Effect of Yoga on Physical and Physiological Parameters

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Abstract*: Yoga is an ancient science which is practiced by an individual as a physical and mental exercise to become fit and healthy. In current study we perform various YOGA exercises to see its effects on various physiological parameters. The main objective of this study is to analyze the effect of karma yoga on physical (strength of quadriceps group of muscles) and physiological parameters such as blood oxygen saturation level (SpO2), heart rate and blood pressure. Healthy subjects are selected randomly for yoga session. SpO2, heart rates are measured using pulse oximeter and blood pressure using blood pressure apparatus. We used Electromyogram (EMG) acquisition and analysis software to acquire EMG signal from the quadriceps muscle. The variations in the physical and physiological parameters after performing karma yoga for a period of time are observed. The study concludes that there is a significant improvement in the strength of quadricep muscle but reduction in the pulse rate, SpO2, systolic and diastolic blood pressure after practicing the scheduled yoga. The significant results of these experiments show that if yoga exercises will be performed by any individual then its helps in improving their physiological parameters.

***Index Terms*: Yoga, Blood oxygen saturation level, heart rate, blood pressure, pulse oximeter, electromyogram**

I. INTRODUCTION

Human body is an electrical conductor. During the contraction of the muscles, electrical signals (myoelectric signals) are generated due to the voltage difference present across the muscle membranes [1]. Electromyography is an experimental method of recording and analysing the myoelectric signals. MOTOR unit is the functional unit that is used to describe the contraction of muscles in our body. Yoga is derived from the Sanskrit word 'Yuj' that means 'to join' or 'to unite' [2]. The aim of yoga is self- realization, to overcome all kinds of sufferings leading to a state of freedom. The significant advantage of yoga is to improve the physical and mental status of an individual.

With the growing affection of people to be fit, Indians have always given great attention towards yoga and other physical exercises.

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It has now become a way of living that aims for a healthy mind in a healthy body. Yoga used to boost physical stamina, strength, and flexibility of muscles, helps in improving blood circulation, enhancement of posture and muscle tone and provides higher powers of self-control and concentration. With more and more yoga practice, we become aware of the connection between our mental, emotional, and physical levels. Yoga works on one's body, mind, emotion and energy. This classified Yoga: karma yoga in which body is utilized; bhakti yoga where emotions are utilized; gyana yoga utilizes mind and intellect; and kriya yoga utilize energy [3]. The main goal of our study is to analyse the changes on physical as well as physiological parameters that arise after performing karma yoga.

Table I: Different Yoga Poses & its benefits on muscle

Yoga	Benefits	Muscles involved	Ref
Chair pose	Strengthens thigh, calves, spine	Gluteus medius, maximus, quadricep muscles	[4]
Leaning crescent pose	Flexes, hips, knees, ankles	Gastrocnemius, Quadriceps	[5]
Standing frog pose	Strengthens hips, backs, knees, ankles	Hamstrings, vastus medialis, lateralis	[5]
Down dog split	Strengthens legs and arms	Gastrocnemius mediale, soleus	[5]
Wide legged forward fold	Relieves stress, calms brain	Hamstrings, soleus	[4]
Squat pose	Stretch hips, lower back, sacrum	Gluteus Medius, maximus, vastus medialis, lateralis, rectus femoris	[6]

II. MATERIALS AND METHODS

Healthy subjects (both male and female) are selected (mean age in years 20 ± 5) randomly who are not undergoing any medication or clinical diagnosis. Exclusion criteria considered are subjects with implants, accidental problems and pregnancy [7-9]. Fig. 1 shows the steps involved in the whole procedure. SpO_2, heart rate, blood pressure is recorded. In case of spO_2 and heart rate pulse oximeter is used to collect the data. For blood pressure measurement, both manual and digital blood pressure apparatus are used to cross check the data obtained.

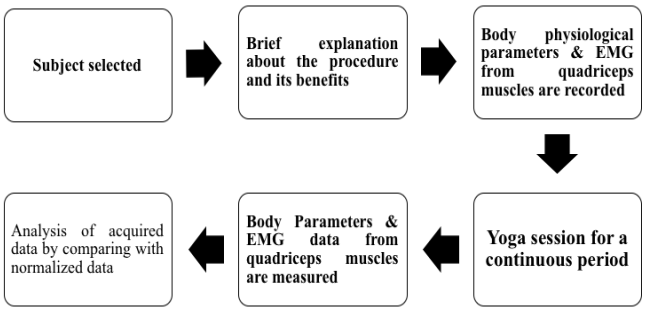

Fig. 1: Flow chart of the methodology

For EMG signal acquisition from the lower limb muscles of the subjects, M/s Delsys EMGworks® 4.3.2 software is used which take the help of Trigno™ wireless system to acquire the data. The major quadriceps muscles group which consists of vastus intermedius, vastus lateralis, vastus medialis, and rectus femoris) are primarily considered focused [10-14]. Wireless EMG sensors having a transmission range of 20m is used. Using EMGworks® analysis software the data acquired is analysed by plotting.

Table 1: Make and model for equipment used

Parameters	Equipment (company & model)	Units
SpO_2	Pulse oximeter (Romsons MD300C2 Ver1.0)	Percent (%)
Heart rate	Pulse oximeter (Romsons MD300C2 Ver1.0)	Beats/min
Blood pressure	Manual & Digital BP apparatus (Diamond BPMR112, Omron JPN1)	mmHg
EMG	Electromyograph (Trigno wireless EMG system)	Volt

After all the data are collected, the subjects are instructed to do the karma yoga that is selected for the yoga session. The yoga practice is divided into two sessions in which first 10mins the subjects are asked to perform some of the beginner's yoga. The second part of the session continues with the yoga that mainly focuses on the lower limb muscles. Beginner's yoga includes mountain pose, downward facing dog, plank (Fig. 2), triangle, tree, warrior 1, warrior 2 [4], bhujangasana [15-18]. Focusing on the lower limb muscles the yoga given in the table 1 is selected. The data are collected regularly at the same time subjects did the yoga for a period of one month [19-23].

Fig. 2: While performing karma yoga (plank)

Fig 3. shows the initial setup for EMG acquisition and the positioning of the sensors on the quadriceps muscles (vastus lateralis, rectus femoris and vastus medialis).

Fig. 3: EMG acquisition system and sensor positioning for limb muscles

III. RESULTS AND DISCUSSIONS

The current research works reveals that there is a significant normalization in the blood oxygen saturation, heart rate, level, systolic and diastolic blood pressure after a certain period of repetitive yoga session. The mean heart rate before yoga was 74 (beats/min) which significantly reduced to 72 (beats/min) after performing yoga exercise for a period of time. The values for mean systolic blood pressure before yoga session was recorded 125 (mmHg) which is afterward normalised to 115 (mmHg). Similarly, the mean diastolic blood pressure before yoga was 85 (mmHg) which reduced to a highly significant value of 73 (mmHg) after the exercise of yoga session. In case of SpO_2 there was no much difference in the results obtained. The pre-test SpO_2 mean was 97 (%) which reduced by 1% after exercise. Fig. 4 shows the comparison between the results obtained after doing yoga with the data collected before performing the yoga. Yoga exercise has a significant impact on the patients with hypertension to bring back the blood pressure to a normal level. A decreased SBP and DBP ensure better peripheral circulation and blood flow to the tissues.

Heart rate: The mean heart rate before yoga was (74±6) beats/min which reduced to (72±6) beats/min after yoga session.

Blood oxygen saturation level: The mean SpO2 before yoga was (97±1) % which lowered to (96±2) % after yoga session.

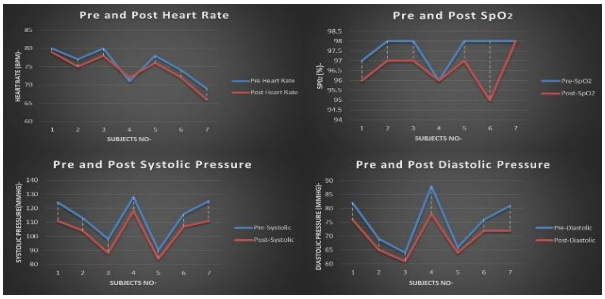

Fig. 4: Graph comparing the data collected for each physiological parameter (heart rate, SpO_2, SBP, DBP) on day 1 with the final day results

Systolic blood pressure: Mean SBP before yoga was (125±3) mmHg which significantly reduced to (115±5) mmHg after yoga session.

Diastolic blood pressure: Mean DBP was (85±3) mmHg before yoga and it decreased to (73±5) mmHg after yoga session.

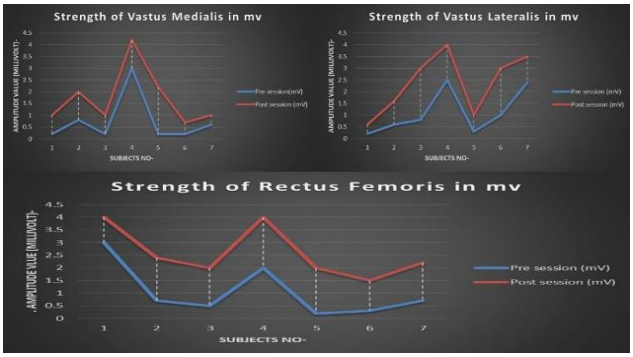

Fig. 5: EMG (vastus medialis, vastus lateralis, rectus femoris) acquired on day 1 compared with the EMG results of final day

Fig. 5 shows the changes in the EMG (amplitude in mv) signal of each quadricep group of muscle (vastus medialis, vastus lateralis, rectus femoris) after practicing yoga for a period of time. In case of vastus medialis, the mean amplitude of EMG before yoga was 0.85 (in mv) which improved to 1.85 (in mv) after the yoga session. Rectus femoris also showed a highly significant improvement of EMG from a mean amplitude value of 0.73 (in mv) before yoga to 2.35 (in mv) after yoga. Similarly, mean EMG of vastus lateralis increased from 1.266 before yoga to 2.68 post yoga.

IV. CONCLUSION

The study describes an effect of yoga on both physiological and physical parameters. A significant reduction in all the considered physiological parameters is observed after the practice of yoga. In case of EMG, an improvement in the strength of the quadriceps group of muscle is noticeable after performing the yoga exercises. These exercises were also beneficial for normalizing the blood pressure of individual. We also conclude that this study is beneficial for the patients with hypertension to restore their blood pressure to a normal level. Physicians suggest osteoarthritis prone patients to practice yoga on daily basis.

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