

## Original Research Article

# Effect of fast Surya Namaskar versus aerobic dance on cardiorespiratory fitness in children aged 10-13 years at the end of 4 weeks: a comparative study

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## ABSTRACT

**Background:** The COVID-19 pandemic led to a major reduction in physical activity (PA) among children, with average PA levels decreasing from 540 to 105 minutes per week. This decline was associated with increased sedentary behavior and reduced cardiorespiratory fitness (CRF), measured by  $VO_2\text{max}$ . Fast Surya namaskar and aerobic dance, both high-intensity aerobic exercises, are known to improve CRF. This study aimed to compare the effects of fast Surya namaskar and aerobic dance on CRF in children aged 10-13 years.

**Methods:** A comparative two-group pretest-posttest study was conducted from March 2024 to March 2025 on 120 healthy children aged 10-13 years from schools in and around Pune. Participants were randomly divided into two groups of 60 each using simple random sampling. Group A performed fast Surya namaskar and group B performed aerobic dance, for three alternate days per week for four weeks. Pre- and post-intervention  $VO_2\text{max}$  and BMI were recorded. Data were analyzed using paired and unpaired t-tests with significance set at  $p < 0.05$  and a 95% confidence interval. The sample size was calculated from a pilot study with a 95% confidence level and 80% power.

**Results:** Both groups showed significant improvements in  $VO_2\text{max}$  and BMI ( $p < 0.0001$ ). Group A's  $VO_2\text{max}$  increased from  $38.64 \pm 3.10$  to  $40.60 \pm 3.79$ , and group B's from  $38.82 \pm 3.06$  to  $41.22 \pm 3.19$ . BMI decreased significantly in both groups.

**Conclusions:** Both fast Surya namaskar and aerobic dance improve CRF in children, with aerobic dance showing slightly greater improvement.

**Keywords:** Aerobic dance, Cardiorespiratory fitness, Children, Surya namaskar,  $VO_2\text{max}$

## INTRODUCTION

The COVID-19 pandemic, due to stay-at-home orders and the closure of recreational facilities, led to a significant reduction in physical activity (PA). Prior to the pandemic, individuals engaged in an average of 540 minutes per week of PA, which dropped to 105 minutes per week during the pandemic, marking a decrease of 435 minutes. Concurrently, the prevalence of physically inactive students rose from 21.3% to 65.6%, and screen

time increased by approximately 30 hours per week on average.<sup>1,2</sup>

PA is critical for cardiovascular health, and its reduction can lead to negative health outcomes, including increased risk of metabolic diseases and obesity. Cardiorespiratory fitness (CRF), measured by  $VO_2\text{max}$ , is a key indicator of health, and a decline in physical activity during the pandemic has been linked to a decrease in  $VO_2\text{max}$ . Prior to COVID-19, average  $VO_2\text{max}$  was 46.2 ml/kg/minute,

while post-pandemic it was 45.7 ml/kg/minute, reflecting a small but notable decline.<sup>3-18</sup>

Surya namaskar (sun salutation) and aerobic exercise are beneficial alternatives to maintain fitness. Surya namaskar, performed at varying paces (slow, medium, or fast), offers benefits ranging from improved flexibility to enhanced cardiovascular health. Aerobic exercises like these improve VO<sub>2</sub>max and CRF, which can positively impact heart health and metabolic function.<sup>7,8,11,19-21</sup>

Maintaining regular physical activity is essential for combating the adverse effects of sedentary behaviour and reducing the risk of noncommunicable diseases. Despite the challenges posed by the pandemic, engaging in exercise helps boost the immune system and improve overall health.<sup>1,6,17</sup>

### ***Need of study***

During the pandemic situation the aerobic capacity has been affected due to reduction in level of physical activity and more sedentary behaviour. PA reduce, from 540 minute/week (before the pandemic) to 105 minute/week (during the pandemic), yielding 435 min decrease on average. During pandemic physical inactive has increased from 21.3% to 65.6%. Screening time has increased approximately 30 hours per weeks.<sup>4</sup>

Fast Surya namaskar and aerobic dance are the different modes of aerobic exercise shown to improve cardiorespiratory fitness. As fast Surya namaskar and aerobic dance is done in high intensity and it help to improve aerobic capacity.

Also, both can be done as an indoor form of exercise.

So, the present study focuses to compare the effect of fast Surya namaskar versus aerobic dance on cardiorespiratory fitness in children.

### ***Aim***

To study the effect of fast Surya namaskar versus aerobic dance on cardiorespiratory fitness in children aged 10-13 years at the end of 4 weeks.

### ***Objectives***

To study the effect of fast Surya namaskar on cardiorespiratory fitness in children aged 10-13 years at the end of 4 weeks.

To study the effect of aerobic dance on cardiorespiratory fitness in children aged 10-13 years at the end of 4 weeks.

To compare the effect of fast Surya namaskar versus aerobic dance on cardiorespiratory fitness in children aged 10-13 years at the end of 4 weeks.

## **METHODS**

This study was designed as a comparative study using a two-group pre-test and post-test design to assess and compare the effects of fast Surya namaskar and aerobic dance on cardiorespiratory fitness in children. The study population consisted of healthy school children aged 10 to 13 years, selected from various schools in and around Pune city.

A total of 138 participants were initially enrolled, out of which 120 children successfully completed the entire study protocol. The sample size was determined based on a pilot study conducted prior to the main research, considering a 95% confidence level and 80% statistical power to ensure adequate representation of the population.

The sampling technique used in this study was simple random sampling, providing each eligible participant an equal opportunity to be included. The study was conducted over a period of one year, from March 2024 to March 2025.

The research was carried out in schools located in and around Pune, in collaboration with the PES Modern College of Physiotherapy, Pune, Maharashtra, India, which served as the coordinating institution and data analysis center.

### ***Inclusion criteria***

Children aged 10 to 13 years, of both genders, with a BMI of 15.89±0.42, and those who were healthy and willing to participate, were included in the study.

### ***Exclusion criteria***

Children were excluded if they had musculoskeletal, neurological, pulmonary, or cardiovascular impairments, or a history of major surgery in the recent past.

### ***Procedure***

Presentation was done in front of ethical committee. Subjects were selected according to the inclusion criteria from the schools in and around the city. Assent and consent were taken from the participants. The subjects were divided into 2 groups by simple random sampling pretest measurement, intervention and posttest measurement was done data was collected and analysed. The intervention was given for 3 days (alternate) for 4 weeks. Group A and group B both the groups got intervention for 3 days (alternate) for 4 weeks pre and post assessment of VO<sub>2</sub>max and BMI.

### ***Data analysis***

The present study aimed at finding the effect of Fast Surya namaskar versus aerobic dance on

cardiorespiratory fitness in children aged 10-13 years at the end of 4 weeks protocol. Total 120 subjects participated in the study various statistical measures such as mean, standard deviation (SD) and test significance were utilized to analyse the data. 95% confidence interval was taken into consideration. The results were concluded to be statistically significant if, p value was 0.05. Data was analysed using unpaired t test for inter group analysis and by using paired t-test for intra group analysis.

## RESULTS

In this study total 120 subjects, children with mean age of group A 12.4 and group B 11.983. The subjects were healthy children, with the mean value of BMI 16.005, 16.01. Each participant has undergone fast Surya namaskar and aerobic dance training for 4 weeks.

There was significant difference ( $p < 0.0001$ ) in pre ( $16.005 \pm 0.1986$ ) and post ( $15.411 \pm 0.2298$ ) mean BMI score within group A. Thus, fast Surya namaskar protocol is effective in weight loss at the end of 4 weeks.

There was significant difference ( $p < 0.0001$ ) in pre ( $38.64 \pm 3.099$ ) and post ( $40.596 \pm 3.792$ ) mean  $VO_2\max$  score within group A (FSN). Thus, fast Surya namaskar protocol is effective in improving the  $VO_2\max$  at the end of 4 weeks.

There was significant difference ( $p < 0.0001$ ) in pre ( $16.01 \pm 0.2938$ ) and post ( $15.376 \pm 0.1740$ ) mean BMI score within group B (AD). Thus, aerobic dance protocol is effective in weight loss at the end of 4 weeks.

There was significant difference ( $p < 0.0001$ ) in pre ( $38.822 \pm 3.055$ ) and post ( $41.22 \pm 3.189$ ) mean  $VO_2\max$  score within group B (AD). Thus, aerobic dance protocol is effective in improving the  $VO_2\max$  at the end of 4 weeks.

## Statistical analysis of descriptive data of study population table

### Age-wise distribution of subjects

Out of the total 120 participants, 16 children (13%) were in the 10–11 years age group, while 104 children (87%) were in the 12–13 years age group.

**Table 1: Age wise distribution of subjects in percentage.**

| Age (years) | No. of subject | Percentage |
|-------------|----------------|------------|
| 10-11       | 16             | 13         |
| 12-13       | 104            | 87         |

### Gender-wise distribution of subjects

Among the 120 participants, 53 (44%) were boys and 67 (56%) were girls.

**Table 2: Gender-wise subject distribution in percentage.**

| Gender | Sample | Percentage |
|--------|--------|------------|
| Boy    | 53     | 44         |
| Girl   | 67     | 56         |

### Intra-group comparison data analysis

The pre and post intervention data in group A (fast Surya namaskar) was analyzed using paired t-test, there was significant difference ( $p < 0.0001$ ) in pre ( $16.005 \pm 0.1987$ ) and post ( $15.412 \pm 0.2298$ ) mean BMI within group A. Thus, fast Surya namaskar protocol is effective in weight loss at the end of 4 weeks (Table 3).

**Table 3: Comparison of pre post score of BMI group a (fast Surya namaskar).**

| Parameter | Pre    |        | Post   |        | P value | t-value | Result      |
|-----------|--------|--------|--------|--------|---------|---------|-------------|
|           | Mean   | SD     | Mean   | SD     |         |         |             |
| BMI       | 16.005 | 0.1987 | 15.412 | 0.2298 | <0.0001 | 22.612  | Significant |

**Table 4: Comparison of pre post score of  $VO_2\max$  group a (fast Surya namaskar).**

| Parameter  | Pre   |       | Post   |       | P value | t-value | Result      |
|------------|-------|-------|--------|-------|---------|---------|-------------|
|            | Mean  | SD    | Mean   | SD    |         |         |             |
| $VO_2\max$ | 38.64 | 3.099 | 40.597 | 3.792 | <0.0001 | 31.720  | Significant |

**Table 5: Comparison of pre post score of BMI group B (aerobic dance).**

| Parameter | Pre   |        | Post   |        | P value | t-value | Result      |
|-----------|-------|--------|--------|--------|---------|---------|-------------|
|           | Mean  | SD     | Mean   | SD     |         |         |             |
| BMI       | 16.01 | 0.2938 | 15.377 | 0.1740 | <0.0001 | 15.933  | Significant |

**Table 6: Comparison of pre post score of VO<sub>2</sub>max group B (aerobic dance).**

| Parameter           | Pre    |       | Post  |       | P value | t-value | Result      |
|---------------------|--------|-------|-------|-------|---------|---------|-------------|
| VO <sub>2</sub> max | Mean   | SD    | Mean  | SD    | <0.0001 | 25.800  | Significant |
|                     | 38.823 | 3.056 | 41.23 | 3.189 |         |         |             |

**Table 7: Comparison of post score of BMI group a (fast Surya namaskar) and group B (aerobic dance).**

| Group   | Post (mean) | P value | t-value | Result          |
|---------|-------------|---------|---------|-----------------|
| Group A | 15.412      | 0.3482  | 0.9418  | Not significant |
| Group B | 15.377      |         |         |                 |

**Table 8: Comparison of post score of VO<sub>2</sub>max group A (fast Surya namaskar) and group B (aerobic dance).**

| Group   | Post (mean) | P value | t-value | Result          |
|---------|-------------|---------|---------|-----------------|
| Group A | 40.597      | 0.2711  | 1.106   | Not significant |
| Group B | 41.230      |         |         |                 |

The pre and post intervention data in group A (fast Surya namaskar) was analyzed using Paired t-test, there was significant difference ( $p < 0.0001$ ) in pre ( $38.64 \pm 3.099$ ) and post ( $40.597 \pm 3.792$ ) mean VO<sub>2</sub>max within group A. Thus, fast Surya namaskar protocol is effective in improving cardiorespiratory at the end of 4 weeks (Table 4).

The pre and post intervention data in group B (aerobic dance) was analyzed using paired t-test, there was significant difference ( $p < 0.0001$ ) in pre ( $16.01 \pm 0.2938$ ) and post ( $15.377 \pm 0.1740$ ) mean BMI within group B. Thus, aerobic dance protocol is effective in weight loss at the end of 4 weeks (Table 5).

The pre and post intervention data in group B (aerobic dance) was analyzed using paired t-test, there was significant difference ( $p < 0.0001$ ) in pre ( $38.822 \pm 3.055$ ) and post ( $41.23 \pm 3.189$ ) mean VO<sub>2</sub>max within group A. Thus, aerobic dance protocol is effective in improving cardiorespiratory at the end of 4 weeks (Table 6).

The post intervention data in group A (fast suryanamaskar) group B (aerobic dance) was analyzed using Unpaired t-test, there was not significant because both the post values show similar difference ( $p < 0.0001$ ) post ( $15.412 \pm 0.2298$ ), ( $15.377 \pm 0.1740$ ) mean BMI between the group A and group B (Table 7).

The pre and post intervention data in group A (FSN) and group B (aerobic dance) was analyzed using unpaired t-test, there was not significant because both post values are almost similar difference ( $p < 0.0001$ ) in post ( $40.596 \pm 3.792$ ) and post ( $41.23 \pm 3.189$ ) mean VO<sub>2</sub>max between the group A and group B (Table 8).

## DISCUSSION

This study compared the effects of fast Surya namaskar and aerobic dance on cardiorespiratory fitness in children

aged 10-13 years. A total of 120 children (44% boys, 56% girls) were randomly assigned to two groups, with 60 participants in each. Group A practiced fast Surya namaskar, while group B engaged in aerobic dance. After 4 weeks, both groups showed significant improvements in VO<sub>2</sub>max, with Group A increasing from 38.64 to 40.60 and Group B from 38.82 to 41.23, with a p value of 0.0001, indicating statistical significance.<sup>1</sup>

Aerobic dance improved VO<sub>2</sub>max due to its high-intensity nature, which boosts catecholamine and growth hormone release, enhances cardiovascular endurance, and improves oxygen delivery.<sup>2</sup> Fast Surya namaskar increased VO<sub>2</sub>max through reduced resting pulse rate, improved vagal tone, and enhanced respiratory muscle strength, demonstrating its effectiveness in improving cardiovascular fitness.<sup>3</sup>

Both interventions were equally effective in improving cardiorespiratory fitness, suggesting that both fast Surya namaskar and aerobic dance are valuable for enhancing aerobic capacity in children. Regular participation in either can contribute to improved health and well-being in school-aged youth.<sup>4</sup>

## Clinical implication

The study shows clinically significant improvement in cardiorespiratory fitness in children aged 10-13 years.

Fast Surya namaskar and aerobic dance are effective in enhancing post cardiorespiratory fitness in children.

Both can be recommended to improve cardiorespiratory fitness in this age group.

## Further scope of the study

Further studies can be conducted with other outcome measure such as physical activity questionnaire for

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

## CONCLUSION

The present study concludes that both fast Surya namaskar and aerobic dance significantly improve cardiorespiratory fitness in children aged 10-13 years after four weeks of intervention, with aerobic dance showing a slightly greater enhancement in  $\text{VO}_2\text{max}$ . These findings highlight that both forms of structured, school-based aerobic exercises can serve as effective, low-cost, and accessible methods to improve cardiovascular health, endurance, and weight control in children. The study contributes to existing knowledge by demonstrating the comparative effectiveness of two indoor, equipment-free exercise protocols, thereby supporting their integration into school physical education programs to promote lifelong fitness habits and prevent lifestyle-related health risks in youth.

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