

# Effects of Aerobic Capacity and BMI on Slow and Fast Suryanamaskar in Children: A Comparative Study

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**Abstract:** Background: Suryanamaskar ancient Yogic technique which links 12 asanas are performed in sequence of one after the other. Each asanas is moved into the alternate inhalation and exhalation. Suryanamaskar can be performed in slow and fast manner. Fast suryanamaskar (FSN) the suryanamaskar is performed in a rapid manner and slow suryanamaskar (SSN) is performed in slow manner. The maximal oxygen uptake (vo2 max), is a fundamental measurement for the exercise physiologist. Vo2 max can be measured by laboratory method and by field test method. For children field test is preferred i.e. 20 meter shuttle run test. Aim: To see the effect of Fast versus slow suryanamaskar on aerobic capacity and height, weight and BMI measurements. Methodology: It is a comparative study, in healthy children (n-60) between the age group of 10 yrs to 16 years. The intervention was carried for 4 weeks with 4-5 days/week. Outcome Measure: VO2 max measurements (By multiple regression analyses) and by measuring height, weight and BMI. Results: The comparison of pre and post vo2 max and BMI values in fast Suryanamaskar was considered significant. The comparison of pre and post vo2 max and BMI values in slow Suryanamaskar was is very significant. The comparison of post vo2 max and BMI values in slow and fast Suryanamaskar was not significant. Conclusion: The study concludes that, Pre and post slow Suryanamaskar BMI and vo2max values show less significant effects on BMI and more effect improving vo2max. The study concludes that, Pre and posts fast Suryanamaskar BMI and vo2max values show more significant effects on BMI and less effect improving vo2max. Post fast and slow Suryanamaskar BMI and vo2max values show no significant effects in this study.

**Keywords:** Fast suryanamaskar FSN, slow suryanamaskar SSN, suryanamaskar SN , Shuttle run test, 20 meter shuttle run test, effects of fast and slow suryanamaskar, children, aerobic capacity, BMI, Vo2max , height, wei

## 1. Introduction

- 1) Health related components are cardio-respiratory fitness, body composition, flexibility, muscular strength, muscular endurance. Performance related or skill related components are balance, reaction time, coordination, agility, speed, power.
- 2) Importance of health related components of physical fitness are improve cardiovascular and respiratory function, reduction in coronary artery disease risk factor, reduce anxiety and depression, enhanced performance of work, recreational and sports activities.<sup>(1)</sup>
- 3) The anthropometric assessment of physical fitness consisted of measurements of body weight, height following world health organization.<sup>(4,5)</sup>
- 4) Weight measured by weight scale and height measured by stadiometer. BMI calculated by ratio between weight and squared height (kg.cm2)<sup>(4,5)</sup>
- 5) The maximal oxygen uptake (vo2 max), is a fundamental measurement for the exercise physiologist. Vo2 max refers to the highest rate at which oxygen can be taken up and consumed by the body during exercise.<sup>(7)</sup>Vo2 max can be measured by laboratory method and by field test method. For children field test is preferred i.e. 20 meter shuttle run test.
- 6) 20 metershuttle test consists in running back and forth between two cones 20 meters apart, with running speed determined by audio signals from a pre-recorded music

CD. The running speed increases at the end of each one-minute stage.

- 7) Suryanamaskar ancient Yogic technique which links 12 asanas are performed in sequence of one after the other .Includes asanas ordered in a way that they alternatively stretch the spine backwards and forwards. Each asanas is moved into the alternate inhalation and exhalation. Number of studies on yoga practice have shown and overall improvement in cardiorespiratory parameters.
- 8) Suryanamaskar can be performed in slow and fast manner.
- 9) Fast suryanamaskar (FSN) the suryanamaskar is performed in a rapid manner and slow suryanamaskar (SSN) is performed in slow manner.

## 2. Need of Study

Improve physical fitness in school going children which is reduced due to inactivity during pandemic as sports activities are reduced and due to which physical inactivity is increased. Now a days due to increased use of mobile and computer children lack in physical fitness. So suryanamaskar is an excellent set of exercise having effect on the physical fitness. Suryanamaskar increases flexibility, strength and cardiovascular fitness in children.

### Aim

To see the effect of Fast versus slow suryanamaskar on aerobic capacity and BMI measurements.

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**Objective:**

- To see the effect in slow suryanamaskar on aerobic capacity and BMI measurements in children at the end of 4 weeks
- To see the effect in fast suryanamaskar on aerobic capacity and BMI measurements in children at the end of 4 weeks
- To compare effect in slow versus fast suryanamaskar on aerobic capacity and BMI measurements in children at the end of 4 weeks (10)

**3. Review of Literature**

- 1) Effects of 4 weeks of yoga practice on respiratory functions tests in young adults. Naciona journal of physiology, pharmacy and pharmacology. pratikAkhani, SiddhartBanode, Nirupama Shah --The main objective of the objective was to investigate the effects of yoga on respiratory efficiency parameters of young adults. Result were found to be increased following yoga. No significant change in the parameters. Conclusion was yoga improves respiratory efficiency in healthy individuals and can be included as an essential part of healthy lifestyle.
- 2) Inter and intra observer reliability in anthropometric measurements in children. International journal of obesity. (2019) – aim is to describe standardisation and reliability of anthropometric measurements. Results were intra observer technical error of measurements (TEM) was between 0.12 and 0.47mm for skin fold thickness between 0.09 and 1.24cm for circumference. Inter observer TEMs for skinfold thickness were between 0.13 and 0.97mm for circumference between 0.18 and 1.01cm. conclusion is in epidemiological surveys it is essential to standardise the methodology and train the participating staff in order to decrease measurement error.
- 3) A role of suryanamaskara for good health by V.d Manisha Nikam February 2020—surya namaskar is a sequence of asanas. Its origin lies in worshipping of surya, the hindu deity. The sequence of movements can be practiced on varying level awareness ranging from that of physical exercise in various styles to a complete sadhana which incorporates asanas, pranayama, mantras and chakra meditation. It concludes that it should be a need to incorporate suryanamaskar in modern life style for healthy mind and body.
- 4) H BG Simons-morton, Guy S Parcel, Nancy M O'Hara—health related physical fitness in childhood : status and recommendation—aim of physical education is motor skills, agility, flexibility, strength, creative movements, social participation, all may be advanced by dedication to maximum activity during physical education. Especially in elementary school, children should spend nearly every minute physical education in enjoyable. Schools recommend districts implement cardiovascular fitness oriented physical education and health related fitness testing; and evaluate physical education on basis on the basis of how much MVPA children obtain during physical education.
- 5) Calculation and validation of models for estimating vo2 max from the 20 meter shuttle run test in children.

Gustavo silva, Nortan Luis Oilveria , Luisa Aries, Jorge Mota, Jose Oleveria, Jose Carlos Riberio – the purpose of this study were to calculate and validate two models to estimate maximal oxygen uptake (vo2max) aged 10 to 18 years, using a 20 meter shuttle run test. the equation estimated by multiple linear regression (MLR) is more appropriate to portugese youths than the equation estimated by artificial neural network (ANN). The following equation was recommended:  $vo2max = 43.313 + 4.567 * sex - 0.560 * BMI + 2.785 * stage$ .

- 6) A comparative study of SSN and FSN on physiological function. International journal of yoga – the aim we conducted this study to determine the differential effect of 6 months training in the fast and slow versions. Training in SSN produced a significant decrease in diastolic pressure. In contrast, training in FSN produced a significant increase in systolic pressure. Although there was a highly significant increase in isometric hand grip (IHG) strength and hand grip endurance (HGE) in both the groups, the increase in HGE in FSN group was significantly more than in SSN group. The present study reports that SN has positive physiological benefits as evidenced by improvement of pulmonary function, respiratory pressures, hand grip strength and endurance, and resting cardiovascular parameters. It also demonstrates the differences between SN training when performed in a slow and fast manner, concluding that the effects of FSN are similar to physical aerobic exercises, whereas the effects of SSN are similar to those of yoga training.
- 7) Effects of slow suryanamaskar on pulmonary function in 10-15 years old school going children at the end of 4 weeks: an experimental study. Medhavijoshi and Dr. Gauri Afle-- To find the effect of slow Suryanamaskar on Peak expiratory flow rate in 10-15 year old school going children at the end of 4 weeks. Outcome Measure: Mini Wright Peak Flow Meter. This study concludes that slow suryanamaskar technique is effective in improving peak expiratory flow rate (PEFR) in 10-15 years old school going children at the end of 4 weeks.
- 8) The ACSM's exercise intensity guidelines for cardio respi fitness: why the misuse? Journal of exercise physiology (JEP) Lance Dalleck, Angela Dalleck volume 11 number 4 august 2008 -- The aim of the literature review was three-fold: 1) to identify studies that misinterpreted the current ACSM exercise intensity guidelines; 2) to identify examples of the ACSM exercise intensity guidelines being misapplied; and 3) to identify the exercise intensity prescription method applied to all training studies. Based on the present findings, we conclude that there is considerable misinterpretation and misapplication of the current ACSM exercise intensity guidelines. Despite the ACSM's shift in recommending the use of %VO2R in place of %VO2max, there continues to be erroneous interpretation of the guidelines in the literature (Table 1), as well as the frequent use of %VO2max in the methodology of aerobic training studies

**Hypothesis:**

- Null Hypothesis: There will be no difference in effect of fast and slow suryanamaskar on aerobic capacity and BMI measurements in children at the end of 4 weeks.
- Hypothesis (H1): Fast suryanamaskar will be more effective than slow suryanamaskar to improve aerobic capacity and BMI measurements in children at the end of 4 weeks.
- Hypothesis (H2): Slow suryanamaskar will be more effective than fast suryanamaskar to improve aerobic capacity and BMI measurements in children at the end of 4 weeks.

**4. Methodology**

- Study design : Comparative
- Study setting : schools around the city
- Sample size : 60
- Sampling method : convenient sampling
- Type of allotment : Randomised (odd/even)
- Duration of study : 6 months
- Duration of Intervention: 4 weeks
- Study population: School children both boys and girls between age of 10 years to 16 years.

**Criteria****Inclusion Criteria:**

- 1) Both boys and girls
- 2) Age group : 10 to 16 years
- 3) Healthy children.(11)

**Exclusion Criteria:**

- 1) Inability to communicate because of language skills, hearing or cognitive impairment.
- 2) Patients having any cardiovascular condition.
- 3) Any neurological or musculoskeletal condition.
- 4) Active yoga and sports training children.

**Material Used:**

- Assent form
- Pen and paper
- Cones
- Chair
- Yoga matt
- Weight scale
- Stadiometer
- Calculator
- Evaluation form
- Meteronom

**Procedure:**

- 1) The study began with a synopsis presentation in front of ethical committee.
- 2) Ethical clearance was obtained from committee.
- 3) Various schools around the city were visited.

- 4) Participants were selected according to inclusion and exclusion criteria.
- 5) The study was explained to participants individually and written assent was taken from participants and their gaurdians.
- 6) Participants were divided into 2 groups. (Group A and Group B)
- 7) Pre assessment of BMI was taken
- 8) Prior assessment by 20meter shuttle run test (with running back and fourth between 2 cones 20 meter apart. Total no. of time is recorded and stage of the test is recorded.(5)

**Intervention**

Group A: Training for slow suryanamaskar.

Group B:Tranning for fast suryanamaskar.

- GROUP A: In fast suryanamaskar (FSN) the suryanamaskar is performed in a rapid manner so that all 12 postures were completed in 2 minutes. So 15 rounds performed in 30-40 minutes.
- GROUP B :In slow suryanamaskar (SSN) the suryanamaskar is performed in a slow manner so that each of 12 postures was held for at least 30 seconds each round took 6 minutes to complete and five rounds were performed 30-0 minutes.(9)
- Post assessment by 20 meter shuttle run test and anthropometric measurements.
- Data analysis

**Protocol****Fast Suryanamaskar**

- Children will be trained to perform suryanamaskar so that all 12 postures are performed in 2 minutes
- Time : 30 min (15 repetitions)
- Frequency : 5 days/week
- Duration : 4 weeks

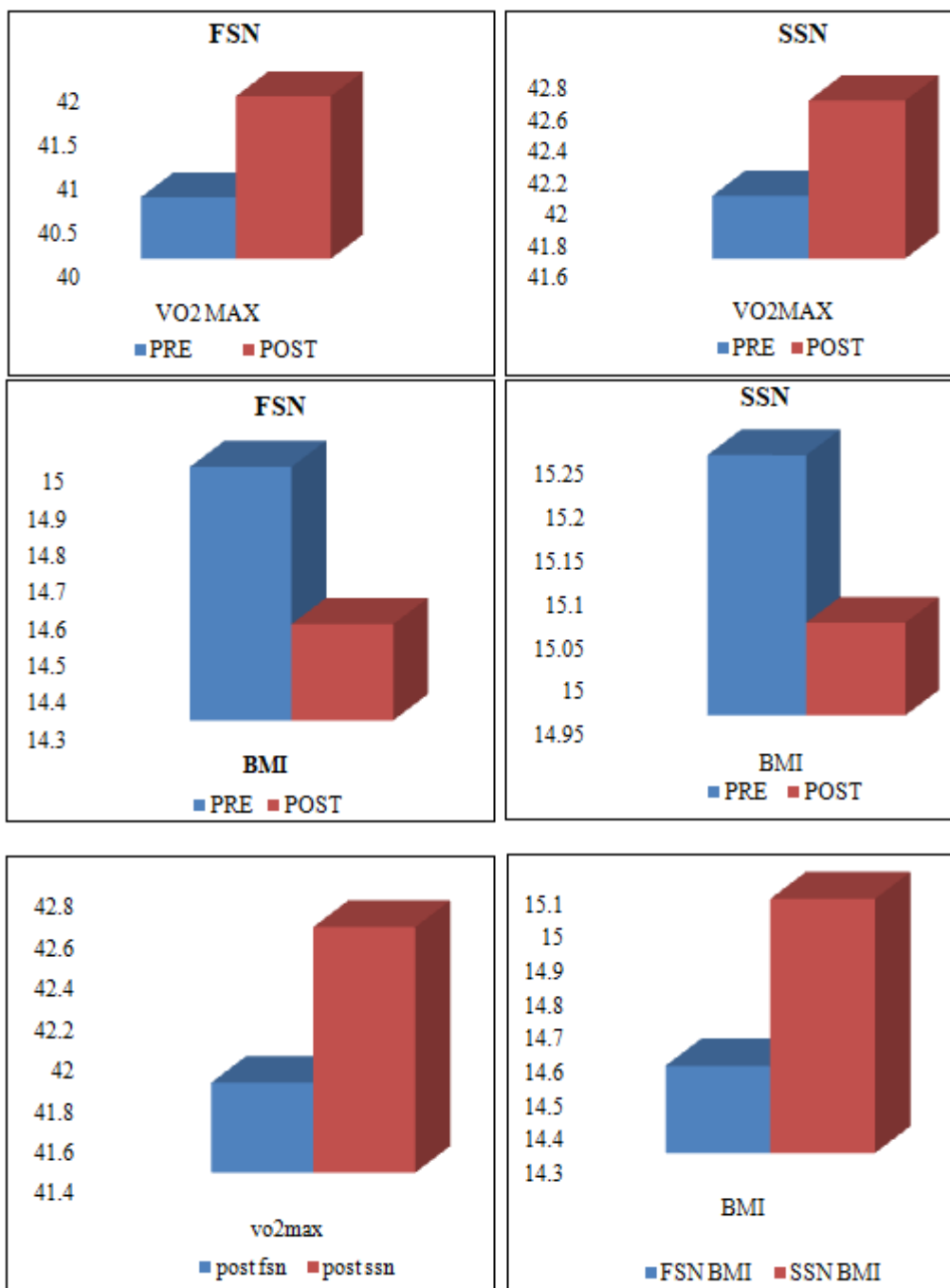
**Slow Suryanamaskar**

- Children will be trained to perform suryanamaskar in slow manner so that each of 12 postures are held for 30seconds.
- Time : 30 min (6 repetitions)
- Frequency : 5 days/week
- Duration : 4 weeks

**Outcome Measures:**

- VO2 max measurement
- By multiple linear regression analyses:  $vo2max (ml.kg/min) = 43.313 + 4.567*sex - 0.560* BMI + 2.785*stage$  (where sex is 0=girls and 1=boys, BMI is measured in kg/cm<sup>2</sup>, stage is no. of stages completed in shuttle run test)
- Measuring height, weight, BMI.

5. Data Collection and Analysis



6. Results

- 1) The comparison of pre and post vo2 max values in fast Suryanamskar P value was 0.0003 which is considered significant. The value pre protocol was 40.69943 with SD of 3.08086 while post protocol mean was 41.84103 with SD of 2.65688. T value was 4.0680.
- 2) The comparison of pre and post vo2 max values in slow Suryanamskar P value was 0.0057 which is considered very significant. The value pre protocol was 41.99853 with SD of 2.93749 while post protocol mean was 42.60470 with SD of 2.92230. T value was 2.9828.
- 3) The comparison of pre and post BMI values in fast Suryanamskar P value was 0.0017 which is considered very significant. The value pre protocol was 14.987 with SD of 2.449 while post protocol mean was 14.560 with SD of 2.018. T value was 3.4693.
- 4) The comparison of pre and post BMI values in slow Suryanamskar P value was 0.0001 which is considered extremely significant. The value pre protocol was 15.250 with SD of 1.578 while post protocol mean was 15.057 with SD of 1.519. T value was 4.3753.
- 5) The comparison of pre and post BMI values in fast Suryanamskar P value was 0.0017 which is considered very significant. The value pre protocol was 14.987 with SD of 2.449 while post protocol mean was 14.560 with SD of 2.018. T value was 3.4693.
- 6) The comparison of pre and post BMI values in slow Suryanamskar P value was 0.0001 which is considered extremely significant. The value pre protocol was 15.250 with SD of 1.578 while post protocol mean was 15.057 with SD of 1.519. T value was 4.3753.

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## 7. Discussion

- The present study was undertaken to compare effects of fast and slow Suryanamaskar on BMI and VO<sub>2</sub> max in healthy children between 10 to 16 years of age group.
- For the study 60 subjects were selected on the basis of the inclusion criteria. And they were divided into 2 groups. Each group had 30 subjects irrespective of age and gender.
- Pre-treatment data was collected using BMI and 20 meter shuttle run test. The treatment protocol was given for a total of 4 weeks and post treatment, same measures were recorded and results were drawn out.
- The first pose started with relaxation of the body and mind. It induces calmness and increases concentration.
- The 2nd and 11th pose are the same where there is slight extension of neck and trunk, it strengthens and tones the abdominal and chest musculature.
- The 3rd and 10th pose helps improve the flexibility as it includes bending forward from the lumbar and thoracic spine and further trying to touch both hands to the floor. It also helps decrease excessive abdominal fat.
- In, 4th and 9th, the equestrian pose, where the left leg is stretched back as far as possible, there is a stretch to the anterior lower limb musculature. It tones the abdominal muscles. Giving an overall flexibility and balance to the body
- In the study by Ananda balayogiBavanani, suggested association between Suryanamaskar and vo<sub>2</sub> max. They also mentioned that there is positive improvement in pulmonary function, respiratory pressures and cardiovascular parameters.
- In their study Bhutkar and colleagues who conducted a pilot study of 6 months of Suryanamaskar practice reported an increase in vo<sub>2</sub>max, indicating improved aerobic capacity after training in suryanamaskar.
- In earlier studies it is also mentioned that, when volume of exercise is controlled, higher intensities of exercise are more effective in improving vo<sub>2</sub>max than lower intensities of exercise in healthy young children.
- Suryanamaskar at different speeds provides different benefits and that when it is done rapidly(FSN) it warms up body and improves endurance, where as done slowly it strengthens and tones the musculature and enhances the function of internal organs.
- The different postures of Suryanamaskar involves isometric contraction and chest wall expansion which may be improving strength of intercoastal muscles
- FSN is a rapid rhythmic sequential performance of various postures and all large muscle groups are subjected to rhythmic contraction and relaxation, involving large muscle groups. This may be bringing about increase in venous return causing rise in stroke volume.
- SSN is a slow rhythmic sequential performance of Suryanamaskar there is significant measures of improving cardiac oxygen consumption and significant improvement in VO<sub>2</sub> max.

- An earlier study on component steps of Suryanamaskar conclude that Suryanamaskar exerts on moderated stress on cardiorespiratory system, so it requires longer duration of training to show effective results.
- Slow Suryanamaskar show more significant effect in improving vo<sub>2</sub>max and minimum effect on BMI. while the fast Suryanamaskar shows minimum significant effect in improving vo<sub>2</sub>max and more significant on improving BMI.
- VO<sub>2</sub>max in both the groups is improving, it was more apparent in SSN.
- As the study also includes adolescence age group it can vary the results.
- In their study, frontiers of hormone research, they reported that, there is increase in growth hormone in response to exercise is dependent on pubertal status; children in more advanced pubertal stages respond with larger peak of growth hormone concentration than in earlier stages.
- The studies evaluated changes in cortisol secretion during aerobic exercise in children and adolescents show either increase or no response to exercise bout. Response to cortisol is highly variable.
- Recent studies showed that physical activity is an important contributor to bone strength prior to adolescence.
- The population of both the groups there is unequal ratio of age and male/female, also adolescence changes can be reason for the insignificant results of BMI.
- The study concludes that there is significant effect in pre and post assessment of fast and slow Suryanamaskar in vo<sub>2</sub>max and BMI.
- Both the groups are not significant as they have different physiological effects on the body and 4weeks of training period is not enough to show significant results.

## 8. Conclusion

- The study concludes that, Pre and post slow Suryanamaskar BMI and vo<sub>2</sub>max values show less significant effects on BMI and more effect improving vo<sub>2</sub>max.
- The study concludes that, Pre and post fast Suryanamaskar BMI and vo<sub>2</sub>max values show more significant effects on BMI and less effect improving vo<sub>2</sub>max.
- Post fast and slow Suryanamaskar BMI and vo<sub>2</sub>max values shows no significant effects in this study.

## 9. Limitation

- Small sample size.
- 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 cannot be included in the study.

## 10. Future Scope

- It can be further studied on larger number of population.
- Different formula can be used for calculating vo2max.
- Any other field test can be used for calculating vo2max.
- Comparison between shuttle run and any other test can be done.
- This study can also be studied in adults.

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**Annexure I**

Assent Form

I Mr./Ms. \_\_\_\_\_ am giving my consent for participating in the study of “Effects of aerobic capacity and BMI on slow and fast suryanamskar in children : A comparative study.”

Conducted by Miss Prachi Arora (Physiotherapy UG student) as a part of her curriculum under the supervision and guidance of Dr.GauriAfle.

I have been informed that no part of my information shall be revealed anywhere else except for the study and adequate secrecy will be maintained throughout.

I am aware that I may choose to quit being a part of study at any time without having to give any reason for doing so.

I agree to cooperate fully and have no objection in participating and hereby give the consent for doing so.

Name of the Participant : \_\_\_\_\_  
 Address : \_\_\_\_\_  
 \_\_\_\_\_

Name of the Institution: \_\_\_\_\_  
 \_\_\_\_\_

Signature: Date: \_\_\_\_\_

Annexure II

Data Collection Sheet

**Demographic Data: Date:**

Name:

Age:

Sex:

Hand Dominance:

**Past History:**

**Medical History:**

**Outcome Measure:**

DATE	BMI	SR STAGE (FSN)	SR STAGE (SSN)	VO <sub>2</sub> MAX (FSN)	VO <sub>2</sub> MAX (SSN)