INFLUENCE OF YOGIC PRACTICES ON PATIENTS WITH ANKYLOSING SPONDYLITIS

A SYNOPSIS OF THE THESIS SUBMITTED TO
THE JADAVPUR UNIVERSITY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY IN ARTS

BY

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APRIL 2024

Introduction:

Ankylosing spondylitis (AS) is a rheumatic disease characterized by chronic inflammatory back pain. It is a condition of impaired movement of the sacroiliac joint, spinal peripheral joint, and spine. The term ‘ankylos’ means to unite or grow together of vertebra; 'spondylos'' means vertebra; and ‘itis’ means inflammation. Over time, the inflammation in the joints and tissues of the spine can cause stiffness and restrict the mobility of the spine. In the 2009 assessment of ‘spondyloarthritis in international society’, spondyloarthritis is categorized into non-radiographic axial and ankylosing spondylitis. Globally, around 39% of patients have chronic lower back pain due to inflammation of the lower spine (Hoy et al., 2014). The prevalence rate is 1.4% globally. In Europe, 1.50 million people, and in Asia, 5 million people, suffer from ankylosing spondylitis (Dean et al., 2014). According to Global Data's "Pharmaceutical Intelligence Centre," In India, the current estimated diagnosed prevalence of AS is 1.65 million. From now until 2028, it is expected to increase annually by 2.95% to reach 2.0 million.

Yoga is an ancient and traditional discipline invented in India to yoke the body, mind, and spirit. Generally, it is supposed to deal only with mind and spirit, but the scriptures of the Patanjali Yoga Sutra convince us that it treats the body and mind as a whole. It is a body-mind medicine that offers a very simple, approachable, and useful manual for cultivating a vibrantly healthy body, mind, and spirit. It makes a huge contribution to human potential and healing. Doctors typically view illness as a malfunction of the physical apparatus and identify the source of the problem, but they may overlook a patient's mental, emotional, or behavioral issues. Although the theory is false, most medical researchers still use it as their guiding concept when conducting research. Yoga works in different body systems to maintain a state of homeostasis. In the present day, it is considered an effective complementary and alternative therapy used in various diseases. Yoga is also effective for rheumatic disorders, but as to whether it may be effective in AS, no such robust clinical trials have been found.

Objectives of the Study:

1) To find out the effect of yoga on selected disease activity, inflammatory markers, blood count, general health, psychological and HRQoL variables in patients with AS.

2) To compare the yoga practices group (medicine with yoga practice) and control group

(medicine with conventional exercise) with respect to selected disease activity, inflammatory markers, blood count, general health, psychological and HRQoL variables in patients with AS.

3) To compare the yoga group and control group in changes score of pre-test to 12 weeks and 12 weeks to 24 weeks with respect to selected disease activity, inflammatory markers, blood count, general health, psychological and HRQoL variables in patients with AS.

Hypothesises of the Study:

The investigator applied the null hypothesis for the investigation after reviewing related literature due to limited review and no directional hypothesis.

$H_0$1-There would be no significant difference between yoga practice group and control group in disease activity, functional limitation, inflammatory markers, blood count, general health, psychological and HRQoL variables at pre-test, 12 weeks and 24 weeks.

$H_0$2-There would be no significant difference between pre-test and post 12 weeks, and post12 weeks to post 24 weeks in yoga practice group with respect to disease activity, functional limitation inflammatory markers, blood count, general health, psychological and HRQoL variables.

$H_0$3-There would be no significant difference between pre-test and post 12 weeks, and post 12 weeks to post 24 weeks in disease activity, inflammatory markers, blood count, general health, psychological and HRQoL variables in control group.

$H_0$4-There would be no significant difference between yoga group and control group in changes score of pre-test to post 12 weeks and post 12 weeks to post 24 weeks in disease activity, functional limitation, inflammatory markers, blood count, general health, psychological and HRQoL variables.

Brief Summary of Review of the Related Literature:

Several studies reported that, apart from back problems, yoga may help to manage disorders like hypertension, asthma, diabetes, fibromyalgia, cancer, hemodialysis, psychological disorders, and musculoskeletal disorders. After intensive searching by keywords such as

yoga, low back pain, inflammatory back pain, rheumatic disorders, and ankylosing spondylitis in three databases, using Medline/PubMed, Google Advanced Scholar, and the Cochrane Library. This study evaluated 112 direct experimental trials, excluding 617 due to duplicates, secondary data, and unavailability of full text articles from 727 identified studies. Several studies were found on various exercise interventions for ankylosing spondylitis. Those studies reported that spinal movement exercises can improve disease activity, functional ability, and inflammation in patients with ankylosing spondylitis. Very few studies were found of yoga in ankylosing spondylitis. Among those studies were very small numbers of subjects, and no robust evidence was found of yogic effects on disease activity, inflammatory response, psychological state, or overall quality of life of the patients with ankylosing spondylitis. According to the results of exercise interventions in AS and the significant effect of yoga on chronic low back pain (either mechanical or inflammatory), rheumatoid disorders, and other disorders, it has been hypothesized that yogic practices may be effective in reducing disease activity, functional ability, inflammation, negative thoughts, and developing physical and physiological functions in AS patients that improve patients' quality of life.

Methodology:

After the approval of ethics committee of the Jadavpur University and the IPGMER, a total of 50 male subjects were selected from the outpatient department (OPD) of Clinical Immunology and Rheumatology, Institute of Postgraduate Medical Education and Research (IPGMER), Kolkata, who were suffering from ankylosing spondylitis. They were randomized into a yoga group (n = 25) and a control group (n = 25), whose ages ranged between 20 and 40 years (27.3 ± 9.52 years). Within 12 weeks, 3 patients of the control group refused to continue, and the data of 2 patients from each group were not taken due to their unavailability on the schedule date of data collection, but they continued their yoga practice programme as earlier up to 24 weeks with their medicines as prescribed by respective doctors. And after the end of 24 weeks, two patients have refused to continue in both groups. Finally, after 24 weeks, present study considered 23 patients from the yoga practice group and 20 from the control group to fulfil the criteria of the study at 24 weeks. The yoga group continued with selected yogic practices for a period of 24 weeks with their regular medicine as prescribed by the respective doctors. The control group followed conventional medical treatment with exercises recommended by PMR practitioners (Physical Medicine and Rehabilitation). For

the yoga group, the self-demonstrated videos of the entire expert's recommended yoga practices were served to the participants via a mobile phone-supported OTG-based memory drive and instructed for each yoga practice session scheduled for 1 hour per day and 5 days per week. The yoga practices of patients were monitored through a blended mode of online video calling and face-to-face interaction. Total six categories variables were tested in this study i.e. .i) disease activity and function limitation ii) Inflammatory markers, iii) blood count iv) general health v) psychological variables and vi) health related quality of life (HRQoL). After the checking normality of the data, non-parametric statistics were used for data analysis. The statistical significance of the difference between the mean of independent variables were tested by Mann-Whitney U, and for the within group comparisons, the Wilcoxon Signed Ranks test was adopted. The significance level was set at a 0.05 level of confidence by using the Statistical Package for the Social Sciences (SPSS 22.0).

Results:

- **Between group comparison of Yoga and Control group at pre-test**

At baseline, no significant differences were found between yoga group and control group in disease activity (BASDAI) functional index (BASFI) ($p>0.05$), inflammatory markers ($p>0.05$), blood count ($p>0.05$), general health ($p> 0.05$), psychological ($p>0.05$) and HRQoL variables ($p>0.05$).

- **Between group comparison of Yoga and Control group at Post 12 weeks**

At post 12weeks, Significant differences were found between the yoga group and the control group in BASDAI and BASFI ($p<0.05$), inflammatory marker variables ($p<0.05$), psychological variables ($p<0.05$), and HRQoL variables ($p<0.05$) and total leukocyte count and platelet count in blood count variables. Rest of blood count variables remain not significant ($p>0.05$). General health variables were found insignificant ($p>0.05$) at 12 weeks. The means of the yoga group in BASDAI, BASFI, ESR, CRP, TNF-alpha, total leukocyte count, platelet count and all psychological variables are lower than the control group at post 12 weeks. The means of the yoga group in HRQoL variables are higher than the control group at post 12 weeks.

- **Comparison of Yoga and Control group at Post 24 weeks**

Significant differences were found between the yoga group and the control group in all BASDAI and BASFI ($p<0.05$), inflammatory markers variables ($p<0.05$), psychological variables ($p<0.05$), and HRQoL variables ($p<0.05$) at 24 weeks. The means of the yoga group are lower than the control group in BASDAI and BASFI, inflammatory markers, psychological variables, and HRQoL variables. Significant differences were found between the yoga group and the control group in haemoglobin ($p<0.05$) and platelet count variables ($p<0.05$), but no significant differences were found in the cases of total leukocyte count ($p>0.05$), segmented neutrophils ($p>0.05$), lymphocytes ($p>0.05$), monocytes ($p>0.05$), eosinophil ($p>0.05$), and basophils ($p>0.05$) at 24 weeks. The mean of the yoga group is higher than the control group in haemoglobin and lower in platelet count.

- **Within Group Comparison (Pre-test & Post 12 weeks)**

Significant differences were found between the pre-test and post-12 weeks in the yoga group concerning disease activity variables ($p<0.05$). The mean score after 12 weeks were lower than the pre-test in BASDAI and BASFI. The same results were also found in the control group ($p<0.05$). Significant differences were found between pre-test and post- 12 weeks in the yoga group in ESR, CRP and TNF-alpha ($p<0.05$), but no significant difference was found in morning cortisol ($p>0.05$). The means scores after 12 weeks were lower than the pre-test in ESR, CRP, and TNF-alpha. In the control group, no significant difference was found in all inflammatory marker variables ($p>0.05$). No significant difference was found between the pre-test and post- 12 weeks in the yoga group in total leukocyte count, segmented neutrophils, lymphocytes, monocytes, eosinophil, basophils, and platelet count ($p<0.05$), but a significant difference was found in haemoglobin ($p > 0.05$). The mean score after 12 weeks was lower than the pre-test for haemoglobin. In the control group also, no significant difference was found in all blood count variables ($p > 0.05$). Significant difference were found between the pre-test and post-test 12 weeks in the yoga group in systolic BP, diastolic BP, and BMI ($p<0.05$), but no significant difference was found in resting heart rate ($p>0.05$). The mean scores after 12 weeks are lower than pre-tests in systolic BP, diastolic BP, and BMI. Significant differences were found between the pre-test and post-test 12 weeks in the control group with respect to systolic BP and diastolic BP ($p<0.05$), but no significant difference was found in heart rate and BMI ($p>0.05$). The mean scores after 12 weeks are lower than the pre-test in systolic BP and diastolic BP. Significant difference was found

between the pre-test and post-test 12 weeks in the yoga group with respect to all psychological variables ($p<0.05$). The mean scores after 12 weeks are lower than the pre-test in all psychological variables. No significant difference was found in the control group with respect to all psychological variables ($p > 0.05$). Significant differences were found between pre-test and post 12 weeks in yoga group with respect to all HRQoL variables ($p<0.05$). The Mean scores of post 12 weeks were higher than pre-test in all HRQoL variables. No significant difference found between pre-test and post 12 weeks in control group with respect to physical functioning, role limitation-physical, role limitation-emotional, vitality, mental health, social functioning, general health and health change($p>0.05$). But significant difference found in pain ($p<0.05$). The Mean score of post 12 weeks is higher than pre-test in pain.

- **Within Group Comparison (Post 12 weeks & Post 24 weeks)**

Significant differences were found between post-12 weeks and post-24 weeks in the yoga group with respect to the disease activity variables ($p<0.05$). The mean scores post-24 weeks were lower than post-12 weeks in BASDAI and BASFI. Significant difference was found between post-12 weeks and post-24 weeks in the control group with respect to BASFI ($p<0.05$), but no significant difference was found in BASDAI ($p>0.05$). The mean score of post-24 weeks was lower than post-12 weeks in BASFI. No significant differences were found between post-12 weeks and post-24 weeks with respect to inflammatory markers, blood count, and general health variables ($p>0.05$) in both groups. Significant differences were found between post-12 weeks and post-24 weeks in the yoga group with respect to all psychological variables ($p<0.05$). The mean scores of post-24 weeks were lower than post-12 weeks in all psychological variables. No significant differences were found between post-12 weeks and post-24 weeks in the control group with respect to all psychological variables ($p>0.05$). A significant differences were found between post-12 weeks and post-24 weeks in the yoga group with respect to vitality, mental health, social functioning, pain, and general health ($p<0.05$), but no significant differences were found in physical functioning, role limitation-physical, role limitation-emotional, or health change of HRQoL variables ($p<0.05$). The mean scores of post-24 weeks were higher than post-12 weeks in vitality, mental health, social functioning, pain, and general health. Significant differences were found between post-12 weeks and post-24 weeks in the control group with respect to mental health and pain

($p<0.05$), but no significant difference was found in other HRQoL variables ($p<0.05$). The mean scores of post-24 weeks are higher than post-12 weeks in mental health and pain.

- **Comparison of the changes between the yoga and control groups at pre- test weeks and at post 12 week test**

A significant difference was found between the yoga group and the control group in the change scores means from pre-test to post-test 12 weeks with respect to BASDAI and BASFI ($p<0.05$). The change scores mean of the yoga group were negatively higher than the control group in BASDAI and BASFI. It indicates that in yoga group significantly better in BASDAI and BASFI in changes score than control group. Significant differences were found between the yoga group and the control group in the changes scores from pre-test to post- 12 weeks with respect to ESR, CRP, and TNF alpha ($p<0.05$). The changes scores means of the yoga group were negatively higher than the control group. It indicates that in yoga group significantly better in ESR, CRP, and TNF alpha in changes score than control group. No significant differences were found between the yoga group and the control group in the change scores from pre-test to post- 12 weeks with respect to blood count variables ($p>0.05$). Significant differences were found between the yoga group and the control group in the changes scores from pre-test to post-12 weeks with respect to BMI ($p<0.05$), but no significant differences were found in systolic blood pressure, diastolic blood pressure and resting heart rate ($p>0.05$). The changes mean score of the yoga group was negatively higher than the control group in BMI. It indicates that in yoga group significantly better in BMI in changes score than control group. Significant differences were found between the yoga group and the control group in the change scores from the pre-test to the post-test 12 weeks with respect to all psychological variables ($p<0.05$). The change scores means of the yoga group were negatively higher than the control group in all psychological variables. It indicates that in yoga group was significantly better in all psychological variables in changes score than control group. Significant differences were found between the yoga group and the control group in the change scores means from pre-test to post-test 12 weeks with respect to HRQoL variables ($p<0.05$) except in general health ($p>0.05$). The changes scores means of the yoga group were positively higher than the control group in all significant HRQoL variables. It indicates that yoga group significantly better in changes scores in all HRQoL variables than control group except in general health variables.

- **Comparison of the changes between the yoga and control groups at post 12 weeks and at post 24 week test**

No significant differences were found between the yoga group and the control group in the change scores from 12 weeks to 24 weeks in BASDAI and BASFI ($p>0.05$), inflammatory markers ($p>0.05$), blood count ($p>0.05$), general health ($p>0.05$), psychological ($p>0.05$), and HRQoL variables ($p>0.05$).

Brief Discussion:

The results of the present study show that yoga practice groups significantly improved disease activity and functional activity scores compared to the control group. The present study results found similarities to earlier studies-the practice of yogasana (postures) increases spinal flexibility (Singphow et al., 2022; Lee et al., 2014), muscle suppleness, the core strength of the muscles (Colgrove et al., 2019), and reduces pain, disability, fatigue, stiffness and awareness on the proper posture (Evans, 2013; Nagarathna, 2012). yogic postures (asanas), shuskma vayama (loosening movements of joints), and surya namaskar (modified sun salutation) primarily target the spine and their associated joints, which improve mobility of the joint, maintain the proper alignment of the muscles, increase strength, stretch the muscles by increasing circulation of blood, reduce stiffness and tenderness of the joint and muscles, and down-regulate pain.

According to the above results on CRP, ESR and TNF-alpha the yoga group is expressively better than the control group because yoga is a compact package of stimulation and relaxation that activates parasympathetic nerve activity and decreases sympathetic nerve activity, which may reduce inflammation, particularly pro-inflammatory parameters. Synchronization of postures, control of breathing, and concentration of mind induce anti-inflammatory parameters. Along with a yogic lifestyle, it may have increased the beneficial impact on inflammation.

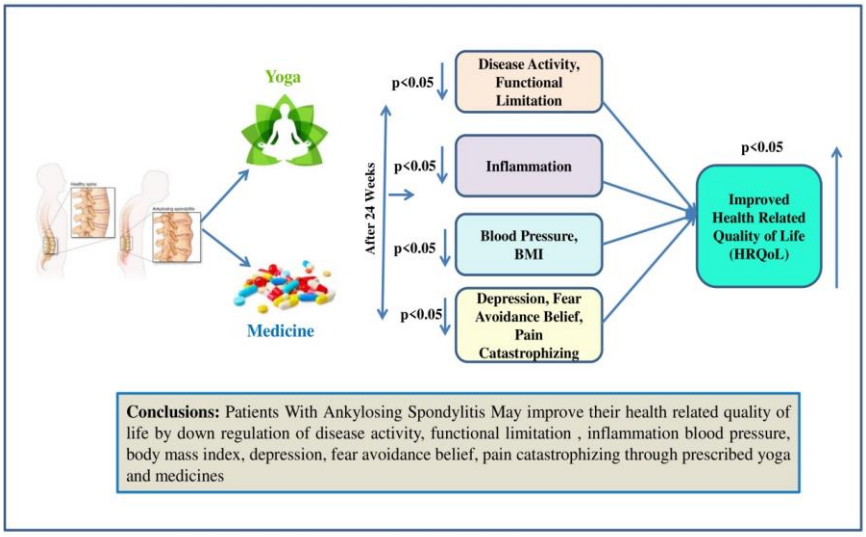
Several studies are also supported present study results, practice of yoga have positive psychological effects mostly in the parts of anxiety (Cramer, 2018; Hofmann, 2016) depression (Kinser et al., 2012; Smith et al., 2007). Another study also clinched with present study documented that regular yoga practices were associated with in changes in self-efficacy, fear avoidance belief, catastrophizing thought as well as positive set up coping

strategy against pain among low-income, racially diverse adults (Marshall et al., 2022). Yoga is body-mind medicine. The ultimate goal of yoga is to realize the self through the control of the mind. Eight-limb of yoga suggests how to achieve the goal of happiness. Asana, pranayama, and meditation are ways of controlling the mind.

Yoga is a holistic approach that improves every dimension of quality of life (Ebnezar 2011; Moonaz, 2015). In present study also found significant improvement in quality of life because asanas (postures) work mostly in the physical dimension by slow and intensive contraction and stretching, which improve blood circulation to the organs and improve the pressure and balance of the muscles. Pranayama (breathing) stimulates internal organs as well as induces vital force in the body. Yogic shat kriyas (six cleansing processes) help to cleanse physical and mental impurities. Dhyana meditation elevates calmness, peace and balance emotional states which lead to achieve spiritual bliss.

Conclusions:

According to the results, yoga practice appears to be effective in improving disease activity, physical function, body mass index (BMI), and inflammation in patients with AS. In addition, this holistic approach yoga may be beneficial in reducing depression, fear-avoidance beliefs, pain catastrophizing, and improving health-related quality of life (HRQoL). Virtual-mode yoga classes may be an effective strategy for increasing access to yoga compared with traditional yoga classes. It is an effective additional method for AS and should be considered as part of comprehensive disease management.



Visual Abstract of the study

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Countersigned by the Supervisor(s) **Candidate**

Dated: **Dated:**