

## Effect of Suryanamaskar on upper body verses lower endurance and flexibility amongst children at the end of six-week training (A comparative study)

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### Abstract

**Background:** Physical fitness is defined as asset of attributes that people have or achieve that relates to ability to perform physical activity. Physical fitness is important in children increases strength and endurance, psychological well-being as reduce stress, anxiety and depression. Physical exercise influence cognitive, emotional and learning, neurological domains, both direct and indirect. Suryanamaskar is branch of complementary medicine that concentrate physical health and mental wellbeing and one of the basic yoga practice its perfect for those looking to perform an intensive workout in a small amount of time.

**Aim:** To see the effect of suryanamaskar on upper body and lower body endurance and flexibility on children after 6 weeks of training.

**Methodology:** School children both girls and boys of age 10 to 16 has been included in the study, pre-evaluation has been done using outcome measure. Suryanamaskar training done for 5 times a week for 6 consecutive weeks. After that post evaluations done.

**Outcome measures:** push up test, shoulder stretch test, squats test, sit and reach test.

**Results:** Lower limb flexibility and endurance is improved than upper limb flexibility and endurance. Which was proved statistically significant ( $p=0.0001$ ).

**Conclusion:** This study shows that more improvement in lower body endurance and flexibility after 6 weeks training of suryanamaskar than upper body.

**Keywords:** Suryanamaskar; Physical fitness; Endurance; Flexibility; Sit and reach test; Shoulder stretch test; Push up test; Squats test

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### 1. Introduction

Physical fitness is defined as asset of attributes that people have or achieve that relates to ability to perform physical activity. (1). Physical fitness is important in a children to maintain cardio-respiratory fitness and also muscular strength and flexibility. Physical activity is protective against a number of important chronic diseases because cardiovascular disease is the most prominent of these days (2). Physical fitness is important in children increases strength and endurance, psychological wellbeing as reduce stress, anxiety and depression. Physical exercise influence cognitive, emotional and learning, neurological domains, both direct and indirect (3). Physical fitness can be describe in terms of skill related and health related fitness. Skill related fitness is associated with motor skill performance or sport. The component of skill related fitness includes speed, agility, balance, coordination, power and reaction time (4). More

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especially 81 percent of youth age 11-17 years not get the recommended daily physical activity guideline of 60 min of moderate to vigorous physical activity (5). The present study focus on the health related fitness which has following components flexibility, muscular strength and endurance as implied by the name health related fitness is an important component of overall health. The muscular endurance is the ability of muscle or muscle group to exert sub maximal force against resistance for an extended period of time. The muscular endurance is specific to the assessment the ability to perform upper body exercise many times is separate from the ability to perform lower body or abdominal exercise many times (6). Flexibility is defined as passive mobility of body part whose restrictions lies in its own structure. It allows greater freedom of movement and improved posture, increase physical and mental relaxation, releases muscle tension and soreness and reduce the risk of injury (7). The assessment of health related physical fitness in children and adolescents provides us with substantial information, which can be used to maintain and improve their health. The most widely implemented health related physical fitness test batteries are 'fitnessGram' and 'national youth physical program', president's challenge physical fitness and YMCA youth fitness test. (8)

**Table 1** President's challenge physical fitness test (8)

| <b>Fitness components</b>                | <b>tests</b>                              |
|------------------------------------------|-------------------------------------------|
| Hamstring and low back flexibility.      | Sit and reach                             |
| Upper body endurance.                    | Pull ups \ push up                        |
| Lower body endurance.                    | Shuttle run                               |
| Shoulder flexibility. (fitnessGram) (13) | shoulder stretch test (back scratch test) |

suryanamaskar is a branch of complementary medicine that concentrates physical health and mental well-being . suryanamaskar training is one of the basic yoga practice its perfect for those looking to perform an intensive workout in a small amount of time. (9) It consist of 12 asanas in sequence manner the asanas include pranamasana (prayer pose), hastauttasana (raised arm pose), hastapadasana (hand to foot pose), ashwa sanchalanasana (equestrian pose), parvatasana (mountain pose ), ashtang namaskar(eight limb salutations), bhujangasana (cobra pose), parvatasana (the mountain pose) ashwa sanchalana asana(equestrian pose ), hastapadasana(hand to foot pose ),hastauttasana (raised arm pose), tadasana (pranamasana).(10) During suryanamaskar , muscles of the entire body experience stretch and pressure alternately and therefore it is said to give more benefits with less expenditure of time.The series of the movement stretch the spinal column and massage, tone and stimulate vital organs through alternately flexing the body forward and backwards. (11) While performing suryanamaskar breathing exercise (pranayam) gives more oxygen to your lungs. The rhythm of breathing becomes heavy with vitality. Each breath becomes deep and clear. it carries more oxygen to the part of your body. suryanamaskar has deep effect in detoxifying the organs through copious oxygenation and has a deeper relaxing effect. it reduces stress, rejuvenates us and improves circulation. (12)

## 2. Need of study

Due to the prevailing pandemic condition as safety measure the closure of school and parks and the cancellation of youth sports and activity classes around the india and worldwide has influenced physical fitness amongst children. Also to fulfil the academic curriculum online sessions and increase use of mobile and computer (increase screen time) amongst children has led to decrease physical fitness. So the present study focuses on

- Home base exercise protocol to improve physical fitness amongst children
- Compare the effect of the intervention on upper body versus lower body flexibility and endurance amongst children at the end of 6 weeks.

### *Aim*

To see the effect of suryanamaskar on upper body and lower body endurance and flexibility on children after 6 weeks of training.

### *Objective*

- To see the effect of suryanamaskar on upper body endurance and flexibility on children after 6 weeks of training.
- To see the effect of suryanamaskar on lower body endurance and flexibility on children after 6 weeks of training.
- To compare the effect of suryanamaskar on upper body endurance and flexibility versus lower body endurance and flexibility on children after 6 weeks of training.

## **2.1. Hypothesis**

### *2.1.1. Null Hypothesis (H0)*

There will be no difference in effect of suryanamaskar on upper body endurance and flexibility versus lower body endurance and flexibility on children after six weeks of training.

### *2.1.2. Alternate Hypothesis (H1)*

There will be significant effect of suryanamaskar on upper body endurance and flexibility compared to lower body endurance and flexibility on children after six weeks of training.

### *2.1.3. Alternate Hypothesis (H2)*

There will be significant effect of suryanamaskar on lower body endurance and flexibility compared to upper body endurance and flexibility on children after six weeks of training.

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## **3. Methodology**

- Study design: Comparative study
- Study settings: in and around the city
- Sample size: 100
- Sampling method: Convenient
- Method of allocation: Randomized.
- Duration of study: 6 months
- Duration of intervention: 6 weeks

Study population: school children both boys and girls between age of 10 -16 yrs

### **3.1. Criteria**

#### *3.1.1. Inclusion criteria*

- Healthy children
- Age group 10 to 16 yrs.
- Both boys and girls.

#### *3.1.2. Exclusion criteria*

- Recent surgery of pelvic, spine, upper or lower extremities.
- Any recent fracture, trauma of LL and spines.
- Cardiovascular disease.
- Musculoskeletal and neurological deficits.
- Professional athletes.

### **3.2. Material used**

- Consent form
- Pen and paper
- Chair
- Yoga matt
- Measuring tape
- Stop watch

- Sit and reach table.

### 3.3. Procedure

- Approval from ethical committee of P.E.S Modern College of physiotherapy was taken
- The purpose of the study was explained to subject and prior ascent and consent were taken (if school opens visit various schools and play grounds)
- Individuals were enrolled according to inclusion and exclusion criteria.
- Pre-assessment of flexibility and endurance was done
- Every individual were asked to perform suryanamaskar five days per week for six weeks
- After six weeks of suryanamaskar session individual were reassessed for upper body and lower body flexibility and endurance

### 3.4. Protocol

|                                                                                      |
|--------------------------------------------------------------------------------------|
| Asses the number of push ups done by child in one min (for upper body endurance).    |
| Asses the shoulder stretch test (for upper body flexibility).                        |
| Asses the number of squats done by the child in one min ( for lower body endurance ) |
| Asses the sit and reach test (for lower body flexibility).                           |
| Spot marching for 5 min.                                                             |
| Suryanamaskar 15 round each day for 5 days in week.                                  |
| Spot marching for 5 min.                                                             |



### 3.5. Outcome measurement



**Figure 1** Pushup



**Figure 2** Shoulder stretch test.( back scratch test)



**Figure 3** Squats test



**Figure 4** Sit and reach test ( v sit and reach test)

### 3.6. Data analysis

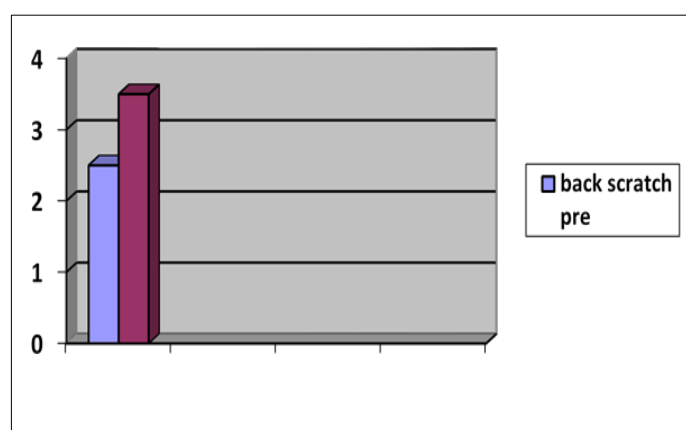
The pre and post analysis was done with in same group using paired t test which showed significant results.

The study data was statistically analyzed using graph pad instat.

#### 3.6.1. Comparison of pre and post flexibility of upper extremity after 6 week training.

**Table 2** Shoulder stretch test (back scratch test).

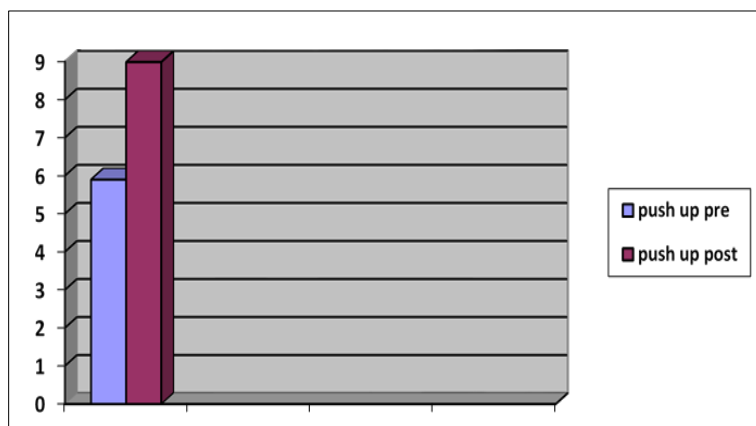
|                    | Pre assesment         | Post assesment |
|--------------------|-----------------------|----------------|
| mean               | 2.5                   | 3.545          |
| Standard deviation | 1.761                 | 1.411          |
| T value            | -10.949               |                |
| P value            | 0.001                 |                |
| significance       | Extremely significant |                |



#### 3.7. Comparison of pr and post muscle endurance of upper extremity after 6 weeks training.

**Table 3** Push up test

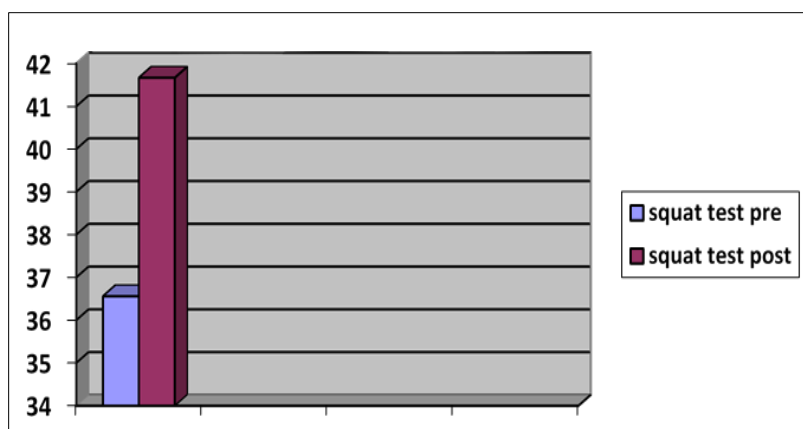
|                    | Pre assesment         | Post assesment |
|--------------------|-----------------------|----------------|
| mean               | 5.94                  | 8.99           |
| Standard deviation | 5.226                 | 5.484          |
| T value            | -8.764                |                |
| P value            | 0.001                 |                |
| significance       | Extremely significant |                |



### 3.8. Comparison of pre and post muscle endurance of lower extremity after 6 weeks training.

**Table 4** Squats test

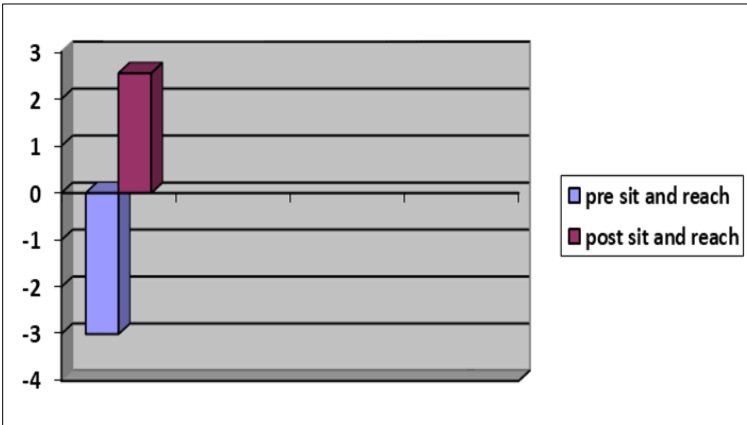
|                    | Pre assesment         | Post assesment |
|--------------------|-----------------------|----------------|
| mean               | 36.56                 | 41.67          |
| Standard deviation | 6.517                 | 5.821          |
| T value            | -13.094               |                |
| P value            | 0.001                 |                |
| significance       | Extremely significant |                |



### 3.9. Comparison of pre and post flexibility of lower extremity after 6 weeks training.

**Table 5** Sit and reach test ( v sit and reach test )

|                    | Pre assesment         | Post assesment |
|--------------------|-----------------------|----------------|
| mean               | -3.001                | 2.550          |
| Standard deviation | 3.151                 | 2.550          |
| T value            | -20.104               |                |
| P value            | 0.0012                |                |
| significance       | Extremely significant |                |



3.10. Comparison between differences mean of upper and lower extremity flexibility.

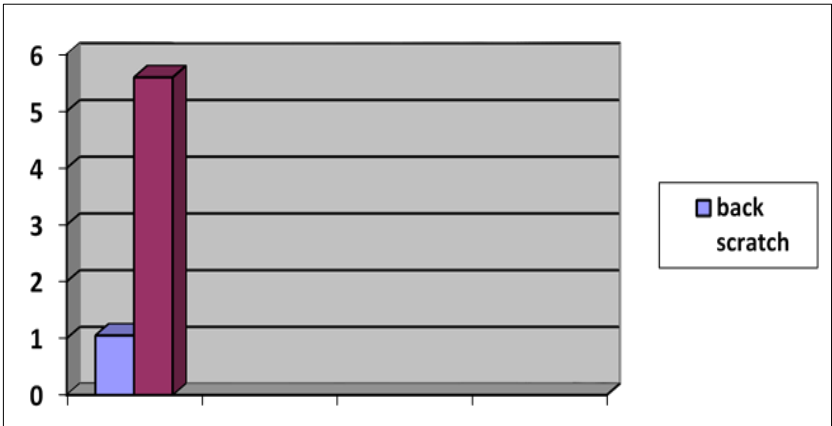


Figure 5 Upper flexibility (back scratch test) vs lower flexibility (sit and reach test).

3.11. Comparison between difference mean of upper and lower muscle endurance.

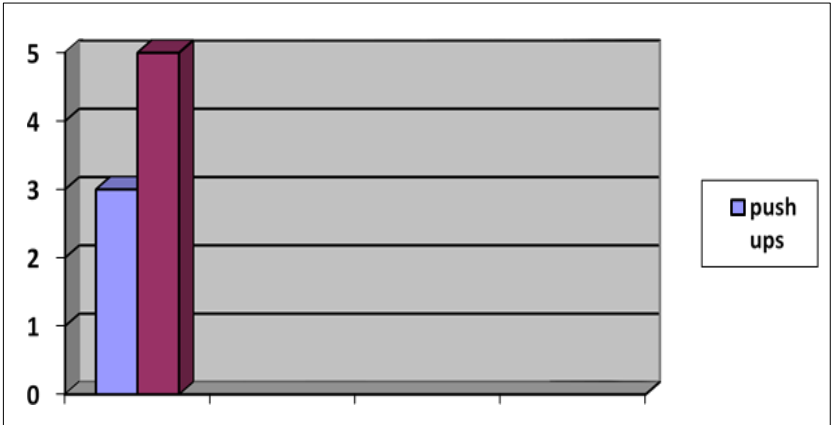


Figure 6 Upper muscle endurance (push up test) vs lower muscle endurance (squats test )

4. Result

100 participants were included in the study. Paired t test was done in same group. In the present study subject were asked to perform suryanamaskar of 15 rounds each day 5 times in week for 6 weeks. Then their flexibility and endurance of upper and lower body was measured. The result of present study as shown in table are mean of pre and post of flexibility of upper body 2.5,3.545 and standard deviation 1.76,1.411 respectively. The obtained T value for

flexibility of upper limb -10.949 is significant at 0.001 this confirm that significant difference exists between the mean of pre and post relation of flexibility of upper limb (table no 1)

Also, the mean of pre and post of flexibility of lower limb -3.001, 2.613. Standard deviation 3.151, 2.550 respectively. The obtained T value -20.104 is significant at 0.005 this confirm that significant difference exists between the mean of pre and post flexibility of lower limb. (Table no 4) The mean of pre and post muscular endurance of upper limb 5.94, 8.99. Standard deviation 5.226, 5.484 respectively. The obtained T value -8.764 is significant at 0.005(0.001) this confirms that significant difference exists between the mean of pre and post muscle endurance of upper limb. (Table no 2) The mean of pre and post muscle endurance of lower limb 36.56, 41.67 standard deviation 6.517, 5.821 respectively. The T value -13.094 is significant at 0.005(0.001) confirms that significant difference exists between the mean of pre and post muscle endurance of lower limb. (Table no 3) The mean difference of pre and post of upper and lower flexibility is 1.045 and 5.24 respectively and mean difference of pre and post upper and lower muscular endurance is 3.05 and 5.11 respectively.

As we can see the significant difference in lower flexibility and endurance than upper.

## 5. Discussion

The purpose of study was to determine the effect of six week training of suryanamaskar on upper body vs lower body flexibility and muscle endurance of children between 10 to 16 yrs .The finding of study revealed that there was significant improvement found in flexibility and muscle endurance in both upper and lower limb. Also revealed more improvement in lower than upper extremity. For the study 100 subject were selected on the basis of inclusion criteria Pre protocol assessment was done using push up test, squats test, back scratch test, and sit and reach test after that protocol was given for a total of six weeks and post assessment same measure were recorded and result were drawn out. In other studies of suryanamaskar bhavanani A.B udupa. K madanmohan and ravindra. P (2011) stated that the effect of suryanamaskar are like to aerobic exercise with muscular endurance and power. (14) Sinta and colleague had also stated that suryanamaskar also a form of aerobic exercise with dynamic stretching as well as muscular movement involving all major joint. Sinha B.et.al (2004, 2011). (15) Kanwaljeet singh. Dr baljinder singh Bd. Dr wilfred vaz (2020) also stated that suryanamaskar improve muscular endurance and hamstring flexibility significantly. (16) In other study by kristrine fondran (1992) has also proved that suryanamaskar improve hamstring flexibility, upper limb muscle endurance. But there are no known studies that Have demonstrated the effect on upper limb vs lower limb. (17) During sun salutations muscle of entire body experience stretch and pressure alternately and therefore it is said to give more benefits in short duration of time. (11) Many of its pose build strength because they required sustain contractions of many muscles group of entire body which is compare to resistance training. In present study there is improvement in upper body muscle endurance and flexibility this might be because of utilization of upper body muscle for weight bearing during stage 5,6,7,8 stages. (12)

### 5.1.1. Hip joint

During symmetrical poses hip joint observe to move from 130-degree flexion to 15-degree extension achieving maximum flexion of 85 degree during hand to foot pose and maximum extension of 15 degree during cobra pose. While asymmetrical equestrian pose 130 degree on one side with slight hip flexion of 15 degree on opposite side. These finding substantiate the response of increase in muscle flexibility of lower limb. (18)

### 5.1.2. Knee joint

During symmetrical poses max flexion of 30 degree at the knee joint achieve during 8 limb pose. Peak knee joint flexion of 110 degree is observe during asymmetrical equestrian pose in combination with peak hip flexion. Complete knee flexion up to 132 degree during 1<sup>st</sup> equestrian (ashwasanchalan ) to mountain pose and 2<sup>nd</sup> equestrian to forward bending position . Ensure stretching of quadricpe muscle while movement of ankle in a closed kinematic chain through 32 degrees of dorsiflexion. These finding ensure the response of increase in muscle endurance and flexibility. (18)

### 5.1.3. Shoulder joint

Shoulder joint achieved a peak flexion of 54 degree during hand to foot pose. While full overhead extension beyond 180 degree is achieved during raised arm pose. (18)

### 5.1.4. Elbow

Joint is observe to flex maximally to 115 degrees during namaskar pose and 8 limb pose. While least flexion is observed during the mountain pose and hand to foot pose. (18) Upper body quadrant demonstrates wide range of movement

neck extension during most poses shoulder moved through overhead extension of 183 degree of flexion. Elbow from 22 to 116-degree flexion. Seen in mountain pose, cobra pose and upward salutation pose. From which weight bearing poses from 1<sup>st</sup> mountain pose to 2<sup>nd</sup> mountain pose. Ensure that suryanamaskar pose will helps to increase upper limb flexibility and endurance but less than lower limb because of less upper limb weight bearing poses. (18) Body endurance depend on skeletal muscle characteristic oxygen uptake its circulation and utilization performing sun salutation is similar to aerobic exercise as its involve static stretching and slow dynamic component with optimal stress on cardio respiratory system.(17)

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## 6. Conclusion

This study shows that more improvement in lower body endurance and flexibility after 6 weeks training of suryanamaskar than upper body. Thus proving our alternate hypothesis (h2)

### *Limitation*

- Children of age group 10 to 16 yrs were included in the study.
- Students involved in any physical activity like sports training or yoga training can't be included in the study.

### *future scope of study*

- Further studies need to be carried on comparison between different age groups.
- Further studies also recommended using protocols of longer durations.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest.

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