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The effects of yogic training protocols on physical fitness components: A systematic review study

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Abstract

Yoga is an ancient art of practicing asanas and pranayamas. These exercises are considered to be originated in India. Yogic asanas are specific 'Physical Positions' or 'Postures' which co-ordinate with movements to hold the specific position to stretch and strengthen different parts of the body. Pranayama is also helpful in purification of body by removing waste products through the process of inhalation and exhalation. Due to pranayama our internal organs are purified in the same way as the metal of gold and silver are purified when they are put in the fire. The main aim of this article is to present a review study of the effects of yogic training including yogic asanas and pranayamas on physical fitness components of sportspersons. More than 300 research papers were searched using specific keywords in databases, out of which 16 relevant studies were selected for systematic review. The selected studies show positive effects of yogic training on selected physical fitness components. It was observed that yogic training of 10 to 12 weeks has more significant effects on muscular strength, explosive strength, muscular endurance, speed, agility and cardio-vascular endurance. However, many researchers recommended that the yogic training of more than six weeks has a positive effect on physical fitness components.

Keywords: Yogic training, yogasanas, pranayamas, physical fitness components

Introduction

Physical Fitness is considered the ability to carry out daily tasks with vigour and alertness without undue fatigue and ample energy. Today, games have become more demanding, fast and technique-oriented. That's why specific training related to different games is preferred by coaches to give best performance at national & international level. Physical Fitness is pre-requisite of games and each game require specific type of physique and physical fitness. Some games require balancing ability and flexibility; some require speed, some demand agility and co-ordination and some require a lot of strength. But all physical fitness components are co-related with each-other and we can't ignore the importance of even a single component. For example, if muscular strength is more; explosive power also will be automatically more. Flexibility depends on strength and co-ordination and if we want to increase flexibility, we should train strength. Endurance ability is also indirectly dependent on speed and cardio-respiratory endurance; strength depends on flexibility and co-ordination & speed depends on endurance, flexibility and explosive strength. Agility depends upon speed development. So, we require to develop each physical fitness component for best performance in sports. Yogic training including yogic- asanas and pranayamas are best methods to develop physical fitness. Sasi *et al.* (2011) ^[11], observed the effects of suryanamaskara, yogasanas and pranayamas on physical fitness, health and cardio-respiratory endurance of trainees. The result of the study indicates the therapeutic effect of Suryanamaskara by combining Asanas and Pranayama in the development of selected components. Asanas proved beneficial in development of flexibility, speed, strength, agility and co-ordination. Pranayama techniques proved beneficial in improvement of the functioning of diaphragm, spleen, pancreas, liver and stomach. Pranayama strengthens intercostal muscles and other internal organs. Tidal volume, expiratory reserve volume, vital capacity, inspiratory reserve capacity, total lungs capacity and maximal oxygen uptake was increased due to regular practice of Pranayama.

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Methodology

Identification and Selection of Studies

Embase, web of sciences, Scopus, PubMed and research gate databases were searched. The words like 'Yogic training', 'Yogasanas', 'Pranayamas', 'Male and Female', 'Physical Fitness Components and "peer reviewed" were applied to search the results. In addition, references list of identified studies were searched out to select the desirable researches. 'Yogic Training', 'effect on Physical fitness components', 'physical fitness', 'body composition, 'pranayama techniques', 'Speed', 'Agility', etc. were the key terms to identify the literature.

Summary of the Included Studies

Study: Tran, M.D., *et al.* (2001)^[16]

Sample: Total 10 untrained subjects (n = 8; Females & n=2; Males of 18-27).

Experimental intervention

- 8 Weeks, 2 days per week, 85 minutes per session yogic protocol including Yogic Asanas, Pranayama and Relaxative Exercises were scheduled e.g.
 - (i) 10 minutes Pranayama (Breathing Control Exercises)
 - (ii) 15 minutes warm up exercises
 - (iii) 50 Minutes Yoga Poses (Asanas)
 - (iv) 10 Minutes supine relaxation (Savasana/ Corpse pose)

Outcomes

- Regular Hath Yoga Practice brought significant change in Health related fitness.
- Significant improvement was observed in iso-kinetic Muscular strength for elbow Extension (31%); Flexion (19%) and Knee Extension (28%) at ($p < 0.05$).
- Significant improvement was noticed in Isometric muscular strength of ankle Flexibility (13%), shoulder elevation (155%), trunk extension (188%) and Endurance (57%) for knee Flexion at ($p < 0.01$)
- Trunk flexibility was improved at ($p < 0.05$).
- Significant increase was noticed in maximal oxygen uptake e.g. Absolute=7% & Relative=6% at ($P < 0.01$).

Study- Cowen, V. S., & Adams, T. B. (2005)^[4].

Sample- n= 26 Healthy adults (20 females & 6 males of 20-58 age; mean age=31.8)

- The subjects who were not engaged in yoga from last 6 months were selected with the help of Physical Activity Readiness Questionnaire (PARQ) for the study.
- All the subjects were divided into two experimental groups: -
 1. Astanga Yoga group n=15
 2. Hatha Yoga group n=11
- Out of 26 subjects, 17 subjects completed all Assessments for experimentation i.e. Astanga Yoga group (60% subjects) and Hatha yoga group (83.7%)

Experimental intervention

- 6 weeks yoga classes, twice a week (total 12 classes), 75 minutes per class, were scheduled for experimentation.
- Astanga Yoga group was provided primary series of Ujjayi Pranayama. And Suryanamaskara-A, Suryanamaskara-B, and a postural series including selected asanas/mudras.
- All the postures were held for 5 breaths.
- Hatha Yoga group was instructed to perform Relaxation Asanas and seated breathing exercises such as Kapalabhati and Anuloma Viloma. They were given a postural series including selected asanas/mudras.

- Subjective and objective data were collected using combination of assessment and indirect physical fitness measures i.e. participants were allowed to use their own Height, weight, age and seated resting blood pressure
- Physical fitness assessment including flexibility, heart rate, upper body dynamic muscular strength, predictive cardio-respiratory fitness & endurance and trunk dynamic muscular strength & endurance were measured to assess the effects of yoga protocol.
- Perceptual assessment including stress, physical, Social role functioning, mental health, pain and health perception and overall wellbeing were assessed using Perceived Stress Scale, Short Form 20 General Health Survey (SF 20), General wellbeing Schedule.

Outcomes

- Significant improvements were observed in diastolic blood pressure (-5%), trunk endurance (+54%), flexibility (+17%) and upper body and trunk dynamic muscular strength (+47%), in all participants.
- Significant betterment was realized in Perceptual Measures including perceived stress (-23%), health perception (+7%) through SF 20 in all Yoga participants.
- Significant increase was noticed in Anxiety (+10%) over time.
- Astanga Yoga Group was found better in post Yogic physical fitness assessment Compared to initial assessment in upper body and trunk dynamic muscular strength (+69%), diastolic blood (-9%), flexibility (+20%) and endurance (+52%)
- Astanga Yoga group shown significant improvement in stress (- 20%) and Health perception (+9%)
- Hatha Yoga group shows improvement only in flexibility (+14%) and trunk dynamic muscular strength and Endurance (+57%) in post Yogic protocol and no significant improvements were analyzed in Health perspective for Hatha Yoga group

Study: Bhutkar, P.M., *et al.* (2008)^[2]

Sample- n=78 (48 Male & 30 Female)

Experimental intervention-

- Both males and females were given 6 months Surya Namaskara practice.
- Purpose of the study was to observe respiratory capacity and cardio-respiratory efficiency.
- Data were collected using Bicycle Ergometry and different Lung infunction tests

Outcomes

- Surya Namaskara practice was found beneficial for decreasing blood pressure and resting pulse rate.
- Surya Namaskara practice improves Cardio-Respiratory efficiency of Healthy individuals as well as of Patients

Study- MadanMohan, *et al.* (2008)^[8]

Sample- n = 46

[Male (n= 30) & Female (n= 16) having age of 17 to 20 years]

- All the subjects were divided into following groups –
 1. Experimental Group = n=23 (15 Male & 8 Female)
 2. Control Group = n= 23 (15 Male & 8 Female)

Experimental intervention-

- 6 weeks training programme was formulated to analyse the effects of yogic training on Respiratory pressure and Endurance & Strength of Respiratory Muscles and Endurance.

- Experimental Group was provided selected yogic training protocol while Control Group didn't participate in any activity.
- Data were collected using Harvard Step Test on Index of sweat loss, maximum expiratory inspiratory pressure, hand grip strength and endurance.
- Level of significance was set at 0.05 level of confidence.

Outcomes

- Strength of Respiratory Muscles and Endurance was improved due to Yogic Training in both male and female ($p < 0.05$).
- Yogic Training showed significant improvement in Respiratory pressure and Endurance i.e. recorded 40 mm Hg in both Males and Females.
- Due to Yogic Training, Significant improvement was observed in sweating response assessed by Harvard Step Test.
- Yogic Training was found better in increasing strength and endurance of respiratory muscles

Study- Chen, *et al.* (2009) [3]

Sample-

- (n) = 31 Asthma Patients of Public Elementary School of Taipai Country (Age range = 7 to 12 years)
- Sample was divided into two groups namely Experimental group (n=16) and Control Group (n=15)

Experimental intervention-

Quasi Experimental Design was used for experimentation.

- 7 weeks, 3 days per week; 60 minutes per session yogic training was provided to experimental group.
- Control Group was not given any training protocol.
- Pre and post training data was collected prior to and after training.
- A follow up programme was given to 30 students (Experimental Group, n=16; Control Group, n=14)

Outcomes

- Yogic Training was found beneficial to develop muscular strength and endurance in asthmatic children.
- Physical Components as flexibility, muscular strength, endurance and cardio-respiratory endurance were developed after 7 weeks yogic training programme in Experimental Group.
- Analysis of data indicates improvement in flexibility, BMI, muscular Strength and endurance
- No significant difference was found in both groups in relation to physical fitness.

Study: Karunakaran and Ramesh (2009) [6].

Sample: 30 Boys of Pondicherry University (Age = 23 to 27 Years)

Sample was divided into two groups: -

1. Experimental Group = 15 Boys
2. Control Group = 15 Boys

Experimental intervention

- A training protocol of 12 Weeks, 5 days per week (Morning and Evening Sessions) was formulated for experimentation to assess the effect of yogic Physical exercises, Pranayama and Meditation on physical and physiological variables.
- Experimental Group was given Physical exercises, Pranayama and Meditation and Control Group didn't participate in any activity.
- Pre and post training scores were analysed statistically by

using ANCOVA (Analysis of Co-Variance).

Outcomes

- Experimental Group was found better than Control Group in relation to physical and physiological fitness variables except systolic and diastolic blood pressure.

Study: Takahasi (2011) [13]

Sample: n= 21 Untrained College male subjects; Mean age (21.43 +/- 2.29 years) of Nebraska Lincoln University.

Experimental intervention-

- 8 common exercises with 60% of IRM (Repetition Maximum) load were given for learning trials and RPE (Rating of Perceived Exertion Experienced) in learning trials.
- All the subjects were made familiar about the operation of 8 selected machines arranged in Circuit fashion at a Cadence of 40 beats per minutes by using OMNI-RPE scale chart to rate their perceived exertion.
- 6 weights were used for separate learning trials with Subjects' 60 % of IRM and OMNI - RPE for active muscles.

Outcomes

- In analysis of both 2 groups x5 (selected weights) with ANCOVA (with Repeated, measures); revealed that; there was significant (LAMBDA) = 0.10, F= 32256.06 = 6.95 at ($P < 0.001$); Partial (Eta) = 2+0-44.
- Significant change was noticed in pre self-selected weights and post 60 % of IRM learning trials.
- Follow up Univariate Analysis was used to examine and the results showed that learning effects were significant ($P < 0.001$)
- To determine the significant difference of variables from each other pair wise comparisons of selected weights were examined.
- It was concluded that post 60% 1RM learning trials self selected weights were significantly heavier than Post RPE-6 learning trials; self selected weights (Post SS weight B), except Rowing exercises.

Study: Xu, L., *et al.* (2011) [17].

Sample: n= 25 female admitted in yoga course in Handan College.

Experimental intervention

- 6 months' yoga training protocol was designed to analyse the effects of yoga on body shape, mental health and quality of physical functioning of female College students.
- The body shape, mental health and body functioning related data were collected prior to and after the yoga training protocol.

Outcomes

- Body weight thigh circumference, waist circumference and upper arm circumference were significantly changed due to yoga protocol.
- Reading of Vital capacity, VO₂ max, heart rate, step test, and Sit and Reach and sit-ups showed significant improvement due to 6 months' yoga protocol.
- Mental health self-assessment questionnaire (SCL--90), self-rating depression scale (SDS) and self-rating anxiety scale (SAS), indicates significant improvement compared to those before practice.

Study: Allison, N. & Abel, *et al.* (2013) ^[1].

Sample: Review of 57 research studies

Methods

- Only experimental researches published in peer reviewed research journals after 1980 were included for review with the purpose to investigate the effects of regular yoga practice on pulmonary function in healthy individuals of the participants of these studies.
- Databases namely sport discuss, Medline & PubMed were used with keywords pulmonary function, yoga and respiration.

Outcomes

- The results of the selected studies show that minimum 10 weeks Yoga practices is beneficial to improve pulmonary functions, peak expiratory flow rate, maximum inspiratory pressure, maximum expiratory pressure, forced vital capacity, maximum voluntary ventilation and forced expiratory volume in one second among participants.
- Pranayama proved beneficial for those participants who were engaged in the breathing exercisers for a longer duration.

Study: Telles, s., *et al.* (2013) ^[14]

To study the effects of yoga and physical exercise on physical fitness, cognitive performance, self-esteem, and teacher-rated behaviour and performance in school children.

Sample: n=98 school children (Age= 8 to 13 years)

The students were divided into two groups: -

1. Physical exercise group (n = 49)
2. Yoga group (n = 49)

Experimental intervention

- Three months' experimental design was formulated for Physical exercise and yoga groups for 5 days a week, 45 minutes each day.
- Yoga group was given yoga protocol including chanting, breathing techniques, postures and guided relaxation).
- Physical exercise group was given exercises protocol including jogging on the spot, rapid repetitive movements, relay races and games.
- Data were analyzed using RM ANOVA and *post-hoc* tests were Bonferroni adjusted.

Outcomes

- Physical exercise group showed significant for social self-esteem in comparison to yoga group ($p < 0.05$).
- BMI, and number of sit-ups were increased in both groups ($p < 0.001$).
- Balance was not improved in physical exercise group but yoga group showed improvement in plate tapping ($p < 0.001$).
- Both groups showed improvement in the Stroop task for color, word- and color-word naming ($p < 0.01$).
- Physical exercise group showed higher interference scores. ($p < 0.05$).

Study: Tracy *et al.* (2013) ^[15]

Sample: (n=21)

All the subjects were divided into two groups

- a) Yoga training group (n= 10; 29 +/- 6 years of age)
- b) Control group (n = 11; 26 ± 7 years of age).

Experimental intervention

- 8 weeks training including 24 yoga sessions, 90 minutes per session was designed to observe the effect of short-term Bikram yoga training on general physical fitness
- Pre and post training data were collected of both groups for Isometric deadlift strength, resting heart rate, handgrip strength, lower back/hamstring and shoulder flexibility, blood pressure, and lean mass, fat mass (dual-energy x-ray absorptiometry) and maximal oxygen consumption (treadmill).
- There were no changes in handgrip strength, cardiovascular measures, or maximal aerobic fitness

Outcomes

- Yoga group showed significant improvement in deadlift strength, lower back/hamstring flexibility and shoulder flexibility in comparison to control group.
- body fat was also decreased in yoga group compared to control group.
- There were no changes in handgrip strength, maximal aerobic fitness and cardiovascular measures
- fitness and cardiovascular measures

Study: D'souza, C.& Avadhany, S.T. (2014) ^[5]

Sample: Pre-Pubertal School going children (7-9 years)

- They were divided into two groups:-
- Yoga group (YG)
- Physical exercise (PE) group

Experimental intervention-

- Yoga group (YG) was given specific yoga training.
- Physical exercise (PE) group was given specific Physical exercises.
- The subjects of both groups were assessed for strength, endurance, aerobic capacity and whole body endurance through 20 meter shuttle and physical fitness
- The subjects were assessed three times Pre- training, 3 months Post intervention and 3 months after detraining

Outcomes

- The yoga group showed increase in respiratory muscle strength in significant way.
- The study concludes that presents the efficacy of yoga to improve strength, endurance, whole body endurance and aerobic capacity with 3 months of training. The effect of the training does not prolong after 3 months detraining.

Study: Park, M.S., *et al.* (2014) ^[10]

This study was conducted to observe effects of a yoga exercise program on stress response, physical fitness and self-esteem among middle-aged women.

Sample: n= 39 middle-aged females of District Y (Seoul).

All the subjects were divided into two groups: -

- Treatment Group (n=19).
- Control group (n=20).

Experimental intervention-

- The participants of treatment group were provided yoga exercise protocol, three times a week in including yoga classes and practices.
- Data were collected using Stress Inventory (1977) and Rosenberg's self-esteem scale (1965).

- Measurements of grip strength, balance and flexibility and compared to analyse the effects of yoga protocol.

Outcomes

- The stress response of treatment group showed significant decrease ($t=-6.18, p<.001$) and increase in grip strength ($t=2.52, p=.018$), self-esteem ($t=4.46, p<.001$) and balance ($t=3.24, p=.003$) in comparison to control group.
- No significant difference was observed in flexibility ($F=0.51, p=.479$) between both groups.

Study: Kim, J. S. (2015)^[7].

The study was conducted with the purpose of observing the effect of Yoga and Pilates training on the obesity indexes, muscle mass in each body part and physical fitness of male College students.

Sample

N= 20 obese male students.

Two groups were formulated for experimentation: -

- yoga group (n=10)
- Pilates group (n=10)

Experimental intervention

12 weeks, 5 days a week, 90 minutes per session was provided to both the groups according to their designed training protocol.

Outcomes

- Both yoga and Pilates groups showed significant increase in skeletal muscle mass and decrease in BMI, body fat rate and WHR.
- Both groups showed significant increase in muscle mass on the right arm, left arm, trunk, right leg, and left leg.
- Significant increase was noticed in physical fitness of lower muscle strength of lower extremities, flexibility, muscular endurance & left balance and right balance.
- Pilates exercises were found to have a more significant effect than yoga on skeletal muscle mass and the improvement of left and right body balance.

Study: Malathy, C, & Dean, R.A., (2015)^[9].

Sample: 120 College Women (17 to 20 years)

120 subjects were divided into 4 groups: -

1. Physical Exercise Group (n = 30)
2. Circuit Training Group (n= 30)
3. Yogic Practice Group (N = 30)
4. Control Group - (n = 30)

Experimental intervention: 12 weeks, 6 days per week, 90 minutes per session was scheduled for experimentation.

- Physical Exercise Group was given selected Physical Exercises Training.
- Circuit Training Group was given Circuit Training.
- Yogic Practice Group was given selected Yogic Exercises
- Control Group didn't participate in any type of activity.
- Pre and Post t-test scores were compared using ANCOVA (Analysis of CO-Variance) and paired mean difference was determined by Scheffe's Post Hoc Test.

Outcomes

- On Endurance Physical Exercise group showed significant difference compared to Circuit Training Group and yogic Practice Group.
- Yogic Training Group and Control Group showed no

significant differences on Endurance.

- Significant improvement was noticed in all groups i.e. Physical Exercise Group, Circuit Training Group and Yogic Practice Group except control group.

Study: Sovová E, *et al.* (2015)^[12].

Sample: n= 58 (16 males & 42 females); mean age= 50.0 ± 11.06 years

Experimental intervention-

- All the subjects were given yoga protocol for at least one hour a day for over 2 years.
- To observe the basic performance of Yoga trainees spiroergometry testing was done under maximal exercise testing.

Outcomes

- The yoga group showed significant improvement in maximum performance per kilogram ($P = 0.007$).
- They also showed maximum oxygen consumption per kilogram per minute ($P = 0.028$).

Discussion

This reviewed studies indicates that strength, endurance, muscular strength, speed, explosive strength, agility, co-ordinative abilities, body composition including body mass, muscle mass, lean body mass, decrease in fat percentage is clearly achieved by following yogic tytraining including yogasanas and pranayama protocols. Yogic training is an influential protocol which is a key to improve all physical fitness components of all age groups to some extent. It was observed that yogic training of 10 to 12 weeks or more have more significant effects on muscular strength, muscular endurance, coordinative abilities, speed, flexibility, agility and cardio-respiratory endurance. However, many researchers recommended the yogic training of more than six weeks also proves beneficial to develop physical fitness components. It was observed in many studies that intensity and repetitions of performing yogasanas may vary for desired results. Many researchers recommended 4 to 5 sets including variation in asanas and pranayamas; decrease in the rest period to increase the load intensity.

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