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RESEARCH ARTICLE

IMPACT OF SLOW SURYANAMASKAR AS AN EXERCISE PROTOCOL ON PULMONARY FUNCTIONS IN SCHOOL GOING CHILDREN

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ABSTRACT
Suryanamaskar or Sun Salutation is a mostly practiced Yoga pose by most yoga practitioners all around the world. It consists of synchronizing body flow movements which alternatively contracts and stretches the body musculature, with continuous alteration of the Inhalation & Exhalation. Most of the Indians or ancient Yoga practitioners as well as various health professionals always keep advising for the practice of suryanamaskar. Previous literature has shown its effects on different systems of the body. Primarily the ethical approval was taken for the study to conduct from the ethical board. The consent from the parents of the school-going children was taken. The Purpose of the Research was explained to the children as well as the parent to improve the compliance towards study results. The study is conducted with 65 samples of school-going children with 4 weeks of intervention of slow Suryanamaskar practice. The purposive sampling method has been used to sort the samples as per the requirements. The whole study was conducted between 6 months of period. The finding of this study shows the significant improvement of the mean values of the Peak Expiratory Flow Rate at the end of the study duration. This study concludes that slow Suryanamaskar has a great impact on the improvement of pulmonary functions.

KEYWORDS: Slow Suryanamaskar, Pulmonary Functions, Peak Expiratory flow rate, Peak Flow Meter

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INTRODUCTION
Suryanamaskar is an ancient yogic technique that links 12 asanas are performed in the sequence of one after the other. It includes asanas ordered in a way it moves the spine in such a way that it alternatively get forward and backward stretch. Alternate Synchronize movement of inhalation & exhalation is taking place. Several studies on yoga practice have shown an overall improvement in the cardio-respiratory parameters.

Suryanamaskar includes 12 poses that are, pranamaasanas (prayer poses), hasttauttasana (raised arm pose), padahastasana (hand to foot pose), ashwasanchalaaasana (equestrian pose), paarvatasana (mountain pose), ashatang namaskar (eight limb salutations), Bhujangasana.

As per the previous literature available in various databases, it shows Slow Suryanamaskar (SSN) significantly progresses the strength of both expiratory & inspiratory muscles. As per the Hypothesis of previous literature, it states that doing SSN causes isometric contractions with the chest wall expansion which may lead to increasing the strength of intercostal muscles.(1) An improvement in respiratory muscle strength, increase in the excursion of the diaphragm, as well as increased thoracic compliance has been seen with regular practice of Suryanamaskar.(2)

PEFR is a person's capacity of maximum intensity of expiration and is measured with a Peak flow Meter. If the readings of the peak flow meter are greater it denotes the patient is healthy, if the readings of the peak flow meter are lesser it denotes the subject's airways are constricted or restricted, or unhealthy.

From changes in reading of peak flow meter we can determine lung functionality, and therefore can also be used for prognostic as well as diagnostic purposes.

In school-going children, there are possible internal factors that cause postural dysfunction and reduction in muscle strength and flexibility. The external factors like carrying heavy bag packs, lack of exercise, a sedentary lifestyle also lead to the same. An overall reduction in the growth may lead to decrease respiratory parameters and functioning.(3)

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A study showed lower control respiratory pressures could be because our subjects were sedentary and were not involved in any sports or physical fitness activities.[4]

In this age group of 10 to 15 years, respiratory functions are in growing phase therefore an overall reduction of healthy lifestyle leads to obesity reduce muscular strength, and various other diseases, while practicing Suryanamaskar on regular basis can keep the overall growing functions of the body healthy and provide beneficial effects on respiratory functioning.

NEED OF STUDY

Performing Suryanamaskar along with other yoga asanas and breathing techniques is effective on pulmonary functions in healthy individuals. Performing Slow Suryanamaskar is more effective on pulmonary functions than Fast Suryanamaskar. The effect of these yoga techniques on Peak Expiratory Flow rate (PEFR) in healthy individuals has been studied over 6 months. Few studies have been done to find the effect of the Pranayama and Suryanamaskar techniques on the PEFR of children over a short period. Thus, the need for study is to find the effect of Slow Suryanamaskar on pulmonary function (PEFR) in school-going children over 4 weeks.

AIM

To study the effect of Slow Suryanamaskar on PEFR in 10-15 years old school-going children at the end of 4 weeks.

OBJECTIVES

- To evaluate the Peak expiratory flow rate in 10-15 years, school-going children, by mini Wright Peak flow meter.
- To find the impact of slow Suryanamaskar on Peak expiratory flow rate in 10-15year old school-going children at the end of 4 weeks.

METHODOLOGY

- Study Type : Experimental study
- Ethical Code: ECI2015IN
- Study Design: pre & post experimental study
- Sample Size :65
- Sampling Method: Purposive
- Study Population: School going children age 10-15 years
- Duration of Study:6 months
- Duration OF Intervention: 4 weeks
- Study Setting: Various schools in and around Pune.

CRITERIA

Inclusion criteria

- Healthy participants aged between 10-15 years.
- Both males and females

Exclusion criteria

- Congenital heart diseases
- Respiratory Diseases
- Recent injuries to thethorax
- Active yoga or sports training

MATERIALS AND TOOLS

- Consent and assessment forms
- Paper/notebook
- Pen
- Peak flow meter

Figure 1: Mini Wright Peak Flow Meter

OUTCOME MEASURES

Peak expiratory flow rate (PEFR)

- PEFR is an objective measure of Broncho pulmonary function. Mini wright Peak flow meter is the device used to measure PEFR. It is a small portable device with which on-spot reading can be obtained.
- Procedure to perform: Participants are asked to take a deep inspiration and then forcefully with maximum effort are asked to blow out through the mouthpiece into the instrument.

PROCEDURE

1. The study began with the presentation of a synopsis to an ethical committee and after approval from the ethical committee.
2. Various schools were visited in Pune and the subjects were selected based on inclusion and exclusion criteria.
3. The subjects were then explained about the study. Consent was taken from the school authorities and guardians/parents of those eligible and willing to participate in the study
4. Before the intervention, the outcome measure for peak expiratory flow rate was taken by a mini wright peak flow meter.
5. At the end of the intervention period, outcome measure was taken again.

Figure 2: Therapist explaining the subjects how to use the peak flow meter

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INTERVENTION

The participants were trained to perform slow Suryanamaskar in a manner so that each of the 12 poses is held for 30 seconds.

Each round took 6 minutes to complete and 5 repetitions were performed in 30-40 minutes.

No. of repetitions- 5

No. of sessions per week- 5

SURYANAMASKAR INCLUDES 12 POSITIONS:

Figure 3: Shows all the Suryanamaskar poses

Figure 4: Showing therapist is monitoring during the session of the SSN

Figure 5: Shows the group session of SSN is being monitor by Therapist

DATA ANALYSIS

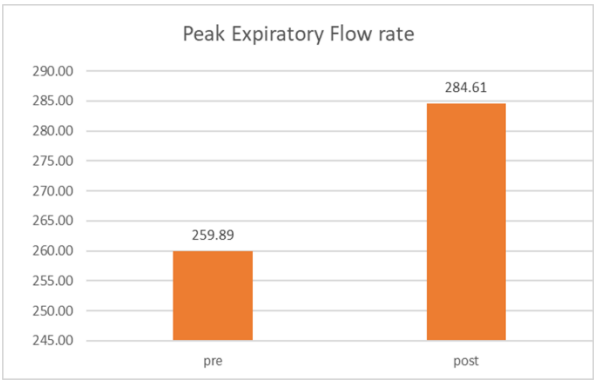
- The Peak expiratory flow rate was analysed using a mini Wright peak flow meter.
- The data was Prepared in an Excel Spreadsheet.
- Data entered was analysed with the help of PRIMER version 7.
- Paired t-test for pre & post-treatment values was done.
- P < 0.001 (significant)
- t = - 7.907 with 59 degrees of freedom

STATISTICAL ANALYSIS

- The PEFR values were improved with a pre-test mean of 259.9 to 284.6 with SD 53.64 to 51.97.
- P<0.001 (significant)
- t = - 7.907 with 59 degrees of freedom

PEAK EXPIRATORY FLOW RATE	PRE (L/MIN)	POST (L/MIN)
MEAN	259.9	284.6
STANDARD DEVIATION	53.64	51.97
p value	p<0.001 (considered significant)	
t value	t = 7.907	

Table 1: Shows the Mean & Standard Deviation pre and post treatment



Graph 1: Shows the comparison of Mean of Peak Expiratory Flow Rate before & after Intervention

RESULT

- The PEFR values were improved with a pre-test mean of 259.89 to 284.61 with a SD of 53.64 to 51.97
- The finding of this study revealed a significant improvement in post-intervention peak expiratory flow rate (PEFR) values at the end of 4 weeks.

DISCUSSION

The objective of this study was to see the effect of Slow Suryanamaskar on pulmonary function in school-going children at the end of 4 weeks.[5]

For the study total of 65 subjects fulfilling the inclusion criteria were selected from schools and nearby areas out of which 5 were dropped out due to absenteeism. Thus, the data was carried out for 60 subjects.[6] Pre-treatment data was collected using a mini wright peak flow meter. The treatment protocol was given for a total of 4 weeks and post-treatment, the same measures were recorded and results were drawn out.[7]

A study by Jie ji et all suggests that there is a significant association between physical activity and lung function

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growth among girls aged 9–11 years.[8] Physically active girls had significantly higher lung function and growth rates in lung function indices than physically inactive girls during an 18-month follow-up perio.[9]

Makwan et al also showed increased FEV-l after 10 weeks of yogic practice. The increase in FEV-l might be due to a significant increase in vital capacity.[10] A study by Joshi e tall reported a significant increase in FVC and PEFR following 6 weeks of yoga which included pranayama and Suryanamaskar.[11] According to the result of this study, there was an effect of slow Suryanamaskar on peak expiratory flow rate in 10-15 years old school-going children at the end of 4 weeks.[12] Slow Suryanamaskar was aimed at improving the musculoskeletal strength, endurance, and flexibility, thereby improving pulmonary function in a healthy individual.[13] It includes 12 poses. The first pose starts with the relaxation of the body and mind. It induces calmness and increases concentration.[14]

The 2nd and 11th poses are the same where there is a slight extension of the neck and trunk, it strengthens and tones the abdominal and chest musculature.[7] 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 and is also beneficial for the gastrointestinal tract and nervous system.[15] 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 overall flexibility and balance to the body.

Slow Suryanamaskar also stretches the anterior chest wall muscles. Each pose in this is held for a period of 30 seconds. This hold of 30 seconds subjects the muscles to a stretch and an isometric contraction. The stretch upon the inter costals muscles reduces the stiffness and is often correlated with an increase in the respiratory muscle endurance.[16] The 30-second hold is a long duration of time in which the isometric contraction occurs therefore leading to an increase in muscle endurance.

The overall effect was an increased expiratory and inspiratory pressure which in turn expands the chest wall cavity and improves lung compliance. A study has also shown that when muscles undergo a constant stretch it reflexively relaxes which leads to a decrease in the out of phase activity from stiff intercostal muscle spindles which otherwise contribute to breathlessness, which is reduced and as a result of which the endurance could be improve.[17]

The current study conducted on school-going children over for 4 weeks revealed that there is an improvement in the PEFR, but there is no direct evidence to support the content that the improvement is due to an increase of muscle strength or muscle endurance of respiratory muscles.[18] Therefore, according to the study slow Suryanamaskar can be incorporated into routine extra-curricular activities of school-going children to maintain optimal pulmonary functions.[19]

CONCLUSION

This study concludes that the slow Suryanamaskar technique is effective in improving peak expiratory flow rate (PEFR) in 10-15 year old school-going children at the end of 4 weeks.

LIMITATIONS

- The study was done using Small sample size
- Only few male subjects could be included

FUTURE SCOPE

The effectiveness of slow Suryanamaskar on subjects with respiratory conditions can be studies.

FUNDING

This study has not received any external funding.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interests and participated equally for the study.

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AUTHOR CONTRIBUTIONS

MVJ made the methodology part of the manuscript, CAK helped in the formation of the manuscript in the protocol format; MVJ & CAK took the data collection and calculated the statistical analysis.WMN and OCW help in Supervision and Edition the layout for the manuscript.

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