Effect of Yogic Practices on Postural Deformities of Spine: A Systematic Review

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ABSTRACT

Introduction: The Spine or backbone also called the vertebral column is made up segmented series of vertebrae separated by intervertebral discs on top of one another. It houses a spinal canal, a cavity that encloses and protects the spinal cord. When abnormalities of the spine occur, the natural curvatures of the spine are misaligned or exaggerated in certain areas, as occurs with lordosis, kyphosis, and scoliosis. It can affect the spine's ability to do its job, leading to pain, neurological problems, and mobility challenges.

Aim: The current review aims to study the effectiveness of yoga therapy in the management of spinal deformities by going through published scientific literature

Method: The purpose of this review was to review systematically the impact of yogic interventions on postural deformities of the spine. In this review, a total number of 25 published papers from 2010 to 2022 were included and critically reviewed. Randomized control trials, cross-sectional studies, quasi-experimental, retrospective studies, and pilot studies, these study designs were used with the majority being randomized control trials.

Results: The number of subjects participating in the studies ranged from 21 to 1245 but most of the studies had a small sample size. The duration of the intervention period varied greatly, with the majority being 4 weeks or longer. Most of the studies had a small duration of intervention carried out to see the effect of selected Yogic practices on chosen parameters. The research was not uniform in intervention but often varying in nature. All the findings were on the different aspects of spinal deformities each requiring an entirely different intervention. Despite the limitations, it can be concluded that the yoga interventions were effective in improving Cobb's angle and flexicurve angle for the management of lordosis, kyphosis, and scoliosis across all the reported findings.

Conclusion: Evidence suggests that yoga is an acceptable and safe intervention, which may result in clinically relevant improvements in pain and functional outcomes associated with a range of musculoskeletal disorders (MSDs). Habitual yoga practitioners showed greater spine health in both sagittal and coronal planes which suggested that long-term practice of yoga is beneficial for spine-related disorders.

Keywords: Lordosis, Kyphosis, Spinal Deformities, Scoliosis, Yoga.

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Introduction

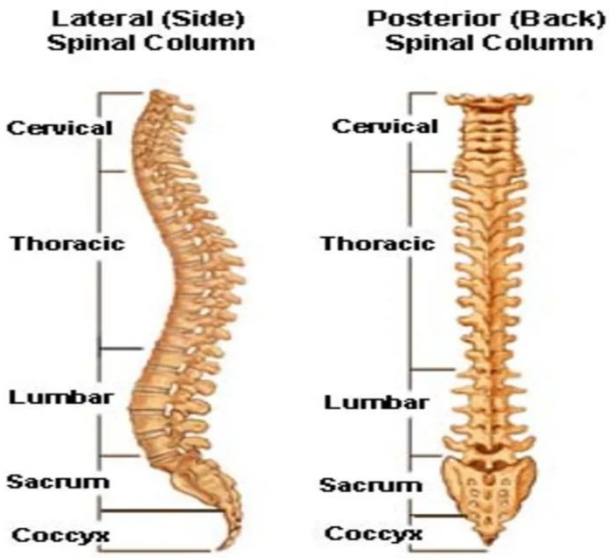
As a practice and philosophy of life, yoga has been followed for more than 4500 years with known evidence of yogic practices in the Indus Valley Civilization. The last few decades have seen a resurgence in the utility of yoga and meditation as a practice with growing scientific evidence behind

it. Significant scientific literature has been published, illustrating the benefits of yogic practices (Tripathi & Bharadwaj, 2021).

The Spine or backbone also called the vertebral column is made up segmented series of vertebrae separated by intervertebral discs on top of one another. It houses a spinal canal, a cavity that encloses and protects the spinal cord.

A healthy spine when viewed from the side has gentle curves to it. The curves help the spine absorb stress from body movement and gravity. The spine should run straight down the middle of the back. When abnormalities of the spine occur, the natural curvatures of the spine are misaligned or exaggerated in certain areas, as occurs with lordosis, kyphosis, and scoliosis. It can affect the spine's ability to do its job, leading to pain, neurological problems, and mobility challenges. Spinal deformities can occur for various reasons, including birth defects, ageing & degeneration, and trauma (Saini, 2017). All spinal deformities involve problems with the curve or rotation of the spine.

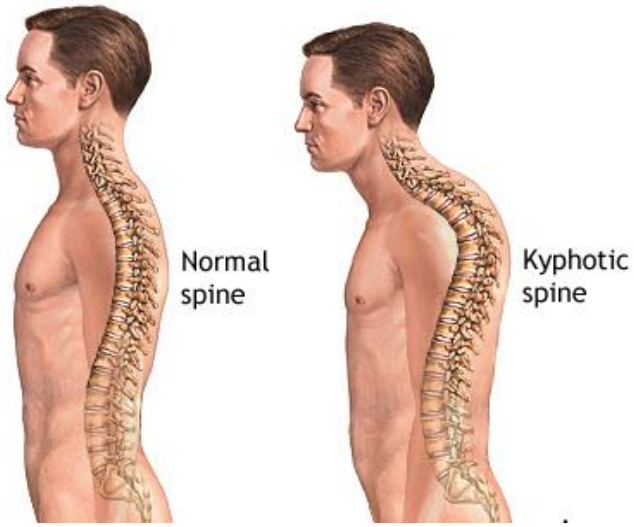
There are three spinal deformities and their subtypes that we are concerned about within our study. A healthy spine:



Individual vertebrae are named according to their region and position. From top to bottom, the vertebrae are:

- Cervical spine: 7 vertebrae (C1–C7)
- Thoracic spine: 12 vertebrae (T1–T12)
- Lumbar spine: 5 vertebrae (L1–L5)
- Sacrum: 5 (fused) vertebrae (S1–S5)
- Coccyx: 4 (3–5) (fused) vertebrae (Tailbone

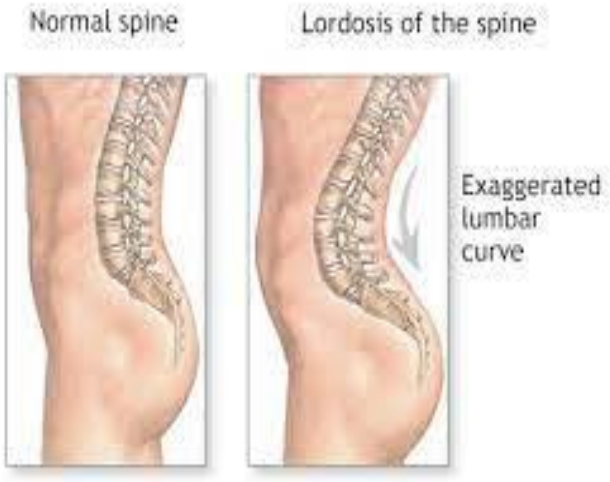
Kyphosis is characterized by an abnormally rounded upper back with more than 50 degrees of curvature. Trauma and developmental anomalies, degenerative disc disease, inflammatory diseases, and infectious diseases are the causes of kyphosis.



Considering the degree of kyphosis; is divided into two types: low degree (such as postural round back) and high degree (angular gibbus deformity, congenital kyphosis, Pott disease, and the best-known form which is Scheuermann).

Kyphosis may also develop due to muscular and neuromuscular diseases in addition to the above-mentioned causes. Cerebral palsy, muscular dystrophy, spinal muscular atrophy and myelomeningocele, neurofibromatosis and connective tissue disease, Paget disease, tumours, and surgery may also cause kyphosis (Yaman & Dalbayrak, 2014).

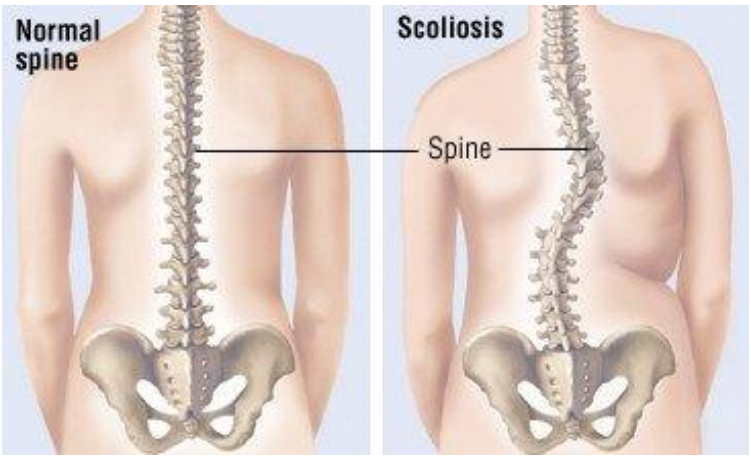
Lordosis is defined as an abnormal inward curvature of the lumbar spine. However, the term lordosis is also used to refer to the normal inward lordotic curvature of the lumbar and cervical regions of the human spine. Lumbar hyperlordosis is an excessive extension of the lumbar region and is commonly called hollow back, swayback, or saddleback. Lumbar kyphosis is an abnormally straight lumbar region.



There are 5 primary types of lordosis- Postural lordosis, congenital/ traumatic lordosis, post-surgical laminectomy hyperlordosis, neuromuscular lordosis, and lordosis secondary to hip flexion contracture (Sparrey et al., 2014).

Scoliosis: A person with scoliosis has a sideways curve to their spine. The curve is often S-shaped or C-shaped. This curving ordinarily ends at the same time. The skeleton stops growing but in

adulthood, the curve can still progress slightly, often as a result of disk degeneration.



There are 6 types of scoliosis namely congenital scoliosis, early onset scoliosis, adolescent idiopathic scoliosis, degenerative scoliosis, and Scheuermann's kyphosis. The cause of most cases is unknown, but it is believed to involve a combination of genetic and environmental factors(Shakil et al., 2014).

There are several studies conducted to see the possibility of intervention of yogic practice and improvement related to spinal deformities in the past. Yoga, which involves meditation, breath control, and the maintenance of various bodily postures has shown an improvement in clinical trials of spinal deformities. During a yoga session, a person assumes a series of prescribed stationary positions that utilize isometric contraction and relaxation of different muscle groups to create specific body alignments which helps to correct postural deformities (Oken et al., 2004). Yoga postures establish a proper rhythm in the neuromuscular tonic impulses and improve the general tone of the muscles. Asanas, as preventive medicine, can be used for avoiding the causation of postural deformities. Yoga combined with movement reeducation based on perceptual and motor development from Body-Mind Centering may be very useful in reducing pain and improving well-being and functional abilities regardless of age (Monroe, 2010). Yoga has long been used to improve physical and emotional well-being and alleviate chronic pain, stress, and anxiety.

Review of Literature

A study was carried out where the researcher tried to test the efficacy of isometric yoga poses in the management of scoliosis. He found that asymmetrically strengthening the convex sides of the lumbar and thoracic curves by daily practising the side plank and/or the half-moon pose with the alterations practiced may significantly reduce scoliosis in adolescents. These practices are very helpful even in idiopathic scoliosis and degenerative scoliosis (Fishman et al., 2017). Another study which tested hath yoga on shaping the anterior-posterior curvature of the spine found a positive impact of hatha yoga on proper body posture in the sagittal plane. A significant decrease in the thoracic kyphosis angle was found in the research done on male students. The researcher found that both in males and females, the thoracic kyphosis and lumbar lordosis angles were reduced (Grabara & Szopa, 2011b).

Also, a study showed that a 6-month yoga intervention resulted in statistically significant improvements in hyperkyphosis. Participants experienced a 4.4% greater improvement in flexicurve kyphosis angle and a 5% greater improvement in kyphosis index than control participants (Greendale et al., 2009).

Effect of yoga asana for correcting lordosis curve measured by a Spondylometer as noted in the study. In the study there was the administration of a 1-month yoga program improvement in the curve was compared to the control group. However, this improvement was very minimal but was significant enough to support their hypothesis (Saini, 2017).

A study where set aim was to find the long-term effects of yoga practice on disc degenerative disease reported that there was a possible association between yoga practices and the risk of age-related disc degeneration. The overall disc scores of the yoga group were significantly lower (indicating less degenerative disc disease) than those of the control group (P\0.001). The scores for the cervical vertebral discs of the yoga group were also significantly lower than those of the control group(P\0.001), while the lower scores for the yoga group in the lumbar group approached, but did not reach, statistical significance (P=0.055). The scores for individual discs of yoga practitioners showed significantly less degenerative disease at three-disc levels, C3/C4, L2/L3, and L3/L4(P\0.05). Magnetic resonance imaging showed that the group of long-term practitioners of yoga that were studied had significantly less degenerative disc disease than a matched control group (Jeng et al., 2011).

Geriatrics are the hardest to work with as every exercise might not be appropriate for them. The main purpose of physical exercise for the elderly should be keeping fit, lowering the risk of disability, and improving the quality of life. It was demonstrated in a study that evaluated the influence of hath yoga practices on shaping anteroposterior spinal curvatures. It was found that measurements of the angle of thoracic kyphosis before starting the series of hatha yoga classes and after finishing them showed a decrease in thoracic curvature in participants. Amounts of anteroposterior curvatures of the spine, measured after completing the series of hatha yoga classes, fluctuated around correct values better than before taking them up. This study showed that yoga training improves habitual body posture in case of aggravating (excessive) anteroposterior curvatures of the spine (Grabara, 2014).

Chronic low back pain is associated with patients diagnosed with lordosis thus alleviating pain becomes a necessity. Yoga helps decrease pain levels and improve the lordosis curve when performed regularly (Tatar et al., 2021). In multiple studies, it was found that specific yoga poses like the variations of the plank are effective in reducing Cobb angle (Fishman, 2021; Fishman et al., 2014).

Evidence suggests that yoga interventions are a fairly new concept in the management of spinal deformities and further trials are needed to assess their efficacy. Although current data already shows positive indications of yoga's efficacy. It is also notable that yoga trials require less preparation and on-site demands are minimal. Furthermore, the "do it yourself" nature of yoga and little to no assistance is needed in the application of intervention thus making it a suitable choice.

The main aim of the study was to study the effectiveness of yoga therapy in the management of spinal deformities by going through published scientific literature. There were primary and secondary objectives. The primary objectives were: to study the effect of yogic practices on different spinal deformities; to systematically review the data from current studies; to explore the applicability of selected yogic practices in therapeutic spheres. The secondary objectives were: to study different severity cases of lordosis, kyphosis, and scoliosis and their management through yoga; to other lifestyle management that could lead to improvement with yoga; to see other interventions that work by yogic practices to aid in the management of the said disorder.

Materials and Methods

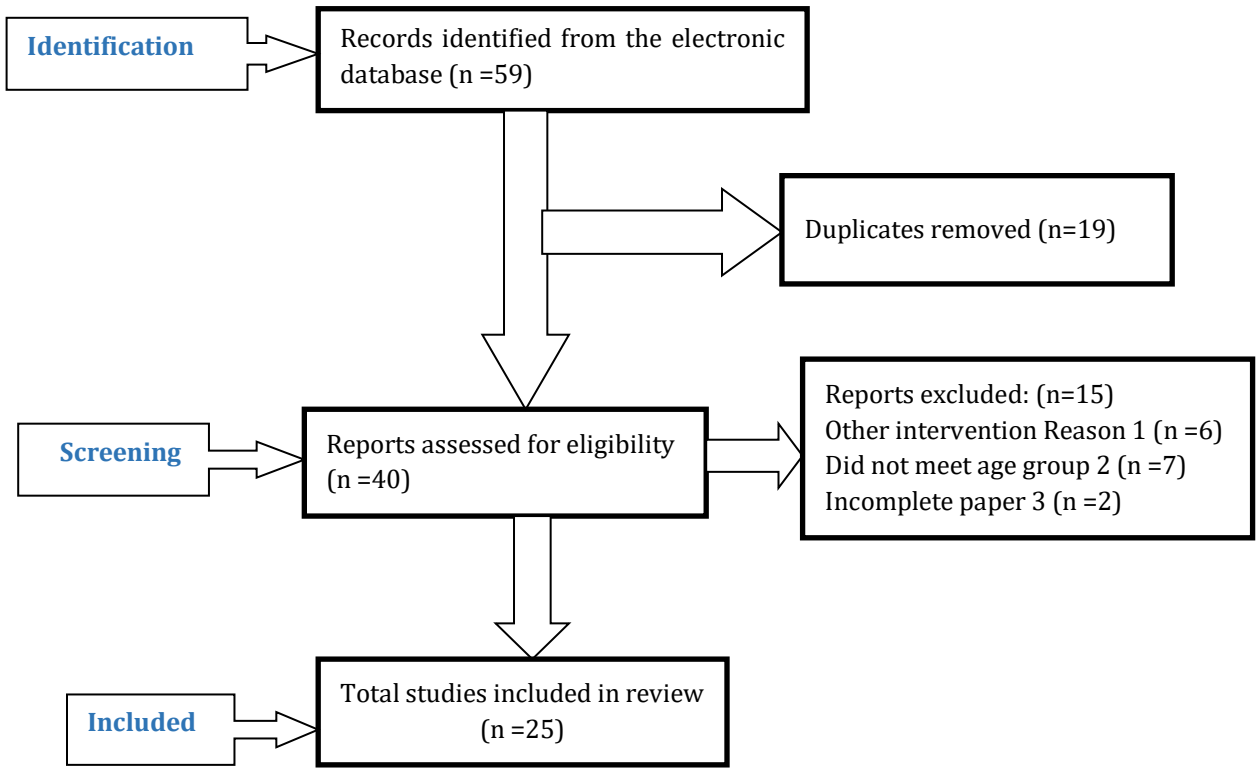
A systematic review of articles was obtained from different sources. Inclusion criteria were studies

that had yoga intervention as the primary component of treatment or management and targeted people with any of the three spinal deformities namely lordosis, scoliosis, and kyphosis. Articles with any type of study design were utilized.

Source

Following the PRISMA guidelines the electronic database Medline, PubMed Google Scholar, Cochrane, Jane, and Science Direct were searched. The keywords -yoga, yoga for kyphosis, yoga for scoliosis, yoga for lordosis, yoga and spinal health, yoga, and postural deformities were used to research the published literature on the topics. Certain inclusion and exclusion criteria were set to include and exclude the research papers on the related topics in the current review. The inclusion criteria consist of - full-length papers, peer-reviewed papers, studies describing a randomized controlled trial (RCT), pilot studies with human subjects exploring the effects of yogic practices on the spine, published in the English language, published between Jan 2008- December 2021, yoga as a primary intervention, Full available article and age group- 12-55. The exclusion criteria applied in the current review were: incomplete papers, published before January 2008, published in a language other than English, and related to another disease except for yoga and other treatment like Naturopathy, Ayurveda, etc.

Flow Chart



Results

After going through the selected literature, it was evident that certain yogic postures are useful in reducing abnormal curvatures of the spine that are caused due to bad posture or any other complications. However, results were significant in most studies but the improvement wasn't that noticeable suggesting that yoga needs to partake for a long time. Studies that had yoga intervention applied for a long time showed significant improvements in spinal curvature. Yoga significantly improved pain in mild-to-severe LBP

associated with spinal deformity. Most significant results were found in the management of scoliosis which showed a decrease in the Cobb's angle and showing noticeable results within 3-6 weeks. Both kyphosis and lordosis also showed improvements but it was rather slow and less noticeable as lordotic and kyphotic curves are hard to change but yoga proved a good management tool for them. Psychosocial outcomes were significantly improved. With the use of case-specific yogic practices, all three spinal deformities can be effectively managed and even altered if given enough time.

Discussion

The current review was focused on finding the effect of yogic activities on postural deformity and also understanding the mechanism of its action. And also, to learn about the three postural deformities (kyphosis, lordosis, and scoliosis) in detail. This systematic review of the literature suggests that the available evidence regarding the effects of yoga on spinal deformities is scarce and largely of low quality and that a few trials report some benefits of yoga or multimodal interventions that include yoga, a finding that is consistent with previous narrative reviews. Hatha yoga exercises elongate the spine by employing active muscle work; they increase mobility in the joints and eliminate muscular contractions. In each asana, one aims to arrange individual body parts about oneself as well as the ground in such a way that the achieved pose is stable and comfortable. The arrangement of body parts cannot upset body equilibrium. Conscious work with one's body while remaining in the asana stimulates neural connections between the peripheral and central nervous systems as well as stimulating parts of the brain responsible for physical coordination and balance (Sathyaprabha et al., 2008). An improved sense of balance leads to better posture which in turn rejuvenates the spine and reduces any deformity.

The results of RCTs reporting between the control and intervention groups results suggest that targeted spinal extension muscle exercises and yoga may reduce kyphosis among adults with hyperkyphosis. Exercise adherence was generally good in studies since yoga is easy to do. Simple asana like the mountain pose (parvatasana) can help in both reducing the kyphotic and lordotic curves and improving spine health. Meanwhile asymmetrically strengthening the convex sides of the lumbar and thoracic curves by daily practising the side plank and/or the half-moon pose with the alterations may significantly reduce scoliosis in adolescents (Fishman et al., 2014). These practices are very helpful even in idiopathic scoliosis and degenerative scoliosis. As mentioned, in physical exercises of yoga, special attention is paid to the elongation of the spine as well as to increasing mobility in the joints. This leads to a reduction, and then elimination of muscular contractures and stiffening, which are the reasons for bad posture. The increasing mobility of the spine, especially concerning backward bends and twists, not only corrects one's posture but also prevents or alleviates existing lumbago.

A study on the influence of yoga physical exercise showed that alleviation of back pain and a considerable improvement of spinal flexibility happened to a greater extent than during other physical exercises (Tekur et al., 2008). People who had been practising yoga for a longer period noticed a reduction in back pain, as well as a remarkable improvement in body posture. Poor study design and reporting across many trials of yoga for the treatment/management of spinal deformities weaken the conclusions that can be derived and the generalizability of the work to date. The inconclusive findings in many studies may have been the result of small sample sizes or that few studies accounted for the exercise levels of participants at baseline. RCTs should state their power to detect a meaningful difference and perform an appropriate sample size calculation. However, some studies that had a large sample size reported encouraging results in favor of yoga therapy as a means to treat and manage spinal deformities (Grabara, 2021). Also, there are several methods for assessing posture and no

clear consensus on which should be used in clinical trials; however, it has been suggested that the flexicurve may be favored because it is easy to use and will not introduce large errors when there are deformities, such as scoliosis, present in the ends of the spine, where the Cobb and kyphometer angle measurements are based (Ward et al., 2014).

After reviewing the selected studies that were shortlisted in this review by the screening through inclusion and exclusion criteria it is evident that yoga is helpful in the management of spinal deformities and promotes spine health and mental wellbeing. The regular practice of yoga should be taken into consideration when treating musculoskeletal disorders as yoga offers a cheaper alternative to modern medicine and other therapeutic interventions.

Future Directions

Future research should incorporate a larger sample size with randomized control and intervention group. Future analysis of outcomes which consider the amount of yoga received by participants may provide insight into any putative duration or dosage effects of yoga interventions. Moreover, researchers may also assess the effect of yoga on spinal deformities in patients that have two or more deformities at once.

Limitations

The limitations of this review must be acknowledged. Studies that had other interventions similar to yoga were excluded. The inclusion of only English-language articles may have introduced bias. This study only included articles published from 2010 to 2022 therefore the data is lacking. There may be more scientific reports but due to the limitation of certain domain databases, articles could not in included in the review. The heterogeneity across the studies and lack of available data do not allow for a meta-analysis to be done at this time.

Conclusion

Evidence suggests that yoga is an acceptable and safe intervention, which may result in clinically relevant improvements in pain and functional outcomes associated with a range of Musculoskeletal disorders. It is to be noted that patients with spinal deformities can't be recommended general yoga protocols and must perform their deformity-specific yogic practices which would also consider other factors. Habitual yoga practitioners showed greater spinal health improvement in both sagittal and coronal planes which suggested that long-term practice of yoga is always beneficial in spine-related disorders.

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