ISSN: 2319-6505

Available Online at http://journalijcar.org

International Journal of Current Advanced Research
Vol 4, Issue 8, pp 290-295, August 2015

International Journal of Current Advanced Research

ISSN: 2319 - 6475

RESEARCH ARTICLE

EFFECT OF ONE YEAR OF YOGA THERAPY ON RANGE OF MOTION AND DISABILITY IN RHEUMATOID ARTHRITIS PATIENTS

Rukamani Nair[1], Ranjna Chawla[2], Aparna[3] and Gaurav Thakur[4]

[1,4]Bapu Nature Cure Hospital & Yogashram, Mayur Vihar I, Delhi-91 (India)
[2,3]G B Pant Institute of Post graduate Medical education and Research (GIPMER), New Delhi

ARTICLE INFO

Article History:

Received 10th, July, 2015
Received in revised form 20th, July, 2015
Accepted 10th, August, 2015
Published online 28th, August, 2015

Key words:

Rheumatoid arthritis (RA), Range of motion (ROM), Health Assessment Questionnaire (HAQ), Rheumatoid factor (RF)

ABSTRACT

Background and objectives: Rheumatoid arthritis (RA) is an autoimmune disease. Rectification of lifestyle with the use of non-conventional modalities can help to reduce the rate of disease progression. Aim of the study was to find out the effect of yoga intervention for one year in improvement of joint movement and disability by measuring range of joint motion (ROM), Health Assessment Questionnaire (HAQ) and rheumatoid factor (RF) in patients with RA. Effect of yoga was studied on regression of symptoms and improvement of condition.

Methods: Total of Seventy two rheumatoid arthritis patients were enrolled and divided in two groups. Group 1 included 36 patients taking Allopathic medication. Group 2 included 36 patients taking yoga along with allopathic medication. Range of joint movement in shoulder, elbow, wrist, MCP, hip, knee, ankle, PIP was assessed bilaterally in terms of degree. Disability was assessed using HAQ, an observational and self-reporting method.

Results: The patients, after yoga intervention, experienced improvement in ROM for many joints of hand, shoulder, knee, hip and in HAQ.

Interpretation and conclusions: The study concluded that yoga therapy, when used in conjunction with other prescribed treatments, can have a positive systemic effect on ROM and HAQ and thus helps in the effective management of rheumatoid arthritis.

INTRODUCTION

Rheumatoid arthritis (RA) is a chronic inflammatory disorder that primarily affects joints. The process involves inflammation and fibrosis of the tissues around the joints. It also affects the underlying bone and cartilage [(1)]. Rheumatoid arthritis affects most of the joints of the body but certain joints, particularly those of the wrists, hands and feet, are more likely to be affected. At initial diagnosis, the joints on both hands and feet are found to be affected in almost half the cases. As the disease progresses, all these joints are likely to be affected. Once diagnosed of RA, patients generally spend their lifetime using traditional and alternative therapies attempting to manage and decelerate the debilitation process [(2)]. RA like other autoimmune diseases is noted for its deteriorative properties of physiological systems because of faulty immune response. RA causes significant disability [(3)] and enhanced mortality, predominantly related to accelerated cardiovascular disease [(4)]. Patients with rheumatic diseases and musculoskeletal conditions such as osteoarthritis, fibromyalgia and rheumatoid arthritis may suffer not only from the physical manifestations of illness, but also from the nutritional, emotional, social and spiritual context in which their illness arises[(5)]

Treatment of rheumatoid arthritis should start as early as possible. Aggressive treatment, after the first 3-4 months of symptoms, reduces the rate of disease progression. There is increasing evidence that the first few months after symptom onset represent a pathologically distinct phase of disease. In this very early phase it may be possible to permanently switch off the disease process [(6)].

Yoga is a discipline developed in ancient India, characterized as a science of self-study and awareness through '*asanas*' (body postures), '*pranayama*' (patterns of breathing) and meditation. The ultimate goal of this practice is the achievement of harmony in body, mind and spirit. Yoga has spiritual roots, with the main goal of helping individuals to realize true happiness, freedom, or enlightenment. Beyond this, however, yoga has several secondary goals, such as improving physical health and enhancing mental well-being and emotional balance [(7)].

Treatment for rheumatoid arthritis requires improvement of lifestyle with increasing attention on patient's self help in controlling the disease. The study is an attempt to interrupt the inflammatory symptoms associated with the advancement of joint deterioration, minimize the occurrences of intense pain episodes and subside the condition into a remission phase with the help of yoga. The present study was planned to find out therapeutic potential of yoga for one year in patients suffering from RA. The effect was evaluated by studying the parameters like range of joint movement in shoulder, elbow, wrist, MCP, hip, knee, ankle and PIP bilaterally, RA factor and HAQ. The goal of treatment was to study the regression

of symptoms like joint pain, swelling, visible deformity and muscle weakness by studying ROM and HAQ.

MATERIALS AND METHODS

The study was conducted from March 2011 to June 2013 in the Department of Research, Bapu Nature Cure Hospital in collaboration with department of Biochemistry, GB Pant Hospital. A total of Seventy two radiologically and serologically proven RA patients were enrolled and divided in two groups. Group 1included 36 patients taking allopathic medication Group 2 included 36 rheumatoid arthritis patients taking naturopathy, yoga and allopathic medication. Written consent was taken from all the patients and ethical guidelines were followed during the study.

The study had due approval from ethical committee of the institution. RA patients satisfying the American College of Rheumatology criteria for rheumatoid arthritis were recruited by inclusion and exclusion criteria[8] (Guidelines for the management of rheumatoid arthritis, 2002 update). After baseline investigation patient were given intensive information, education and counselling about risk factor of the disease and importance of yoga. After their awareness and counselling about the disease, yoga modalities were administered to patients

Treatment

Yoga Therapy

The yoga therapies (20 min), practiced were Pawanmuktasana part I (anti-rheumatic), Shavasana and Pranayama (Bhramari, Kapalbati, Deep breathing and Nadisodhana) [9].

The total treatment period for each patient was one year. Therapies were administered thrice a week on alternate days for first two months (1-2) then followed by twice in a week for the next four months (3-6) and in last six months (7-12) once a week.

On days without session, patients were advised to continue this practice for 20-25 minutes at home. The daily adherence to this program was evaluated by analyzing questionnaire that was collected every month. The treatment was modified or omitted to avoid strain, whenever there was any inflammation in the joints. Yoga therapist followed the specific recommendations of orthopaedic surgeon for safe and healthy execution of treatment.

Allopathic Medicines

For delay in progression of RA, allopathic treatments were used in conjunction with yoga regime. The prescribed disease modifying drugs were Methotrexate, Sulfasalazine and Hydroxychloroquine. For better management of the disease conditions, drugs like calcium and folate were also administered as per specific requirement. The doses were kept stable and the participants were asked to consult rheumatologists at the end of every month to review the medication. Principles of treatment remained same in both the groups and doses were modified according to the activity of disease.

Parameters Studied

Over years a number of methods have been devised for measuring disease activity in RA. These include patient questionnaires, joint counts, lab tests etc. In this study therapeutic effect of naturopathy and yoga was finally assessed with the following parameters

Health Assessment Questionnaire (HAQ)

HAQ is measurement of functional disability. Functional improvement in Activities of Daily Living (ADL) was studied by the Indian version of Health Assessment Questionnaire (HAQ) [10]. The Indian HAQ comprises of 12 questions (nine basic and three advanced activities of daily living i.e. dressing, bending, walking etc. on the standard HAQ format) relevant to Indian population. The score of 0,1,2,3 being given for without difficulty, with some difficulty, with much difficulty and unable to perform respectively. The total score divided by 12 gives the Disability Index (range 0-3).

Rheumatoid factor (RF)

The blood samples were taken for Rheumatoid factor (RF) prior to the intervention and after 10a period of 12 months. [11]

Range of Movement (ROM)

Joints affected

Rheumatoid arthritis affects most of the joints of the body (wrists, hands and feet) but certain joints are more likely to be affected. These include:

- The metacarpophalangeal (MCP) joints- the row of knuckles on the hand closest to the wrist.
- The proximal interphalangeal (PIP) joints- the second (or middle) row of knuckle on the hand the wrist joints.
- The metatarsophalangeal (MTP) joints- the row of joints at the base of the toes.

Joint movements

Various movements of different joints of the body e.g. Flexion (to move leg forwards, extension (to move leg backwards), abduction (to move your leg away from your side) were done. These all movements were done 5 to 10 times after completion of massage.

Range of Movement (ROM)

In shoulder, elbows, wrists, MCP, hip, knees, ankles, PIP were recorded in terms of degrees[12] (using the anatomical position as zero degrees) for the following:-

Shoulder Abduction, Extension Left and Right; Knee Flexion, Extension Left and Right; Hip Joint Extension,

Flexion Left and Right; Proximal Interphalangeal (PIP) Extension, Flexion Left and Right; Metacarpophalangeal (MCP) Extension, Flexion Left and Right; Wrist Extension Flexion Left and Right; Elbow Joint Extension, Flexion Left and Right.

Statistical Methods

Results are expressed as mean ± standard deviation (SD). Student's paired t test (two-tailed) from baseline to 12 months was computed

RESULTS

A significant reduction in PIP extension and flexion left and right ($p<0.001$) was found in control group not taking yoga and naturopathy treatment. On the other hand PIP extension and flexion left and right showed no reduction but instead showed improvement, which was significant only for PIP flexion left.

In MCP extension left and right, the reduction in control group or improvement in treatment group was insignificant. On the other hand in the treatment group, the improvement was observed in the MCP extension left ($p<0.001$), MCP extension right ($p<0.05$). MCP flexion left and right showed significant reduction ($p<0.05$) in the control group not taking any treatment. In the treatment group the improvement was observed in MCP flexion left ($P<0.05$) (Table 1).

Table 1 Values of joints of wrist and hand in control and yoga group before and after a period of 12 months

Variable in degrees	Assessment	Control group (MEAN ± SD)	Treatment group (MEAN ± SD)
PIP extension left	Before	98.06±7.10	89.44±19.26
	After12 months	86.11±15.17***	96.67±11.46
	P value	5.9E-05	0.057
PIP extension right	Before	97.00±7.75	90.92±17.87
	After12 months	85.28±14.44***	96.67±9.86
	P value	5.6E-05	0.095
PIP flexion left	Before	97.78±7.22	90.00±18.05
	After12 months	85.56±14.82***	97.08±9.44*
	P value	3.2E-05	0.040
PIP flexion right	Before	97.00±7.75	90.92±17.87
	After12 months	85.28±14.44***	96.67±9.86
	P value	0.000249	0.087
MCP extension left	Before	28.19±3.41	24.83±7.40
	After12 months	26.53±5.32	29.44±1.99***
	P value	0.118	0.00057
MCP extension right	Before	27.94±4.50	25.83±6.78
	After12 months	26.67±5.07	28.61±4.24*
	P value	0.262	0.040
MCP flexion left	Before	47.33±5.83	41.61±11.83
	After12 months	46.39±7.52*	46.36±6.93*
	P value	0.043	0.040
MCP flexion right	Before	45.97±8.35	42.92±11.67
	After12 months	40.97±10.20*	46.53±6.74
	P value	0.026	0.1124

*p < 0.05, **p < 0.01, ***p < 0.001

A reduction in wrist extension and flexion left and right was found in control group. This reduction was significant only in wrist flexion left and right ($p<0.05$). An improvement was seen in the wrist extension and flexion left and right in treatment group but that was not significant.

In control group elbow extension and flexion left and right showed a significant reduction ($p<0.05$). The treatment group on the other hand showed improvement but that was significant only for elbow extension right ($p< 0.05$) and elbow flexion left ($p< 0.05$).

Shoulder abduction and extension left and right showed reduction but that was significant only for the right side ($p<0.01$). In the treatment group a significant improvement was observed in shoulder abduction left and right ($p<0.01$) and shoulder extension left and right ($p<0.001$) (Table 2)

Table 2 Values of different variables of arms in control and yoga group before and after a period of 12 months

Variable in degrees	Assessment	Control group (MEAN ± SD)	Treatment group (MEAN ± SD)
Wrist extension left	Before	55.97±17.56	53.56±21.44
	After12 months	52.78±17.38	61.03±14.35
	P value	0.44	0.086
Wrist extension right	Before	61.25±14.80	56.31±20.37
	After12 months	56.25±15.28	61.11±14.10
	P value	0.163	0.248
Wrist flexion left	Before	73.47±10.68	62.11±24.13
	After12 months	66.53±12.54*	69.31±18.52
	P value	0.0127	0.160
Wrist flexion right	Before	73.61±10.46	64.31±23.76
	After12 months	67.64±9.60*	70.14±17.42
	P value	0.013	0.238
Elbow extension left	Before	142.64±5.41	138.97±12.67
	After12 months	140.64±9.26*	143.19±5.37
	P value	0.02	0.070
Elbow extension right	Before	141.67±6.87	138.75±11.73
	After12 months	136.03±12.12*	143.33±4.47*
	P value	0.018	0.031
Elbow flexion left	Before	146.67±8.94	140.97±16.42
	After12 months	140.97±12.53*	147.36±9.37*
	P value	0.03	0.046
Elbow flexion right	Before	146.43±8.54	143.33±12.59
	After12 months	139.86±13.42*	147.08±6.90
	P value	0.0177	0.121
Shoulder abduction left	Before	155.83±29.99	156.39±28.90
	After12 months	145.28±28.83	172.64±13.07**
	P value	0.132	0.003
Shoulder abduction right	Before	163.89±23.82	155.56±30.35
	After12 months	147.78±28.19	172.50±13.60
	P value	0.010**	0.0031**
Shoulder extension left	Before	51.11±10.70	48.06±13.32
	After12 months	48.47±10.06	57.36±5.54***
	P value	0.284	0.00024
Shoulder extension right	Before	51.81±11.22	50.44±11.94
	After12 months	47.36±10.52	58.06±4.67***
	P value	0.087	0.00066

*p < 0.05, **p < 0.01, ***p < 0.001

In control group there was a significant reduction in knee extension left ($p<0.05$), knee extension right ($p<0.01$), knee flexion left and right ($p<0.01$). In the treatment group a significant improvement was seen in the knee extension right ($p<0.01$), knee flexion left and right ($p<0.01$).

In control group hip extension and flexion left and right showed reduction, but significant only for hip flexion left ($p<0.01$). The treatment group on the other hand showed significant improvement for hip extension left and right ($p<0.01$) and for hip flexion left and right ($p<0.01$) (Table 3)

Results of RA factor showed an increase in the control group and a decrease in the treatment group however the changes were not significant. In HAQ a significant improvement was observed in treatment group ($p<0.001$) as compared to control group ($p< 0.05$) (Table 4).

Table 3 Values of different variables of Legs in control and treatment (Naturopathy and yoga) group before and after a period of 12 months

Variable in degrees	Assessment	Control group (MEAN ± SD)	Treatment group (MEAN ± SD)
Knee extension left(degree)	Before	120.61±15.27	117.78±14.71
	After12 months	112.36±14.56*	122.92±17.98
	P value	0.022	0.188
Knee extension right	Before	121.08±13.34	119.58±13.00
	After12 months	112.22±14.56**	126.67±7.17**
	P value	0.009	0.0055
Knee flexion left	Before	123.75±12.44	119.31±16.39
	After12 months	114.17±15.74**	128.47±10.54**
	P value	0.0055	0.0062
Knee flexion right	Before	125.14±11.86	120.19±17.37
	After12 months	114.86±15.09**	129.31±10.15**
	P value	0.002	0.0082
Hip extension left	Before	29.31±2.44	28.33±3.38
	After12 months	28.94±2.90	30.00±1.20**
	P value	0.569	0.0042
Hip extension right	Before	29.58±1.84	28.44±3.43
	After12 months	29.22±2.46	30.00±.1.05**
	P value	0.483	0.0081
Hip flexion left	Before	118.06±4.01	115.56±9.09
	After12 months	113.33±7.93**	118.86±3.98*
	P value	0.00214	0.047
Hip flexion right	Before	116.39±5.93	116.25±7.59
	After12 months	113.53±7.93	119.17±2.80*
	P value	0.087	0.034

*p < 0.05, **p < 0.01, ***p < 0.001

Table 4 Values of RA factor and HAQ in control and yoga group before and after a period of 12 months

Variable in degrees	Assessment	Control group (MEAN ± SD)	Treatment group (MEAN ± SD)
RA Factor(U/ml)	Before	120.94±93.99	164.56±117.71
	After12 months	127.06±91.79	142.25±105.15
	P value	0.598	0.399
HAQ(0-3 range)	Before	1.4±0.46	1.19±0.47
	After12 months	1.1±0.54*	0.65±0.58***
	P value	0.0134	4.1E-05

*p< 0.05, **p < 0.01, ***p < 0.001

DISCUSSION

In spite of remarkable improvement in drug treatment, arthritis cannot be completely cured. There is a need for additional activities that patients can do to reduce pain and disability. Exercise is known to have benefits for people with arthritis. Physical exercise interventions that build strength, increase range of motion, and provide aerobic activity have been widely studied and supported for the maintenance treatment of disabling rheumatic conditions [13, 14]

The present study has shown that in treatment group, following yoga practice, ROM improved significantly for PIP flexion left, MCP extension left and right. MCP flexion left, elbow extension right and elbow flexion left, shoulder abduction and extension left and right , knee extension right, knee flexion left and right and hip extension, flexion left and right. On the other hand in control group a significant reduction was observed in PIP extension and flexion left and right and MCP flexion left and right, wrist and elbow extension and flexion left and right and shoulder abduction and extension left and right, knee extension and flexion left and right and hip flexion left. For the functional improvement in disability, as measured by HAQ, the improvement when compared in both the groups was found to be significant in yoga group as compared to control group.

According to treatment guidelines published by the American College of Rheumatology [15, 16] additionally, physical activity is an essential part of the effective treatment of osteoarthritis (OA) and rheumatoid arthritis (RA).

In persons with arthritis, exercise is safe and does not exacerbate pain or worsen disease [17]. In fact, exercise may play a key role in promoting joint health [18], since those who do not exercise often suffer more joint discomfort than those who do exercise [19]. The health and psychological benefits of exercise are widely recognized [20, 21]. However, regular physical activity is especially important for people with arthritis, who often have decreased muscle strength, physical energy, and endurance [22], in part due to their arthritis and the tendency to be sedentary [23].

Yoga has been associated with a number of physical benefits including reductions in oxygen consumption, minute ventilation, diastolic and systolic blood pressure and heart rate[24]. As with conventional exercise interventions, yoga has been found to have significant benefits for reducing chronic pain and related disability[25]. A recent review concluded that yoga provides psycho physiological benefits that are particularly apparent for people with musculoskeletal conditions[26]. Yoga has been found to be associated with improvements in autonomic regulation, including decreases in anxiety and blood pressure, and improved metabolic regulation[27]. The psychological benefits of yoga such as stress reduction, increased self-efficacy, improved coping and well-being contribute to greater overall health.

Many patients with chronic illnesses like osteoarthritis (OA), *fibromyalgia* (FM) and rheumatoid arthritis (RA) experience high levels of pain and psychological distress which are incompletely relieved by current pharmacologic or physical interventions. Pain in these chronic illnesses arises from a complex interplay between psychological, structural and biologic aspects of each disorder. Mind-body therapies like yoga may be particularly applicable for promoting overall quality of life for patients with these chronic rheumatic conditions. In a trial women with *FM* after undertaking 8-week 'Yoga of Awareness' program showed significantly greater improvements on standardized measures of *fibromyalgia* symptoms and functioning, including pain, fatigue and mood, as well as in pain, acceptance and other coping strategies[28].

Another trial of 8 week yoga program, in a group of obese patients with knee OA, demonstrated reduction in pain and functional disability[29] A study of the effects of a 10-week course of yoga for symptoms of OA of the hands showed reductions in finger joint tenderness and hand pain during activity, as well as short-term improvement in range of motion [30]. In one study, patients with carpal tunnel syndrome participated in an 8-week yoga program and had significant improvements in grip strength and pain[28]. No serious side effects have been reported in the trials assessing yoga for musculoskeletal complaints.

The present study of one year of yoga intervention for RA was able to demonstrate statistically significant improvements in ROM and HAQ. All the patients of group 2 given yoga therapy had good relief in pain, swelling and stiffness of

muscles resulting in improvement of range of motion of many joints. Some patients in the treatment group were able to decrease or discontinue allopathic medications. Combinations of medications with yoga can provide important additional physical and psychological health benefits and help in the better management of chronic rheumatoid arthritis condition in a scientific manner. Although yoga interventions can confer significant benefits for arthritis related pain and disability but noncompliance of patients may hamper the potential effectiveness. Over the years there has been a beginning to see a positive change in the perception of alternative medicine and more rigorous protocols are required to determine the effectiveness of such treatment and whether or not they can be used to prevent disability or delay surgery.

CONCLUSION

In this study patients taking yoga therapy experienced improvement in ROM for many joints of hand, shoulder, knee and hip. The overall improvement in movement, pain and general health of RA patients by yogic techniques used in the study may be because of psycho physiological benefits and autonomic regulation which result in improvement of mental health and muscle strength. Yoga, the cost effective treatment may offer the best hope for arresting arthritic condition and can be used effectively as an additional therapy to allopathic medicine. But for making yoga a routine in daily life constant efforts on part of the patient is required.

Acknowledgments

This project is supported by ICMR and we are thankful for the release of funds

References

1. American College of Rheumatology Subcommittee on Rheumatoid Arthritis. Guidelines for the management of rheumatoid arthritis. 2002 update. Arthritis. *Rheum*. 2002; 46:328-346
2. Bacon PA, Townend JN. Nails in the coffin: increasing evidence for the role of rheumatic disease in the cardiovascular mortality of rheumatoid arthritis. *Arthritis and Rheumatism.* 2001; 44: 2707-2710.
3. Bearne LM, Scott DL, Hurley MV. Exercise can reverse quadriceps sensorimotor dysfunction that is associated with rheumatoid arthritis without exacerbating disease activity. *Rheumatology (Oxford)* 2002; 41(2):157-166.
4. Büssing A, Ostermann T, Lüdtke R, Michalsen A Effects of yoga interventions on pain and pain-associated disability: a meta-analysis. *J Pain*. 2012; 13:1-9.
5. Carson JW, Carson KM, Jones KD *et al.* A pilot randomized controlled trial of the Yoga of Awareness program in the management of fibromyalgia. *Pain.* 2011; 151: 530-539
6. Eichner ER. Exercise and arthritis. The hematology of inactivity. *Rheum Dis Clin North Am* 1990; 16(4): 815-825.
7. Forestier R, André-Vert J, Guillez P, Coudeyre E, Lefevre-Colau MM, *et al*. Non-drug treatment (excluding surgery) in rheumatoid arthritis: clinical practice guidelines. *Joint Bone Spine.* 2009; 76:691-698.
8. Forrest G, Rynes RI. Exercise for rheumatoid arthritis. *Contemp Intern Med* 1994; 6(11):23-28.
9. Garfinkel MS, Singhal A, Katz WA *et al*. Yoga-based intervention for carpal tunnel syndrome: a randomized trial.*JAMA.*2009; 280:1601–1603
10. Gheranda Samhita: http://www.yogavidya.com/Yoga/Gheranda Samhita.pdf
11. Hermann, E; Vogt, P; Müller, W. Rheumatoid factors of immunoglobulin classes IgA, IgG and IgM: Methods of determination and clinical value. Schweizerische medizinische Wochenschrift. 1986; 116(38):1290-7
12. Hochberg MC, Chang RW, Dwosh I, Lindsey S, Pincus T, Wolfe F. The American College of Rheumatology 1991 revised criteria for classification of global functional status in rheumatoid arthritis, *Arthritis Rheum. 1992;* 35(5):498-502.
13. Hochberg MC, Altman RD, Brandt KD, Clark BM, Dieppe PA, Griffin MR *et al*. Guidelines for the medical management of osteoarthritis. Part II. Osteoarthritis of the knee. American College of Rheumatology. *Arthritis Rheum* 1995; 38(11):1541-1546.
14. Karim Raza,, Caitriona E. Buckley, Mike Salmon Christopher D. Buckley Treating very early rheumatoid arthritis Best Pract Res Clin *Rheumatology*. 2006 Oct; 20(5):849-863.
15. Kolasinski SL, Garfinkel M, Tsai AG *et al.* Iyengar yoga for the treatment of symptoms of osteoarthritis of the knees: a pilot study. *J. Altern. Complement. Med.* 2005; 11: 689-693.
16. Kumar A, Malviya AN, Pandhi A, Singh R. Validation of an Indian version of the Health Assessment Questionnaire in patients with Rheumatoid Arthritis: *Rheumatology*. 2002; 41: 1457-1459
17. Lyngberg K, Danneskiold-Samsoe B, Halskov O. The effect of physical training on patients with rheumatoid arthritis: changes in disease activity, muscle strength and aerobic capacity. A clinically controlled minimized cross-over study. *Clin Exp Rheumatol* 1988; 6(3): 253-260.
18. Newsome G. Guidelines for the management of rheumatoid arthritis: 2002 update. *J Am Acad Nurse Pract.* 2002; 14(10): 432-437.
19. Nordemar R, Ekblom B. [Effects of long-term physical therapy in rheumatoid arthritis]. Lakartidningen 1981; 78(15):1561-1564.
20. Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C *et al*. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*. 1995; 273(5): 402-407.
21. Ralph Yachoui; Sharon L Kolasinski Complementary and Alternative Medicine for Rheumatic Diseases. *Aging Health*. 2012; 8(4): 403-412.
22. Raub J A. Psychophysiologic effects of hatha yoga on musculoskeletal and cardiopulmonary function: a literature review. *J. Altern. Complement. Med.* 2002; 8:797-812.

23. Shah, Ankur. Harrison's Principle of Internal Medicine (18th ed.). United States: McGraw Hill. p. 2738.
24. Sivasankaran S, Pollard-Quintner S, Sachdeva R *et al.* The effects of a six-week program of yoga and meditation on brachial artery reactivity: do psychosocial interventions affect vascular tone? *Clin. Cardiol.* 2006; 29:393-398
25. US Department of Health and Human Services. Physical Activity and Health: A Report of the Surgeon General. 1996. Atlanta, GA, US Department of Health and Human Services, Centres for Disease Control and Prevention, National Centre for Chronic Disease Prevention and Health Promotion.
26. Werner R. A Massage Therapist's Guide to Pathology. Baltimore: Lippincott, Williams & Wilkins, 2005.
27. Wolfe F, Hawley DJ. The long term outcomes of rheumatoid arthritis: work disability: a prospective 18 year study of 823 patients. *The Journal of Rheumatology*. 1998; 25:2108-2117.
28. Yang K A review of yoga programs for four leading risk factors of chronic diseases. *Evid Based Complement Alternat Med*. 2007; 4:487-491.
29. Yoga Research and Education. 2003. www.yrec.org
30. Zhang W, Nuki G, Moskowitz RW, Abramson S, Altman RD, *et al.*, OARSI recommendations for the management of hip and knee osteoarthritis: part III: Changes in evidence following systematic cumulative update of research published through January 2009. Osteoarthritis Cartilage. 2010; 18:476-499.

****