervous system.

Conclusions: Yoga is a noninvasive practice that may improve some LUTS. Rigorous studies are needed to determine the specific mechanisms through which yoga may affect LUTS.

Keywords: yoga, lower urinary tract, urinary incontinence, autonomic nervous system, pelvic floor

Introduction

Many people use yoga as a therapy to help improve specific physical or mental conditions and/or alleviate certain biophysiological symptoms. For example, yoga has been used to treat chronic back pain,[1,2] reduce the fear of falling in older people,[3] treat asthma,[4] improve respiratory muscle performance in people with chronic obstructive pulmonary disease,[5] improve health in women with cancer,[6] prevent cardiovascular disease,[7,8] complement other therapies in the care of people with schizophrenia,[9,10] improve the quality of life for people with epilepsy,[11] reduce emotional stress,[12] relieve fatigue,[13] and reduce depression.[14] Researchers also have found that practicing yoga increases the tension and strength of the pelvic floor muscles (PFMs).[15,16]

The process of storing and emptying urine depends on the combined functioning of the bladder, urethra, and PFMs that are subject to complex activity in the somatic and central nervous system (CNS) and, most important, the sympathetic and parasympathetic divisions of the autonomic nervous system (ANS).[17–20] Normal urine storage is dependent on spinal reflex mechanisms that activate thoracolumbar sympathetic pathways and tonic inhibitory systems in the brain that suppress the sacral parasympathetic outflow to the bladder.

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Voiding is coordinated by a series of processes that allow bladder contraction and emptying through the inhibiting activity of the sympathetic nerves and somatic pathways and increasing the activity of the parasympathetic nerves. Voiding also requires relaxation of the urethral sphincter and pelvic floor.[19,21] Decreased PFMs strength and ANS and CNS dysfunction can lead to lower urinary tract symptoms (LUTS), including stress urinary incontinence (UI), urinary frequency, nocturia, and urinary urgency with and without incontinence, which in turn may affect the quality of life.[22,23]

Because PFMs, the ANS, and CNS play important roles in maintaining urinary continence, understanding how yoga may improve LUTS could be useful to improving the quality of life of people who suffer from LUTS. We conducted this scoping review to map the related research in a systematic manner and to identify gaps in knowledge regarding the relationship between yoga and LUTS. The findings of this review will inform future directions in urological and bladder health research. The following research questions were formulated for this review:

1. What is the evidence for yoga's effects on LUTS?
2. Does the literature suggest factors that may mediate yoga's effects on LUTS?

Methods

To determine the state of knowledge about the possible effects of yoga on LUTS, we used the PRISMA extension for Scoping Reviews (PRISMA-ScR) methodological approach, as proposed by Tricco et al.[24]

Eligibility criteria

We included articles in this review if they met the following inclusion criteria: (1) an English language full-text publication was available; (2) yoga was an intervention under study; (3) men and women older than 18 years were participants in the study; and (4) the authors discussed the effects of yoga on LUTS. Articles were excluded if (1) they were not published in English and (2) participants were younger than 18 years. The primary author screened the articles using title, abstract, and full texts to determine the eligibility for inclusion.

Information sources and search

We identified relevant articles by searching the PubMed, Embase, and PsycINFO electronic databases with the assistance of a health sciences librarian. We conducted the search in February 2018 and used the following search strategies.

1. PubMed: (yoga) AND ((urinary incontinence) OR (''Urinary Tract''[Mesh] OR ''Urinary Bladder''[Mesh] OR ''Urethra''[Mesh] OR ''Ureter''[Mesh] OR urinary OR urethra OR urethras OR bladder OR bladders OR ureter OR ureters OR Urethral))
2. Embase: ('yoga'/exp OR yoga) AND ('urinary incontinence'/exp OR 'urinary incontinence' OR (urinary AND ('incontinence'/exp OR incontinence)) OR 'urinary tract'/exp OR 'urinary bladder'/exp OR urinary OR 'urethra'/exp OR urethra OR urethras OR 'bladder'/exp OR bladder OR bladders OR 'ureter'/exp OR ureter OR 'ureters'/exp OR ureters OR urethral)
3. PsycINFO: (yoga) AND ((urinary incontinence) OR (DE ''Urinary Tract'' OR DE ''Urinary Bladder'' OR DE ''Urethra'' OR DE ''Ureter'' OR urinary OR urethra OR urethras OR bladder OR bladders OR ureter OR ureters OR Urethral))

Selection of sources of evidence

Titles and abstracts were screened independently by two reviewers and were preliminarily selected using the inclusion criteria. The full texts of articles were then screened and articles included by consensus. Disagreements were resolved by discussion with a third reviewer.

Data charting process

The three authors jointly developed a data charting form to determine which variables to extract. The three authors discussed the results and continuously revised the data charting form in the process.

Data items

We abstracted data about each selected study's characteristics: author(s) and year, type of study, population, intervention, measures, outcomes, and potential mediators.

Critical appraisal of individual sources of evidence

We assessed the methodological quality of each study based on the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Quasi-Experimental Studies (for the nonrandomized experimental studies), the JBI Critical Appraisal Checklist for Randomized Controlled Trials (for the randomized controlled trials), and the JBI Critical Appraisal Checklist for Case Reports (for the case reports). The Critical Appraisal Checklist for Quasi-Experimental Studies consists of 9 questions, the Critical Appraisal Checklist for Randomized Controlled Trials consists of 13 questions, and the Critical Appraisal Checklist for Case Reports consists of 8 questions. The response choices for each question are: ''yes,'' ''no,'' ''unclear,'' or ''not applicable.'' Specifically, we used these tools to assess the selected studies' methodological quality and bias in design, implementation, and data analysis.

Synthesis of results

We summarized the populations, methods, and interventions used in each study. These summaries also include broad findings about the evidence for yoga's effects on LUTS and factors that may mediate yoga's effects on LUTS.

Results

Selection of sources of evidence

The initial search generated 172 articles (Fig. 1): 42 from PubMed, 124 from Embase, and 6 from PsycINFO. We immediately excluded 36 duplicate articles. After analysis of the titles and abstracts, we excluded 109 articles because they did not meet the established eligibility criteria. We excluded 13 articles for the following reasons: no full text was available or the article was a letter, protocol, supplement, review, or news article. We excluded six articles

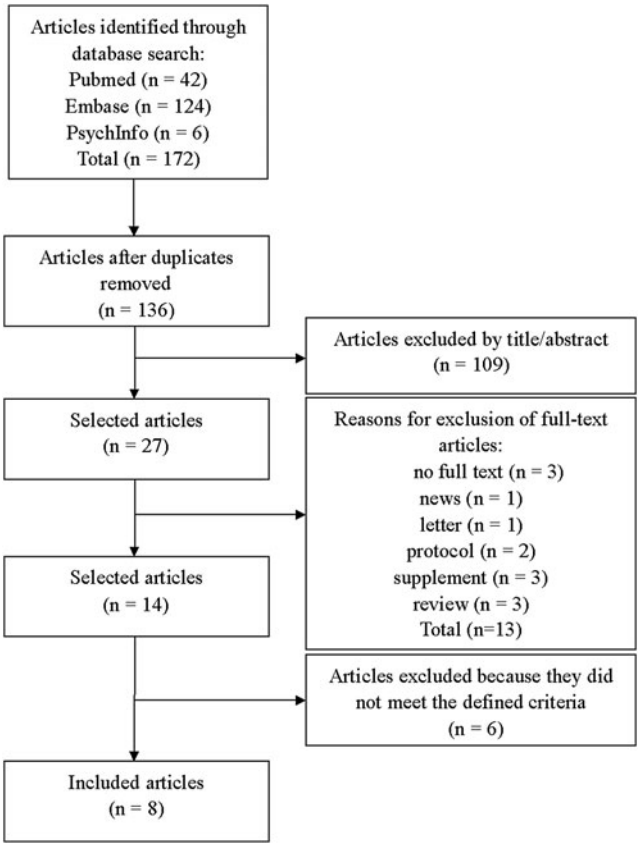

FIG. 1. Flow diagram for articles included/excluded in the scoping review.

because they did not discuss the effects of yoga on LUTS. We retained eight articles for this review; three articles reported randomized controlled trials, four articles described nonrandomized studies, and the one remaining article was a case report.

Characteristics of sources of evidence

Table 1 presents the characteristics of the eight articles,[25–32] including the authors and year, design, population, intervention, measures, outcomes, and potential mediators.

Critical appraisal within sources of evidence

Tables 2–4 present summaries of the methodological quality assessment of the three randomized trials, the four nonrandomized pilot studies, and the case report, respectively, according to the JBI Critical Appraisal Checklist. Four studies were judged to be of good quality, that is, they met >65% inclusion criteria for all questions on the checklist. The remaining four studies met <60% inclusion criteria. Seven of the eight studies had small samples and none controlled for confounding variables.

Synthesis of results

The eight articles[25–32] were published between 2012 and 2017 and included 186 men and women. One study[25] was conducted in Korea with 34 women with unspecified UI; 1 study[30] was conducted in Germany with 11 men and women with micturition frequency, urgency, and unspecified UI; 1 case[31] was reported in India with 1 woman with stress UI; and 5 studies were conducted in the United States with 19 women, 14 women and men, 50 men, 27 men, and 30 women, respectively.[26–29,32] Women with stress UI, urgency UI, and mixed UI were recruited into one of the studies.[26] In three studies,[27–29] the type of UI was not specified. In one study,[32] women with urgency UI were recruited.

Seven[25–31] of the eight studies used an integrated yoga program that included physical postures, breathing exercises, relaxation, and meditation as the intervention. In the other study,[32] the authors compared the effects of a mindfulness-based stress reduction program that included mindful-yoga to a yoga program that focused on Asana, practice of physical poses, on urgency UI. This latter group served as an active control group and the participants were not instructed in breathing techniques.

In the seven studies that focused on integrated yoga, Kim et al.[25] used Yin-Yang yoga (a Korean version of Hatha yoga), Huang et al.[26] used Iyengar yoga (a form of Hatha yoga that is known for its potential therapeutic applications), and Ben-Josef et al.[28,29] used Eischens yoga (a style of yoga committed to transformational work through asanas, pranayama, awareness, micromovements, resistance, and partner feedback). Specific types of yoga were not described in the other studies.[27,30,31]

All studies had a yoga instructor or yoga doctor who led the group yoga sessions.[25–32] Written instructions for practice at home were offered in four of the studies.[25–27,30] Most yoga interventions ranged from 6 to 9 weeks,[25–29,32] and yoga sessions were offered for 21 consecutive days in 2 studies.[30,31]

The frequency of the sessions differed across the studies. Yoga sessions were offered twice weekly in five of the studies,[25–29] twice a day in two studies,[30,31] and once weekly in one study.[32] The length of the yoga group sessions varied from at least 1 h[26,29,30] to 90 min,[27,28,31] and for an unspecified time interval in two studies.[25,32]

Different measurement instruments and strategies were used to assess outcomes. For example, one study[25] used two measures: the Bristol Female Lower Urinary Tract Symptoms questionnaire[33] to measure LUTS and a perineometer to measure pelvic muscle strength. Huang et al.[26] used three measures of urinary symptoms: the Urogenital Distress Inventory 6 (UDI-6), which is a validated questionnaire[34] for men and women to assess ''subjective bother'' associated with incontinence-related symptoms, the Patient Perception for Bladder Condition questionnaire,[35] which is used to measure the severity of patients' urinary urgency, frequency, and nocturia symptoms of overactive bladder, and the Incontinence Impact Questionnaire Short Form (IIQ-7),[34] which is used to measure the impact of incontinence on physical activities, emotional health, travel, and social relationships. Cohen et al.[27] assessed bladder function using the Bladder Control Scale, a scale that is included in the Multiple Sclerosis Quality of Life Inventory.[36]

Two studies that involved only male participants[28,29] used the International Prostate Symptom Score[37] scale to determine the severity of urinary symptoms. Scores on this scale range from 0 to 35, where scores from 8 to 19 indicate moderate symptoms and scores from 20 to 35 indicate severe symptoms. Patil et al.[30] assessed bladder symptoms

Table 1. Key Characteristics of Reviewed Studies

Authors (year)	*Type of study*	*Population*	*Intervention*	*Measures*	*Outcomes*	*Potential mediators*
Kim et al. (2015)	Pilot study	Middle-aged (40–64 years) women with UI ($n=34$)	8-Week, twice-weekly sessions combined pelvic muscle exercise and Yin-Yang yoga with instructor in class and practice at home three times a day with written instructions.	BFLUTS questionnaire, pelvic muscle strength measured by perineometer	Decreased mean scores on BFLUTS, indicating lower level of urinary tract symptoms; the mean pressure of PFM increased from 23.40 ± 14.13 to $31.86 \pm 17.06\,cmH_2O$ ($p<0.01$).	PFM strength
Huang et al. (2014)	RCT	Women aged ≥40 years with stress, urgency, or mixed-type UI ($n=19$)	6-Week Iyengar yoga group, twice weekly with instructor and at least 1 h at home with written instructions ($n=10$); control group received no yoga instruction ($n=9$).	7-Day voiding diaries, PPBC, IIQ-7, UDI-6	Decreased total UI frequency; decreased an average 85% in stress incontinence frequency; no significant difference in reduction in urgency UI.	PFM strength ANS regulation
Cohen et al. (2015)	Pilot study	Men and women (34–64 years old) with MS (diagnosis ranged from 2 to 26 years) ($n=14$)	8-Week, twice-weekly 90-min yoga sessions with instructor; written instructions provided for practice at home on days classes were not held.	BLCS	BLCS score decreased from 6.5 to 3.4 ($p<0.05$).	ANS regulation
Ben-Josef et al. (2017)	Randomized phase II trial	Men (53–85 years old) with prostate cancer during RT ($n=50$)	6–9 Weeks Eischens yoga group, twice-weekly 90-min classes with instructors ($n=22$); control group received no yoga instruction ($n=28$).	IPSS	Although urinary scores increased for both groups in the beginning half of the RT course, the yoga group's scores returned toward baseline during the latter half of the treatment period.	PFM strength
Ben-Josef et al. (2016)	Pilot study	Men (51–74 years old) with prostate cancer undergoing external beam RT ($n=27$)	6–9 Weeks, twice-weekly 75-min Eischens yoga sessions in class with instructors.	IPSS	UI and general QOL scores demonstrated reassuringly stable, although not significant trends, which is a potential signal for improvement in urinary symptoms in patients.	PFM strength

(*continued*)

Table 1. (Continued)

Authors (year)	*Type of study*	*Population*	*Intervention*	*Measures*	*Outcomes*	*Potential mediators*
Patil et al. (2012)	Pilot study	MS patients (18–60 years old) with NBD (defined as detrusor hyperactivity: increased frequency, urgency, and incontinence) ($n=11$; 1 man and 10 women)	21 Days of integrated yoga twice daily; 1 h in group with a yoga therapy doctor and another hour individually with written instructions.	Ultrasound scanning for PVR volume, MCL, IIQ-7, and UDI-6	MCL (24 h) reduced from 15.27 ± 2.9 to 11 ± 1.57 ($p=0.001$), PVR volume reduced from 88.73 ± 45.8 to 33.36 ± 29.4 ($p=0.004$), IIQ-7 scores reduced from 66.81 ± 19.31 to 44.91 ± 18.65 ($p=0.003$), and UDI-6 scores reduced from 47.4 ± 19.21 to 34.92 ± 19.22 ($p=0.006$).	ANS regulation
Vinchurkar and Arankalle (2015)	Case report	One woman (63 years old) prediagnosed with stress UI	21 Days of integrated yoga, 3 h split into two sessions daily.	Frequency volume chart score and ICIQ-UI-SF Index	Usage of pad reduced from 3 to 1 per day, ICIQ-UI-SF score reduced from 16 to 9.	PFM strength
Baker et al. (2014)	Randomized single-masked pilot study	Women (18 years or older) with urgency UI ($n=30$)	8-Week MBSR group (meditation practices, mindful-yoga, walking, meditation), once weekly with instructor ($n=15$). 8-Week yoga group (focus on physical practice, how to prevent injury and promote muscle relaxation), once weekly with instructor ($n=15$).	UIEs on a 3-day bladder diary, OABq-SF and OAB-HRQL	Median percentage change in UIEs was greater in MBSR vs. yoga group at 8 weeks, 6 and 12 months; *p*-values were 0.01–0.08. Median percentage changes in OABq-SF and OAB-HRQL were greater in MBSR vs. yoga group only at 8 weeks, $p=0.003$ and 0.02, respectively.	CNS activation

ANS, autonomic nervous system; BFLUTS, Bristol Female Lower Urinary Tract Symptoms questionnaire; BLCS, bladder control scale; CNS, central nervous system; ICIQ-UI-SF, International Consultation on Incontinence Modular Questionnaire–Urinary Incontinence Short Form; IIQ-7, Incontinence Impact Questionnaire Short Form; IPSS, International Prostate Symptom Score; MBSR, mindfulness-based stress reduction; MCL, micturition checklist; MS, multiple sclerosis; NBD, neurogenic bladder dysfunction; OAB-HRQL, Overactive Bladder Health-Related Quality of Life; OABq-SF, Overactive Bladder Quality of Life–Short Form; PFM, pelvic floor muscle; PPBC, patient perception for bladder condition; PVR, postvoid residual urine volume; QOL, quality of life; RCT, randomized control trial; RT, radiation therapy; UDI-6, Urogenital Distress Inventory 6; UI, urinary incontinence; UIEs, urge incontinence episodes.

Table 2. Methodological Quality Summary Using the Joanna Briggs Institute Criteria: Randomized Controlled Trial

	Question number on the Critical Appraisal Checklist												
Study	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Huang et al. (2014)	Yes	Yes	Yes	No	Unclear	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Ben-Josef et al. (2017)	Unclear	No	Yes	No	Unclear	Unclear	Yes	Yes	No	Yes	Yes	Yes	Yes
Baker et al. (2014)	Yes	Yes	Yes	No	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Checklist questions:
1. Was true randomization used for the assignment of participants to treatment groups?
2. Was allocation to treatment groups concealed?
3. Were treatment groups similar at baseline?
4. Were participants blind to treatment assignment?
5. Were those delivering treatment blind to treatment assignment?
6. Were outcome assessors blind to treatment assignment?
7. Were treatment groups treated identically, other than for the intervention of interest?
8. Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?
9. Were participants analyzed in the groups to which they were randomized?
10. Were outcomes measured in the same way for treatment groups?
11. Were outcomes measured in a reliable way?
12. Was appropriate statistical analysis used?
13. Was the trial design appropriate and were any deviations from the standard randomized controlled trial design (individual randomization, parallel groups) considered in the implementation and analysis of the trial?

using ultrasound for postvoid residual urine volume, a micturition checklist to document the number of visits to the toilet, the IIQ-7[34] to assess the psychological impact of incontinence, and the UDI-6[34] to assess ''subjective bother'' associated with incontinence-related symptoms. Vinchurkar and Arankalle[31] used a urine frequency volume chart score specifically to record the number of pads used per day and the International Consultation on Incontinence Modular Questionnaire–Urinary Incontinence Short Form[38] to assess the prevalence, frequency, and perceived cause of UI and its impact on everyday life. Baker et al.[32] used the Overactive Bladder Quality of Life–Short Form and Overactive Bladder Health-Related Quality of Life Questionnaire[39] to assess symptom bother and the impact of overactive bladder on health-related quality of life. The Patient Global Impression of Improvement[40] was also used to assess improvements in participants' conditions.

Although different instruments and tools to measure bladder function and other outcomes were used across the studies, the overall results showed improvements in certain LUTS, fatigue, sexual function, and quality of life after yoga intervention, without negative effects for the participants. All the studies focused on yoga's effects on urinary storage symptoms, such as urinary urgency, frequency, nocturia, and UI as opposed to emptying symptoms, such as hesitancy and incomplete emptying. One study,[30] however, used ultrasound scanning to measure postvoid residual volume, which is a validated measure to assess bladder emptying.[41]

Overall, the studies included in this review assessed the relationship between yoga and LUTS. In five[25,26,28,29,31] of the eight studies, the investigators postulated that the practice of yoga decreased adverse urinary symptoms by strengthening the PFMs, but only one study directly measured the PFM strength.[42] In three studies,[26,27,30] the investigators reported

Table 3. Methodological Quality Summary Using the Joanna Briggs Institute Criteria: Nonrandomized Experimental Studies

	Question number on the Critical Appraisal Checklist								
Study	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Kim et al. (2015)	Yes	Yes	NA	No	Yes	Yes	NA	Yes	Yes
Cohen et al. (2015)	Yes	Yes	NA	No	No	Yes	NA	Yes	Yes
Ben-Josef et al. (2016)	Yes	Yes	NA	No	Yes	Yes	NA	Yes	Yes
Patil et al. (2012)	Yes	Yes	NA	No	Yes	No	NA	Yes	Yes

Checklist questions:
1. Is the study clear with regard to the ''cause'' and the ''effect'' (i.e., no confusion about which variable comes first)?
2. Were the participants who were included in any comparisons similar to each other?
3. Did the participants who were included in any comparisons receive similar treatment/care, other than the exposure or intervention of interest?
4. Was there a control group?
5. Did the study use multiple measurements of the outcome(s) for both pre- and postintervention/exposure?
6. Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?
7. Were the outcomes of participants who were included in any comparisons measured in the same way?
8. Were outcomes measured in a reliable way?
9. Was appropriate statistical analysis used?
NA, not applicable.

Table 4. Methodological Quality Summary Using the Joanna Briggs Institute Criteria: Case Reports

Study	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Vinchurkar and Arankalle (2015)	Yes	No	Yes	No	Yes	Yes	Unclear	Yes

Checklist questions:
1. Were patient's demographic characteristics clearly described?
2. Was the patient's history clearly described and presented as a timeline?
3. Was the current clinical condition of the patient on presentation clearly described?
4. Were diagnostic tests or assessment methods and the results clearly described?
5. Was the intervention(s) or treatment procedure(s) clearly described?
6. Was the postintervention clinical condition clearly described?
7. Were adverse events (harms) or unanticipated events identified and described?
8. Does the case report provide takeaway lessons?

that the practice of yoga may reduce LUTS by balancing/regulating components of the ANS, but none of the studies provided validated objective measures, such as heart rate or blood pressure, to assess yoga's effects on the ANS.[43] In one study,[32] the investigators postulated that the practice of mindfulness-based stress reduction that included only mindful-yoga may reduce LUTS by activating the CNS, but no direct CNS measurement was used in the study.

Discussion

Yoga is an ancient Indian discipline that includes several body postures (*asana*), breathing exercises (*pranayama*), and meditation (*dhyana*)[16,44] and has been practiced in its many forms for thousands of years. Yoga has gained popularity worldwide as a means to improve health and well-being[45] and, in the United States, more than 13 million people engage in yoga practice.[15]

The purpose of this article is to report the results of our scoping review on yoga's effects on LUTS and to identify gaps in knowledge. We found preliminary evidence, mainly from pilot studies, for yoga's effects on storage LUTS, that is, urinary urgency, frequency, nocturia, and UI, but we did not find evidence for yoga's effects on emptying LUTS, such as hesitancy and incomplete emptying. The focus on storage LUTS is not surprising given urgency with and without UI and nocturia are reported by patients as being bothersome.[46] Storage LUTS, prevalent in women, especially UI, often drive women to seek care.[47] Without studies that are designed specifically to investigate yoga's effects on emptying symptoms, however, the totality of yoga's effect on LUTS will not be known.

All studies suggested that yoga may decrease LUTS by strengthening the PFMs, regulating the ANS, and activating the CNS, but direct evidence of these relationships was not provided. We also did not find evidence for optimal dose of yoga needed to improve LUTS, sex differences in yoga's effects on LUTS, and effects of different yoga practices on LUTS.

Limitations

Our scoping review has some limitations. We included only research articles published in English in this review and searched the PubMed, Embase, and PsycINFO electronic databases. Many studies that include yoga interventions have been conducted in India and published in Indian journals; thus, based on our eligibility criteria, this review does not include numerous reports of yoga interventions published in non-English journals or in journals not included in the three databases we searched. Researchers should consider using other publication databases, such as IndMED, in future reviews.

Implications for future research

Although the reviewed research studies have limitations, promising evidence regarding yoga's impact on LUTS exists at the pilot study level. Because no adverse effects from yoga have been reported, and holistic benefits may occur, yoga should be explored further as an effective treatment for both urine storage symptoms and bladder emptying symptoms. Furthermore, yoga practice is widely accepted by both men and women of all ages and does not carry stigma that other lower urinary tract treatments may carry. Therefore, people may readily engage in yoga practice for specific benefits to improve or mitigate LUTS.

To understand yoga's effects on the PFM strength, balance of the ANS components, and activation of the CNS more comprehensively, we recommend that specific measures for these potential mediators should be used at baseline and immediately after the yoga intervention. These measures include: PFM strength measured by perineometer, heart rate while lying down measured by electrocardiogram, slow deep breathing in the supine position using an automatic event marker, blood pressure recorded at 0 min (baseline) in lying position and at 0.5, 1.0, and 2.0 min while standing up, and a handgrip test measured by a handheld handgrip dynamometer.

We also recommend testing the enduring effects of yoga on LUTS by conducting studies with long-term follow-up. Because the different types of UI have different etiologies,[48] researchers should investigate the effects of yoga on the different underlying mechanisms, for example, the PFM strength for adults with stress UI. Researchers should explore (1) yoga practice over the long term to continue the benefits of the PFM strength gain, (2) the dose response of yoga with varying frequencies, such as three to five times a week, and (3) the effects of different types of yoga on LUTS other than storage LUTS.

Conclusions

This review found a small number of published articles, none of which were large-scale rigorous randomized trials, that yielded preliminary evidence for improvement of storage

LUTS, including urinary urgency, frequency, nocturia, and UI in individuals with chronic health conditions. The studies present limited evidence that underlying mediators on yoga's effects on LUTS include enhanced PFM strength, regulation of the ANS, and activation of the CNS, but most of the studies did not measure these factors directly. Significant gaps in knowledge remain, indicating that further research is needed to determine yoga's specific effects on the PFMs, the ANS, and CNS.

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Author Disclosure Statement

No competing financial interests exist.

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