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Effectiveness of Yoga-based Interventions on Chronic Low Back Pain (CLBP) – A Review of Randomized Controlled Trials

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ABSTRACT

Low back pain (LBP) is defined as the pain and stiffness above the inferior gluteal folds and below the costal margin. The LBP lasting for the duration of 12 weeks or more is considered chronic low back pain (CLBP). The age-standardized incidence rate of LBP observed in South Asia was 2,362.13 per 100,000 population. The global incidence of LBP increased by 50%, from 149,294,134.47 to 223,455,640.82 cases from 1990 to 2019 respectively. Studies reported that the yoga-based interventions reduces disability, pain, pain medicine, stress, anxiety, depression and negative emotions, and improves spinal flexibility, quality of life and positive emotions in patients with CLBP more effectively than usual care and physical exercise. Yoga appeared to be more effective than physical exercise in patients with CLBP which may be because of various aspects of yoga, such as maintaining the yoga postures, breath regulation, mindfulness, meditation, relaxation etc. which separated yoga from physical exercises. It is suggested that the government and public hospitals should take actions to employ the ancient science of yoga to cure the patients with CLBP to avoid side effects and complications.

Keywords: *Chronic Low Back Pain; Disability; Meditation; Pain; Yoga.*

INTRODUCTION

Low back pain (LBP) is a common problem which occurs in all age groups, and it is the leading cause of physical disability worldwide.[1,2] The physical disability caused by LBP increased by 54% from the year 1990 to year 2015.[1] The LBP is generally defined as the pain and stiffness above the inferior gluteal folds and below the costal margin.[3] The LBP lasting for the duration of 12 weeks or more is clinically considered as the chronic low back pain (CLBP).[1] Studies demonstrated that the lifetime prevalence of LBP is up to 84%, the prevalence of CLBP is about 23%, and the prevalence of LBP with major disability is up to 12% in general population.[4] A recent study reported that the age-standardized incidence rate of LBP observed in South Asia was 2,362.13 per 100,000 population.[5] The global incidence of LBP increased by 50%, from 149,294,134.47 to 223,455,640.82 cases from 1990 to 2019 respectively. The LBP was found to be common among working populations with the one year prevalence ranging from 23% to 38%, however, one year prevalence of LBP in computers users was found to be 31% to 54 %.[6,7] The multiple components including maintaining the yoga postures, breath regulation, mindfulness, meditation, relaxation etc. comprised in yoga have great potential to cure various chronic lifestyle disorders.[8]

RISK FACTORS ASSOCIATED WITH CLBP

Chronic low back pain (CLBP) is strongly associated with structural pathology such as intervertebral disc prolapse and endplate fractures, although age-related biochemical changes also have clinical relevance.[9] Prevalence of CLBP is considered to increase with the increase in age that may be because of the increased activity limitation

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associated with the age.[1,10] A recent study showed that the incidence of low back pain was the highest in the 80 to 84 years age group globally.[5] Similarly, the age-standardized incidence of low back pain from 1990 to 2019 in female subjects was reported higher than that in male subjects, as demonstrated by the male-to-female ratios of 0.78 and 0.77, respectively.[5] Several personal and environmental factors were also reported as the risk factors associated with CLBP[11], however, biomechanical factors including the postures, gravity and other physical activities have major pathogenic role in CLBP.[4] One of the major cause of CLBP may be the postural habits which generate painful stress concentrations within innervated tissues disruption.[9] Studies reported that the poor posture may cause structural deformation, muscular contractures and pain in the back.[12] Similarly, unnatural long-term stable postures can result in the deterioration of the intervertebral discs as muscles requires movement to maintain coordination.[12] The genetic constitution is also considered as an important factor in CLBP.[4] Moreover, CLBP is also found to be associated with other factors including low educational status, job dissatisfaction, low level of social support in the workplace, stress, anxiety and depression.[11]

CONCEPT OF YOGA

The science of yoga was clearly described by sage *Patanjali* in his ancient text *Patanjali yoga sutra.* According to *Patanjali,* yoga involves eight steps namely *Yama* (abstinences), *Niyama* (observances), *Asana* (physical postures), *Pranayama* (breath regulation), *Pratyahara* (withdrawal of the senses), *Dharana* (concentration), *Dhyana* (meditation), and *Samadhi* (absorption), however, the *Asana*, *Pranayama* and *Dhyana* have been employed commonly for therapeutic purposes nowadays.[8] Yoga is a deep combination of psychological, physical and spiritual sciences designed to provide holistic development of the human body, mind, and soul. The primary purpose of yoga is to unite individual consciousness with the universal consciousness, however, recent studies have reported vast mental and physiological health benefits associated with it.[13-16] As discussed earlier, breath regulation, mindfulness, maintenance of postures, and relaxation etc. are the major components of yoga to deal with chronic medical illnesses such as CLBP.[8]

YOGA-BASED INTERVENTION FOR CLBP

Several randomised controlled trials (RCTs) have demonstrated the effectiveness of yoga on chronic disorders including CLBP. A randomised controlled trial (RCT) demonstrated that a 7-day intensive residential yoga program reduces pain, anxiety, and depression, and improves spinal mobility associated with chronic low back pain more effectively than physical exercises.[17] Another RCT reported that the mindfulness based stress reduction technique was effective to reduce pain, and to improve life quality of female patients with non-specific CLBP.[18] In a recent RCT, a significant improvement in the physical, psychological, and social domains of quality of life was found in both yoga and physical exercise group after 6-week intervention, but the higher percentage of improvement was observed in yoga as compared to exercise group.[19] A RCT conducted with eighty subjects having CLBP reported that a 7-day residential intensive yoga based lifestyle program reduced pain related disability and improved spinal flexibility better than a physical exercise.[20] Similarly, another RCT concluded that a 12-week yoga intervention appeared to be safe and effective in reducing pain and disability among military veterans with CLBP.[21] A recent study showed a significant decrease in depression, anxiety, and pain in patients with CLBP after 12- week (twice a week) yoga intervention as compared to control group.[22] Similarly, another RCT demonstrated that a 12-week (once a week) gradually progressing yoga program led to significantly greater improvements in back function than usual care in the adults with chronic or recurrent LBP.[23] A RCT reported a significant reduction in pain intensity (reduced by 64%), functional disability (reduced by 77%) and pain medication usage (reduced by 88%) after 16-week Iyengar Yoga intervention.[24] Another RCT also reported that a 24-week (twice a week) Iyengar yoga significantly improved functional disability, pain intensity, and depression in adults with CLBP as compared to standard medical care.[25] Similarly, another RCT reported a significant improvement in balance and flexibility, and significant reduction in disability and depression after 6-week hatha yoga intervention.[26] Further, another RCT concluded that 12-week yoga intervention was more effective than a self-care book for improving function and reducing chronic low back pain.[27]

A 12 standardized, weekly 75-minute yoga sessions designed for CLBP appeared to be more effective than a self-care book in improving function and reducing symptoms due to CLBP.[28] Similarly, a 4-week Iyengar yoga program appeared to be effective in pain reduction and improvement in health-related quality of life in nonspecific CLBP as compared to 4-week general exercise program.[29] A significant decrease in the LF power of Heart Rate Variability (HRV), rate of respiration, and a significant increase in the HF power and the pNN50 of HRV were found after yoga intervention for three months in patients with CLBP associated with altered alignment of intervertebral discs.[30] Similarly, in the study, yoga group showed a significant reduction in self-reported pain and state anxiety but Magnetic Resonance Imaging (MRI) - proven changes were not observed in the intervertebral discs and in the vertebrae.[31] In a RCT, there were significantly less disability, higher health status, and greater pain self-efficacy after 6-week yoga intervention (2-hour session, once a week) as compared

with physical therapy.[32] In another RCT, a 12-week (75-minute session per week) yoga and physical therapy both were more effective than health education for reducing perceived stress among low-income adults with CLBP.[33] Similarly, in another RCT, yoga group scores were significantly lower for perceived stress, back pain, sadness and hostility, and higher for feeling self-assured, attentive and serene after the 8-week yoga intervention (50 minutes per week).[34] Table 1 provides the details of RCTs on yoga for chronic low back pain.

Table 1. Randomized Controlled Trials on Yoga for Chronic Low Back Pain

SN	Author	Year	Sample	Design	Assessment	Intervention	Control	Results
1	Marshall et al.	2022	320 adults with chronic low back pain with predominantly low-income patients	Randomized Controlled Trial	Pain Self-Efficacy Questionnaire, Coping Strategies Questionnaire, and Fear-Avoidance Beliefs Questionnaire	75-minute hatha yoga intervention, once a week for 12 weeks	12 weeks of physical therapy intervention or health education	All the interventions were associated with improvements in self-efficacy among adults with chronic low back pain.[35]
2	Neyaz et al.	2019	70 patients (age range = 18 – 55 years) having non-specific chronic low back pain	Randomized Controlled Trial	Defense and Veterans Pain Rating Scale, and Roland Morris Disability Questionnaire	A total of six standardized 35-minute weekly hatha yoga sessions	A total of six 35-minute weekly sessions of conventional therapeutic exercises	Both hatha yoga and the exercise group have shown significant improvement in back pain intensity and back-related dysfunction.[36]
3	Patil et al.	2018	88 women nurses having chronic low back pain were randomized into yoga group (n = 44) and physical exercise group (n = 44).	Randomized Controlled Trial	World Health Organization Quality of Life-Brief Questionnaire	Integrated yoga therapy module practices, 1 hour per day and 5 days a week for 6 weeks	A set of physical exercises for the same duration	A significant improvement in physical, psychological, and social domains in both groups. Greater improvement in yoga group as compared to exercise group was observed.[19]
4	Berlowitz et al.	2020	320 adults with chronic low back pain with predominantly low-income	Randomized Controlled Trial	Perceived Stress Scale	75-minute hatha yoga intervention, once a week for 12 weeks	12 weeks of physical therapy intervention or Health education	Yoga and physical therapy were more effective than health education for reducing perceived stress among low-income adults with chronic low back pain.[33]
5	Kuvačić et al.	2018	Thirty subjects with chronic low back pain were randomly assigned into a yoga group (n = 15) and a control group (n = 15)	Randomized Controlled Trial	Oswestry Low Back Pain Disability Index, Zung self-Rating Depression Scale, Zung Self-Rating Anxiety Scale, and Numeric Rating Scale for Pain	A 8-week (2 days per week) yoga intervention program	Education on spine biomechanics and the management of chronic low back pain	Yoga group showed a significant decrease in depression, anxiety, and pain in patients with chronic low back pain as compared to control group.[22]

SN	Author	Year	Sample	Design	Assessment	Intervention	Control	Results
6	Groessl et al.	2017	One hundred and fifty military veterans with chronic low back pain	Randomized Controlled Trial	Roland–Morris Disability Questionnaire and Pain Intensity	Yoga sessions for 12 weeks (twice a week), consisted of yoga postures, movement, and breathing techniques.	No intervention for control group	Yoga interventions appeared to be safe and effective in reducing pain and disability among military veterans with chronic low back pain.[21]
7	Tekur et al.	2012	80 patients (37 female, 43 male) with chronic low back pain were randomized to yoga and physical exercise groups.	Randomized Controlled Trial	State-Trait Anxiety Inventory, Beck Depression Inventory, Numeric Pain Rating Scale, and 'Sit and Reach' test	A 7-day comprehensive yoga program containing physical postures, breathing practices and relaxation techniques.	Physical exercise program for chronic low back pain for 7 days	A 7-day residential Yoga program reduces pain, anxiety, and depression, and improves spinal mobility in patients with CLBP more effectively than physical exercises.[17]
8	Banth & Ardebil	2015	88 female patients with non-specific CLBP were randomly assigned to mindfulness based stress reduction (MBSR) group & control group.	Randomized Controlled Trial	Mac Gil Pain Scale and Standard Brief Quality of Life Scale	A 90-minute mindfulness based stress reduction session, once a week for 8 weeks along with usual medical care	Control group received only usual medical care.	MBSR appeared to be effective in reduction of pain and improvement of physical and mental quality of life of female patients with non-specific chronic low back pain.[18]
9	Tekur et al.	2008	80 subjects (37 females) with chronic low back pain were randomly assigned to a yoga group or a physical exercise group.	Randomized Controlled Trial	Oswestry Disability Index and spinal flexibility assessed using goniometer	1-week intensive residential yoga program comprised of asanas, pranayamas, and meditation designed for CLBP	Physical exercises designed for CLBP for 1 week	Seven days residential intensive yoga-based lifestyle program reduced pain-related disability and improved spinal flexibility in patients with CLBP better than a physical exercise.[20]
10	Tilbrook et al.	2011	313 adults with chronic or recurrent low back pain were randomized to yoga group (n = 156) and usual care group (n = 157)	Randomized Controlled Trial	Roland–Morris Disability Questionnaire, Pain Self-efficacy, and General Health Measures	A gradually progressing yoga program, once a week over 12 weeks	Control group under usual care	12-week yoga program led to significantly greater improvements in back function than usual care in the subjects with chronic or recurrent low back pain.[23]

SN	Author	Year	Sample	Design	Assessment	Intervention	Control	Results
11	Williams et al.	2005	60 patients with non-specific low back pain with symptoms persisting for more than 3 months	Randomized Controlled Trial	Pain Disability Index, Short Form-McGill Pain Questionnaire, Tampa Scale of Kinesiophobia, Survey of Pain Attitudes, and Back Pain Self-Efficacy Scale	16-week Iyengar Yoga intervention for Low Back Pain	Health education for Low Back Pain	A significant reduction in pain intensity (by 64%), functional disability (by 77%) and pain medication usage (by 88%) in the yoga group was observed.[24]
12	Galantino et al.	2004	Twenty two participants (17 females), age ranging between 30 and 65, with chronic low back pain	Randomized Controlled Trial	Forward Reach test, Sit and Reach test, Oswestry Disability Index, and Beck Depression Inventory	Hatha yoga intervention for one hour, twice a week for 6 weeks	No intervention was given to the control group.	A significant improvement in balance and flexibility, and reduction in disability and depression was observed in the yoga group.[26]
13	Williams et al.	2009	Ninety subjects with chronic low back pain were randomized to a yoga group (n=43) or control group (n=47).	Randomized Controlled Trial	Oswestry Disability Questionnaire, Visual Analog Scale, Beck Depression Inventory, and Pain Medication-usage Questionnaire	A 90-minute Iyengar yoga session, twice a week for 24 weeks	Standard medical care was given to the control group.	Yoga improved functional disability, pain intensity, and depression in adults with CLBP as compared to standard medical care.[25]
14	Sherman et al.	2005	101 adults with CLBP were randomized to yoga, conventional therapeutic exercise, and self-care book group.	Randomized Controlled Trial	Modified 24-point Roland Disability Scale, 11-point Pain Numerical Scale, Functional Status Scale, General Health Status, and Medication Use	12-week yoga intervention for yoga group	Conventional therapeutic exercises or self-care strategies for healthy lifestyle	Yoga and therapeutic exercise ware more effective than a self-care book for improving function and reducing chronic low back pain.[27]
15	Sherman et al.	2011	228 adults with CLBP were randomized to yoga or conventional stretching exercises or a self-care book	Randomized Controlled Trial	Modified Roland Disability Questionnaire, 11-point numerical scale	12 standardized, weekly 75-minute yoga sessions designed for chronic low back pain	Strengthening Exercises or the Back Pain Help book	Yoga sessions appeared to be more effective than a self-care book in improving function and reducing symptoms due to chronic low back pain.[28]

SN	Author	Year	Sample	Design	Assessment	Intervention	Control	Results
16	Gopal et al.	2014	Sixty subjects nonspecific chronic back pain were randomly assigned to yoga group (n = 30) and control group (n = 30)	Randomized Controlled Trial	Health-related quality of life, and Visual analogue scale	Iyengar yoga program comprising 29 yogic postures for 4 weeks	General exercise program for 4 weeks	Iyengar yoga appeared to be effective in pain reduction and improvement in health-related quality of life in nonspecific chronic back pain as compared to general exercise program.[29]
17	Telles et al.	2016	62 patients with CLBP associated with altered alignment of intervertebral discs (aged between 20 and 45 years)	Randomized Controlled Trial	Heart Rate Variability and Rate of Respiration	Yoga intervention (specific yoga postures, breathing techniques, and relaxation techniques) for 3 months	Standard medical care based on the physician's advice	Yoga group showed a significant decrease in the LF power of Heart Rate Variability, rate of respiration and a significant increase in the HF power and the pNN50 of Heart Rate Variability.[30]
18	Evans et al.	2010	53 adults with chronic low back pain were randomized to yoga group (n = 27) and physical therapy group (n = 26).	Randomized Controlled Trial	Roland Morris Disability Questionnaire, Rand Short Form 36 Health Survey, Numerical Rating Scale, and Back Pain Self-Efficacy Scale	2-hour yoga session, once a week for 6 weeks	A 6-week individualized physical therapy	Subjects in yoga group were significantly less disabled, had higher health status, and greater pain self-efficacy as compared with physical therapy participants.[32]
19	Telles et al.	2016	62 patients with chronic low back pain associated with altered alignment of intervertebral discs	Randomized Controlled Trial	Self-rated Pain, State Anxiety, Spinal Flexibility, and Magnetic Resonance Imaging (MRI) of the lumbosacral spine	Yoga intervention (specific yoga postures, breathing techniques, and relaxation techniques) for 3 months	Standard medical care based on the physician's advice	Yoga group showed a significant decrease in self-reported pain and state anxiety but MRI-proven changes were not observed in the intervertebral discs and in the vertebrae.[31]
20	Hartfiel et al.	2012	37 participants chronic low back pain in each group: yoga group and control group	Randomized Controlled Trial	Perceived Stress Scale, Roland Morris Disability Questionnaire, and Positive and Negative Affect Scale	50-minute yoga class per week for 8 weeks	Control group did not receive any intervention.	Yoga group scores were significantly lower for perceived stress, back pain, sadness and hostility, and substantially higher for feeling self-assured, attentive and serene as compared with control group.[34]

DISCUSSION

Several RCTs investigated the effectiveness of yoga-based interventions on chronic low back pain. Both yoga and physical exercise appeared to have positive effects in patients with CLBP. However, most of the RCTs on CLBP demonstrated that the yoga-based interventions are more effective in reducing disability, pain, pain medicine, stress, anxiety, depression, and negative emotions in the patients with CLBP as compared to usual care or physical exercise. Similarly, most of the trials reported that the yoga-based interventions improves spinal flexibility, quality of life, and positive emotions in patients with CLBP more effectively than usual care and physical exercise.

Yoga appeared to be more effective than physical exercise in patients with CLBP which may be because of various aspects of yoga, such as maintaining the yoga postures, breath regulation, mindfulness, meditation and relaxation.[8] Yoga postures improve respiratory and cardiovascular functions, and promote muscular strength and flexibility.[37] Similarly, meditation and relaxation methods after yoga postures help to relax joints and muscles. Further, breath regulation also has the potential to bring the mind at the present and to reduce the level of stress.[38] Pain relief through meditation was found to be associated with greater activation in brain regions associated with the cognitive modulation of pain including the orbitofrontal, subgenual anterior cingulate, and anterior insular cortex.[39] The pain relief is associated with multiple neural mechanisms supporting the cognitive regulation of ascending nociceptive processing [↑prefrontal (PFC) and ↑pregenual anterior cingulate cortex (pgACC); ↓thalamus] and engages non-opioidergic endogenous systems.[40] It is suggested that the surgery and overtreatment should be avoided in CLBP as they have several side effects and complications[4], hence, the effective and risk-free option for the treatment of CLBP may be the yoga therapy.

WAYS FORWARD

Yoga-based interventions reduce disability, pain, pain medicine, stress, anxiety, depression and negative emotions, and improves spinal flexibility, quality of life and positive emotions in patients with CLBP more effectively than usual care and physical exercise. Government and public hospitals should employ the ancient science of yoga to cure the patients with CLBP to avoid side effects and complications.

CONFLICT OF INTEREST

None

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