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Effect of suryanamaskar on flexibility across the gender

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Abstract
The objective of the study was to determine the effect of suryanamakar (sun salutation) on the flexibility across the genders. Subjects was selected according to the inclusion criteria, from Mimer Medical College and Maeer's Physiotherapy College Talegaon Dabhade, Pune. Total number of subjects included in the study was 30 i.e. (15 males and 15 females). Pre and post measurement values was noted down on the basis of 2 flexibility test i.e. sit and reach test and shoulder wrist elevation test. 10 sets of suryanamaskar 3 times for 4 weeks was continued. After completion of intervention it was observed that there was marked improvement in the post values of sit and reach test and shoulder wrist elevation test in both the genders but more improvement was seen in females as compared to males. Statistics was recorded using instat software. Descriptive statistics including p values was calculated using instat software and also mean values and mean difference was calculated and graphs was drawn. In relation to flexibility, a significant ($p<0.05$) effect of suryanamaskar was found in both the genders.

Keywords: suryanamakar, Talegaon Dabhade, flexibilit

Introduction
"Suryanamaskar" The Sun Salutation is a part of Indian Traditional Yogic practices. Suryanamaskar is the sequence of 12 yoga poses that flow in rhythmic breathing pattern. Each cycle of suryanamaskar is a sequence of asanas is such that each asanas is a complimentary to the next. During suryanamaskar, muscles of the entire body experience stretch and pressure alternately. It is claimed that suryanamaskar practice gives benefits of both asana and pranayama and improves general health and fitness. Suryanamaskar is an ideal warm up exercise.

Benefits of Suryanamaskar
1. Boost overall health.
2. Improves digestion.
3. Helps to detox body.
4. Help to get rid of anxiety.
5. Improves flexibility.
6. Promotes regular menstrual cycle.
7. Improves Blood circulation.
8. Help in weight loss.

The beautiful vedic prayer known as gayatri mantra addresses the sun as "The one who illuminates our minds". Historically the sequence of posses now known as suryanamaskar may have developed from an early sunrise practice honoring surya as the source of energy and light for the world. It is performed more than 3,500 years ago.
Flexibility is the ability to move a single joints smoothly and easily through an unrestricted, pain-free range of motion. If flexibility is not maintained the muscle might go in tightness. Muscle tightness can develop from overuse, trauma, stress or illness and it can increase the risk of muscle strain or tearing of muscle fibers during activity. Therefore it is necessary to maintain flexibility to relieve muscle tightness and reduce risk of injury.
A muscle's capacity to produce force depends on the length at which the muscle is held with maximum force delivered near the muscle normal resting length. The number of sarcomeres in series determines the distance through which the muscle can shorten and the length at which it produces maximum forces. Length associated changes can be induced by postural malalignment.
Muscle tightness can lead to postural faults and if it persists it can give rise to discomfort, pain or disability. It ranges from discomfort to incapacitating disability and this may lead to severity and persistence of the faults. Faulty alignment results in undue stress and strain on bones, joint, ligaments and muscles. Lack of mobility, leads to an alignment fault which can be improved by increasing flexibility thus reducing tightness.
In most cases facilitating mind and body flexibility is easily put aside when it is probably needed the most. However, the body flexible may help decrease tightness and tension that can lead to chronic and often debilitating physical problems.
Since time is often seen as a limiting factor when exercising, a daily practice of suryanamaskar can be the perfect solution for time challenged individuals.

AIM
To study the effectiveness of Suryanamaskar on flexibility across the genders.

Objective
To determine the effect of Suryanamaskar on flexibility by using sit and reach test across the gender.
To determine the effect of Suryanamaskar on flexibility by using shoulder wrist elevation test across the gender. To

compare the flexibility across the gender.

Need of Study

- Physical inactivity is a modifiable risk factor for cardiovascular diseases, osteoporosis and various other diseases.
- Physical exercise is considered an acceptable method for improving and maintaining physical health. Various studies have shown that people who maintain appropriate flexibility, using different different types of exercise have additional benefits of prolonged life and helps to avoid contractures and musculoskeletal injuries.
- Hence this study was done to find out effect of suryanamaskar on flexibility across the genders.

Review of Literature

1. Karthik PSI, Chandrasekhar have done a study on: effect of pranayama and suryanamaskar on pulmonary functions in medical students. In this study 50 students doing 1st yr M.B.B.S. Consent form has been taken from them.They have been given yoga training 30 mins daily for 2 month under the guidance of a trained yoga instructor. Vital capacity, Tidal volume, Expiratory reserve volume, Breath holding time, 40mm endurance, peak expiratory flow rate are measured before and after yoga training. The study concluded that there is a statistically significant increase in all the above mentioned pulmonary function following yoga training. Yoga practice can be advocated to improve pulmonary function in healthy individuals and hence to prevent respiratory diseases in future.
2. International Journal of Health Science and research have done a study on effect of suryanamaskar yoga practice on the heart rate, blood pressure, flexibility and upper body muscle endurance in healthy adult. In this study a total of 80 normal healthy subjects (40males and 40 females) between age group of 18-40years from Sumandeep Vidyapeeth University were randomly assigned a yoga or control group. After a 1.5 hour introduction to proper suryanamaskar techniques, the subjects were directed to perform suryanamaskar routines daily for 10mins each followed by a 5mins rest period, for duration of 2weeks. The study concluded that suryanamaskar is effective in increasing hamstring flexibility and improving upper body muscle endurance and helps to reduce blood pressure.
3. *Ryan Halvorson* on May 18, 2011 in the Journal of Strength & Conditioning Research (2010; 24 [10], 2618–26). The subjects included 13 men and 19 women who performed stretch tolerance tests to determine musculoskeletal stiffness and ankle range of motion. They then completed a stretching protocol that included 9 repetitions of a passive stretching exercise, with each rep held for 135 seconds. According to the results, the women experienced improved range of motion following the stretch interval, but the men did not. It was also determined that musculoskeletal stiffness was significantly higher in the men than in the women.
4. Range of motion in Mens Vs Females by Johnalee Johnston Aug.14, 2017. The blueprints for the male and female anatomy show few variances. Male and female hormones and their effect on bone structure and reproduction are the main factors that create differentiation. Lumbar Flexibility In the book "Joint Range of Motion and Muscle Length Testing," researcher Nancy Reese says differences in male and female range of motion in the lumbar — the area between diaphragm and pelvis — regions are greatly determined by age. As children, females generally have more lumbar flexibility than males until the age of nine when males catch up. Range of motion equality generally ends between ages 18 and 35 as males develop more lumbar extension than females and females more lateral flexion, or sideways movement of the spine.
5. Choudhary, R* and Krzysztof stec have done a study on the effect of Dynamic Suryanamaskar on flexibility of University students. In this study, a total of 20 male subjects were selected and used as one practice group. Dynamic suryanamaskar was considered the independent variable and flexibility was considered the dependent variable. Test was for flexibility. The repeated measures design was used for this study. Only one group of 20 participants was created. Test were determined in equal intervals of two weeks. The test started 4 weeks prior to the dynamic suryanamaskar treatment and took place every week thereafter, for total of 3 times.

Flexibility Test

1. Sit and Reach test for hip And Trunk flexibility.
2. Shoulder And Wrist elevation Test for shoulder and Wrist flexibility.

Methodology

Type of Study	Experimental Study.
Type Of Sampling	Purposive sampling.
Sample Size	20 Male And 20 Female =40.
Study Place	Students Studying in MIMER Medical College and MAEER'S Physiotherapy College.
Materials	▪ Measuring Scale. ▪ Measuring Tape. ▪ Stepper. ▪ Stick ▪ Pen and Pencil.
Duration	4 Weeks.

Outcome Mesures

- Sit and Reach Test.
- Shoulder and Wrist elevation Test.

Inclusion Creiteria

- Healthy Males and Females in the age group of 18 to 25 years.
- Males And Females with poor or average flexibility by sit and reach test and shoulder wrist elevation test.
- Individuals who are willing to participate in the study.

Exclusion Criteria

- Individuals suffering from any Neurological cardiovascular and musculoskeletal problems.
- Patients having hypermobile joints.

- Individuals who are in sports activities.

Procedure

All participants studying in MIMER medical college and MAEERS Physiotherapy College Talegaon Dabhade in the age group of 18-25 year as per the inclusion criteria were enrolled in the study.

A pre consent was taken and demographic data was recorded of all participants.

Total 30 participants were taken (15 Male and 15 Females) in the study and their tightness levels were checked using the 2 flexibility test namely sit and reach test used to measure trunk and hip flexibility and shoulder and wrist elevation test which is used to measure shoulder and wrist flexibility Treatment protocol was continued for 4 weeks (10 reps, 3 times, per week).

Sit and Reach Test

Starting position - sit on the floor with the back and head against a wall, legs fully extended, with the bottoms of the feet against the sit and reach box. Place hands on top of each other, stretching the arms forward while keeping the head and back against the wall. Measure the distance from the fingertips to the box edge with a yardstick. This represents the zero, or starting point.

Movement - Slowly bend and reach forward as far as possible, sliding the fingers along the yardstick; hold the final position for 2 seconds.

Score - Total distance reached to the nearest ¼ inch represents the final score.

Table 1

Males	Rating	Females
>17.9	Excellent	>17.9
17.0-17.9	Good	16.7-17.9
15.8-17.0	Average	16.2-16.7
15.0-15.8	Fair	15.8-16.2
<15.0	Poor	<15.4

Shoulder Wrist Elevation Test

Starting position - lie prone on the floor with the arms fully extended overhead, grasp a yardstick with the hands shoulder width apart.

Movement - raise the stick as high as possible.

- Measure the vertical distance [nearest 0.5inch] the yardstick rises from the floor
- Measure arm length from the acromial process to the tip of longest finger.
- Subtract the average vertical score from arm length.

Table 2

Males	Rating	Females
6.0 or less	Excellent	5.50 or less
8.25-6.25	Good	7.50-5.75
11.50-8.50	Average	10.75-7.75
12.50-11.75	Fair	11.75-11.00
12.75 or more	Poor	12.0 or more

***Score*:** Arm length average vertical score [nearest 0.5inch]

Result and Data Analysis

Statistics was recorded using instat software. Descriptive ststistics including p value was calculated.

Table 3: Sit and reach test

Mean Value	Male	Female
Pre	9.33	10.86
Post	19.65	22.46

Table 4: Shoulder wrist elevation test

Mean Value	Male	Female
Pre	14.66	12.95
Post	5.82	5.33

Table 5: Mean Difference

	Males	Females
Mean	12.37	12.90

Result

As compared to males flexibility is more in females after practicing suryanamaskar.

Discussion

This study was conducted to examine the effects of Suryanamaskar on flexibility in males and females ranging from the age group of 18-25years. In this study 15 males & 15 females was included according to the range of flexibility. Sit and reach test and shoulder wrist elevation test were taken in the study who fulfilled the inclusion criteria. Comparing data after intervention showed a significant increase in flexibility in both the genders. There was marked decrease in tightness levels as per sit and reach test and shoulder wrist elevation test scores. Similar study was done by Ryan Halvorson *et al*. also found that there was increase in flexibility in females.

Mean value of sit and reach test for males and females, post values was improved then pre values. But significant improvement was seen in females than in males. Similar study was done by Choudhary. R and Krzystof Stec.

Mean value of shoulder wrist elevation test for both males and females post values was improved. But there was marked increase in flexibility in females as compared to males. Similar study was done by Ananda Balyogi Bhavanani el al. Concluded that suryanamaskar increase flexibility.

Mean difference of sit and reach test and shoulder wrist elevation test for males and females shows significantly good improvement between pre and post values of both the test, but comparing both the genders females showed more improvement in flexibility than males, which shows that females are more flexible than males. Similar study was done by Amanda Balayogi Bhavanani. *et al*. concluded that suryanamaskar helps to improve flexibility and also exerts only a moderate stress on the cardio -respiratory system as it keeps the practitioner within their lactate and anaerobic threshold.

It was seen in present study that 4 weeks of 10 slow suryanamaskar improved the muscle flexibility in both the genders, but marked significant improvement was seen in females, as the area between diaphragm and pelvis is regions are greatly determined by age. During childhood area between

diaphragm and pelvis is more in females as compared to males. Till the age of 18 it is equal and after 35 females shows greater area than males.

Hormones plays imp role in muscle size and flexibility. Testosterone is a male sex hormone which increases size and mass of muscle of the male skeleton. In contrast Estrogen is a female sex hormone which widens the hip of females adding greater muscle mobility. According to the journal "Medicine and science in sports and exercise" said that in upper extremity females have more anterior shoulder joint laxity and hypermobility and less stiffness when compared to men.

Flexibility can be improved with stretching exercise. It is an important part of reducing risk injury and soreness that results from activity. Therefore suryanamaskar should be incorporated into daily fitness routine. Regular practice of suryanamaskar as an exercise will give benefits of fitness and wellness in one's life.

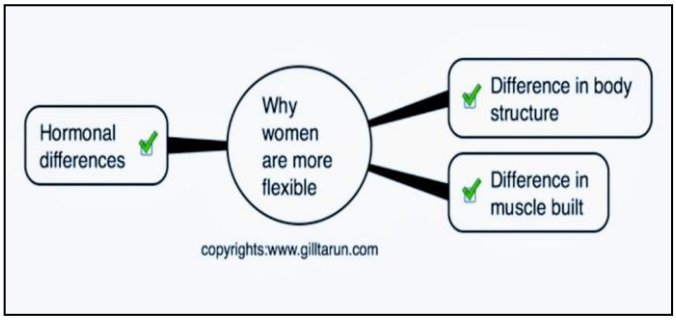
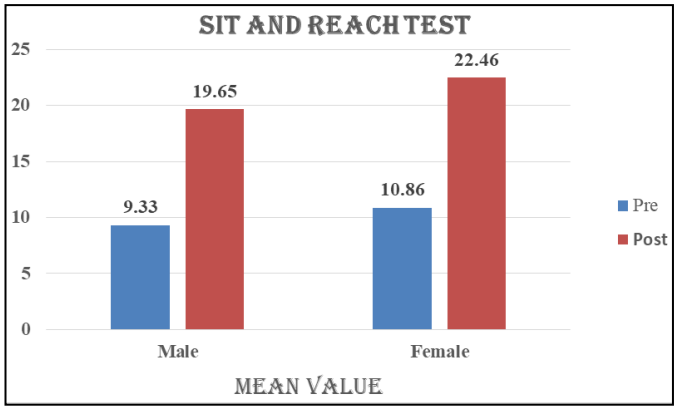


Fig 1



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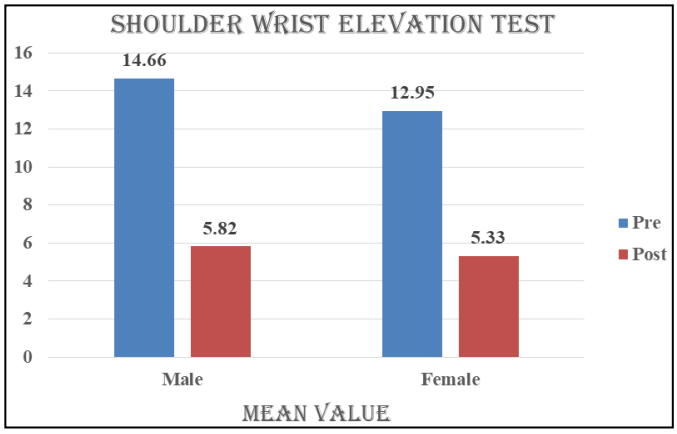

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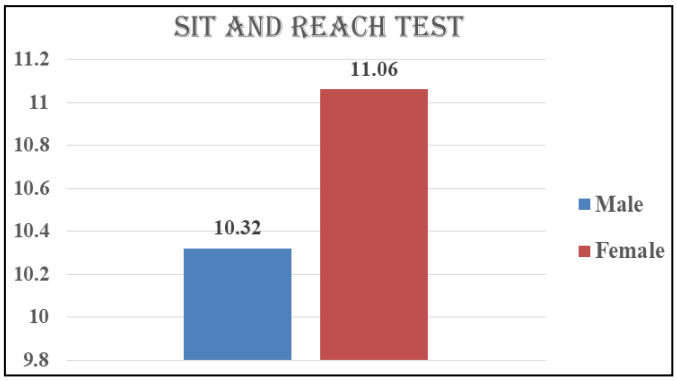

Fig 4

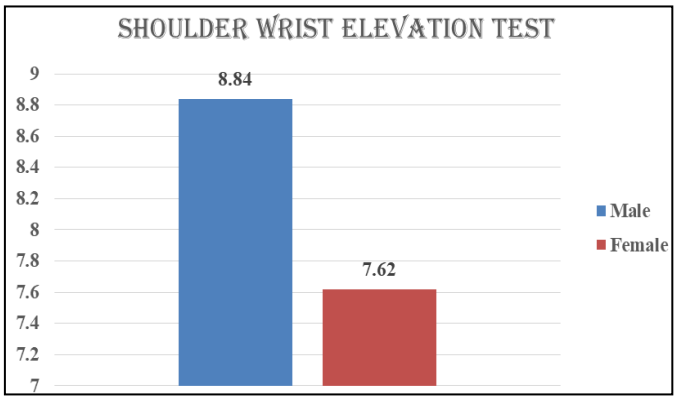

Fig 5

Conclusionx`

- Short duration of suryanamaskar showed improvement in flexibility.

Clinical implication

- Suryanamaskar does not require any tools or gadgets, limited space is enough to perform them and only a few minutes are necessary to perform a given number of cycles. So it can be implemented in normal individual to improve flexibility.

Table 6: Mean difference of Sit and Reach Test

Sit And Reach Test	
Male	Female
10.32	11.06

Table 6: Mean difference of Shoulder Wrist Elevation Test

Shoulder Wrist Elevation Test	
Male	Female
8.84	7.62

Table 8: Master Chart

Sr. No	Males				Females			
	Sit and Reach test		Shoulder Wrist Elevation test		Sit and Reach test		Shoulder Wrist Elevation test	
	pre protocol	post protocol	pre protocol	post protocol	pre protocol	post protocol	pre protocol	post protocol
1	11	21.2	15.5	8.7	11.5	24.2	13	5.5
2	15.4	25.7	19	7.5	11.9	19.3	11.5	7.2
3	8	19.5	17.2	6.8	11.5	20.6	16.4	6.3
4	7.6	20.8	19.5	5.5	9.2	18.3	9.6	7.7
5	10.4	19.9	14.5	4.2	11.5	22.7	13.4	3.5
6	9.8	19.9	11.2	5.5	7.2	18.2	12.8	4.6
7	9.2	18.5	16	5.8	8.6	19.6	11.5	5.5
8	6.5	17.3	13.5	4.3	12.3	20.5	16.1	6.3
9	7.2	18.9	11.2	3.8	14.7	22.8	13.2	7.9
10	10.5	22.5	15	6.5	10.5	27.2	12.3	4.7
11	11.2	24.5	14.5	4.8	7.2	18.7	14	5.8
12	7.2	19.3	9.2	3.5	5.9	20.3	10.8	2.5
13	6.5	17.8	13.4	7.7	11.2	28.8	15.6	4.8
14	10.2	25.9	17.4	8.4	14.5	30.2	12.4	5.7
15	9.3	22.4	19.9	6.6	15.2	25.5	16.3	4.2

Limitation

- The study had small sample size (30 subjects).
- This study was carried out only for short duration of time that is 4weeks (3times per week).

Further scope of the study

- This study was done between age groups of 18-25, similar study can be done in different age groups.
- Suryanamaskar can also be compared to other stretching techniques to see the impact on flexibility.
- Further study can be done with larger sample size.
- In this study treatment protocol was of 4 weeks, similar study can be done with longer duration of time.

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