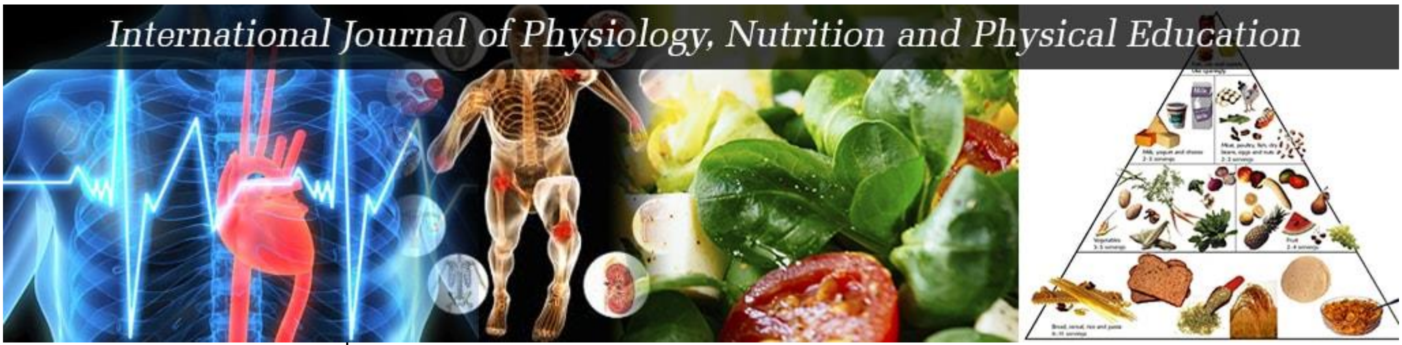

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Impacts of Surya Namaskara on selected physical and psychological variables among college girls

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Abstract

Surya Namaskara, also known as the Sun Salutation, is a remarkable and timeless gift from Indian tradition to the world. Regular practice of Surya Namaskara supports individuals in cultivating a harmonious balance between mind, body, and emotions. It enhances physical flexibility, regulates body composition, sharpens mental clarity, encourages relaxation, and alleviates stress and anxiety. Flexibility and body composition are fundamental elements of health-related fitness, serving as vital indicators of overall wellness. Anxiety and stress, which are intricately linked to psychological health, are effectively managed and reduced through the consistent practice of Surya Namaskara, promoting a healthier and more peaceful state of mind.

Purpose: The aim of this study is to examine the effects of Surya Namaskara on flexibility, body composition, anxiety and stress among college-aged girls.

Methodology: A total of sixty-three (N=63) college girls from Purba Medinipur district in West Bengal, aged 19-22 years, were randomly selected as subjects. They were divided into two groups: the experimental group (Gr. E, N=33) and the control group (Gr. C, N=30). Baseline measurements were taken for both groups, including trunk and spine flexibility, body composition (body mass index [BMI], body fat percentage [%BF], and lean body mass [LBM]), as well as anxiety and stress using standardized questionnaires. Gr. E received Surya Namaskara training five days a week for 45 minutes per session, continuing for three months, while Gr. C did not receive any treatment. After three months, all the subjects were retested on the same criteria. Data were analyzed using paired t-tests to assess the effects of the intervention.

Results: The study revealed that in the experimental group (Gr. E), there was a significant improvement in trunk and spine flexibility, BMI, %BF, LBM, and reductions in anxiety and stress at a 0.05 level of confidence after three months of practicing Surya Namaskara. No significant changes were observed in the control group (Gr. C).

Conclusion: The findings indicate that regular practice of Surya Namaskara significantly improved physical variables such as trunk and spine flexibility, BMI, %BF, and LBM, as well as psychological variables like anxiety and stress among college girls. However, no significant improvement was observed in the control group.

Keywords: Surya Namaskara, flexibility, body composition, anxiety

Introduction

Surya Namaskara, or Sun Salutation, is an ancient and significant practice with roots in Indian culture. Originating over 4,000 years ago during the Vedic period, Surya Namaskara was traditionally performed to honor the sun god, Surya, as mentioned in Hindu scriptures like the Rigveda. Over time, it became integrated into the practice of yoga as a method to balance the body's energy (PRANA), offering both physical and spiritual benefits such as purifying the body, improving circulation, and preparing for meditation. In the early 20th century, yoga masters like Tirumalai Krishnamacharya, Pattabhi Jois and BKS Iyengar popularized Surya Namaskara, making it a fundamental part of modern yoga routines. Today, this dynamic sequence of postures is practiced worldwide, known for its positive effects on flexibility, body composition, and overall health.

Surya Namaskara consists of a series of poses that enhance flexibility, especially in the trunk and spine. Movements such as back arches stretch and extend the spine, improving mobility and reducing stiffness. Forward bends work to stretch the back, from the neck to the hips, promoting a greater range of motion. The repetitive nature of the practice gradually warms up the muscles and increases blood flow, making the trunk and spine more supple and flexible.

Regular practice of Surya Namaskara helps improve body composition by engaging multiple muscle groups and boosting metabolism. This dynamic sequence of poses can burn calories, aiding in weight management and fat loss. It also builds strength and endurance by targeting key areas like the arms, legs, core, and back. Additionally, Surya Namaskara enhances circulation, which supports better nutrient absorption and metabolic efficiency. Its calming effect helps reduce chronic stress, which can otherwise contribute to weight gain, especially in the form of belly fat.

On a spiritual level, Surya Namaskara plays a crucial role in promoting mental and emotional well-being. By focusing on the breath and movement, practitioners can cultivate a calm and peaceful mind. This ancient practice is known to help individuals overcome negative emotions like anger, fear, and stress, creating a space for inner peace. Regular practice fosters self-confidence, relaxation, and a positive attitude, while also reducing anxiety and stress.

Purpose of the study

The present study aims to determine the effects of Surya Namaskara on flexibility, body composition, anxiety, and stress among college-aged girls.

Methodology

Sample: Sixty three (N=63) college girls from District Purba Medinipur, West Bengal, aged between 19 and 22 years, were randomly selected for the study. The subjects were divided into two groups: an experimental group (Gr. E, N=33) and a control group (Gr. C, N=30).

Procedure: Initially, all subjects were tested for trunk and pine flexibility, body composition (BMI, body fat percentage, and lean body mass), anxiety, and stress. The experimental group (Gr. E) underwent Surya Namaskara training for five days a week, with 45-minute sessions, over the course of three months. The control group (Gr. C) did not participate in any such training. After three months, all subjects were retested on the same parameters, and the data were analyzed using paired t-tests to determine the effects of Surya Namaskara.

Tools

- **Flexibility Tests:** Trunk flexibility was assessed using the "Sit & Reach" test (with a Johnson Box), and spine flexibility was measured using the "Bridge" test (with a measuring tape).
- **Body Composition:** BMI was calculated using a weighing machine and stadiometer, with a BMI calculator. Body fat percentage (%BF) was measured using the SIRI formula and skinfold calipers, while lean body mass (LBM) was calculated by subtracting total fat mass from body mass.
- **Psychological Measures:** Anxiety was measured using the Hamilton Anxiety Rating Scale (HAM-M), and stress levels were assessed using a stress questionnaire designed by the International Stress Management Association (ISMAUK).

Surya Namaskara treatment: Each session of Surya Namaskara began with a prayer to help focus the mind. The experimental group practiced twelve rounds of Surya Namaskara with coordinated breathing exercises. After the first phase, subjects rested in savasana (corpse pose) for 90 seconds. The second and third phases of Surya Namaskara followed the same pattern, and each session ended with a relaxation technique for five to ten minutes.

Results and Discussions

Flexibility measures such as Trunk flexion and Spine flexion scores and Body Composition such as BMI, Body Fat Percentage and LBM scores for college girls were analysed by paired t-test and level of significance was set up at .05 level of confidence.

Table 1: Group means increase in trunk flexion and spine flexion among Gr. E and Gr. C after three months treatment

Variable	Type of Test	Gr. E (N=33)			Gr. C (N=30)		
		Mean	S.D	$t_{.05}$	Mean	S.D	$t_{.05}$
Trunk Flexion	Pre-test	1.55	1.54	5.29	1.12	0.22	0.15
	Post-test	3.76	1.03		1.13	0.25	
Spine Flexion	Pre-test	15.39	1.8	5.26	14.95	1.45	0.05
	Post-test	10.17	1.56		15.04	1.46	

Significant at .05 level of confidence

Table-I, represents the mean values of pre and post-test for trunk flexion of Gr. E and Gr. C. The mean values of pre-test and post-test of Gr. E were 1.55 and 3.76 respectively in trunk flexion. On the other hand, mean values of pre-test and post-test of Gr. C were 1.12 and 1.13 respectively in trunk flexion. The t-value of Trunk flexion of Gr. E was 5.29 and the t value of Gr. E in relation to improvement of trunk flexion was significant at .05 level of confidence after three months treatment. The t-value of Trunk flexion of Gr. C was 0.15. To be significant at .05 level of confidence the t-value should be greater than 2.04. The t-value of Gr. C in Trunk flexion was not improved significantly at .05 level of confidence after three months treatment. Table 1, also represents the mean values of pre-test and post-test for Spine flexion of Gr. E and Gr. C. The mean values of pre-test and post-test of Gr. E were 15.39 and 10.17 respectively in spine flexion. On the other hand, mean values of pre-test and post-test of Gr. C were 14.95 and 15.04 respectively in Spine flexion. The t-value of spine flexion of Gr. E was 5.26 and the t-value of Gr. E in relation to improvement of Spine flexion was significant at .05 level of confidence after three months treatment. The t-value of Spine flexion of Gr. C was 0.05. To be significant at .05 level of confidence, the t-value should be greater than 2.04. The t-value of Gr. C was not improved significantly at .05 level of confidence after three months treatment.

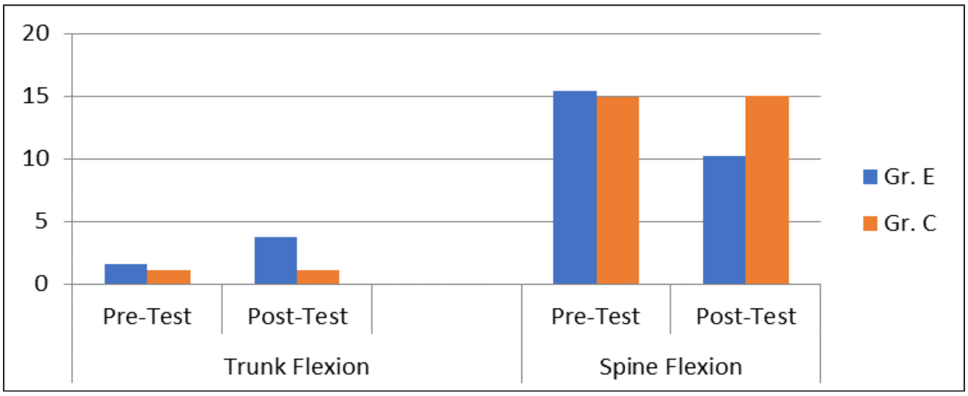

Fig 1: A comparison of means of pre and post test data on trunk flexion and spine flexion among Gr. E and Gr. C.

From the findings of the study, it can be stated that experimental group who were under the treatment of Surya Namaskara, which was improved in trunk and spine flexibility. Regular practice of Surya Namaskara can significantly improve trunk and spine flexibility by increasing range of motion, lengthening muscles, and promoting neuromuscular relaxation. Incorporating this sequence into a yoga or exercise routine can enhance overall spinal and hamstring mobility and reduce the risk of back and lower body injuries. Amin and Goodman (2014) [2] revealed in their research findings that the significant improvement of spine flexibility was observed after six week Iyangar yoga practice. Grabara M and Szopa J, (2015) [6] showed the result of the study that the applied yoga exercises increased spinal mobility and flexibility of the hamstring muscles regardless of age. Petric N, Vauhnik R and Jakovljevic M (2014) [13] studied and confirmed that the results of regular practice of hatha yoga has a significant effect on body flexibility such as spine and hip flexibility in young healthy women. Ethiraj and Associates (2024) [4] found from the research that back flexibility and lumbar flexibility increased in the treatment group after six weeks of Surya Namaskara practice. Lau *et al.* (2015) [9] studied that the 12 weeks hatha yoga training improved spine and trunk flexibility among Chinese adults. Karasugi *et al.* (2015) [8] suggested that Surya Namaskara was a beneficial physical activity for the pre-elderly and elderly population to developed spine and trunk flexibility and subsequently improve the quality of life. Sancheti PK, *et al.* (2015) [16] observed that the significant improvement in flexibility was seen among Surya Namaskara groups who were between 20-40 years females. Suwannakul B, Sangkarit N and Thammachai A (2025) [21] showed the result that Surya Namaskara as a treatment, improved the trunk flexibility among university students after eight week observation. Regmi A and Josh DD (2020) [15] demonstrated that Surya Namaskara is effective in improving hip adductor flexibility in a group of young physiotherapy students. Mangaonkar A and Puntambekar A (2018) [10] concluded that Surya Namaskara, as well as dynamic stretching, was effective in improving hamstring flexibility. It also proved that Surya Namaskara is more effective in improving hamstring flexibility as compared to dynamic stretching. Flexibility is one of the most important components of Health related physical fitness. In present time, a large numbers of people suffering from trunk and spine mobility problem due to modern lifestyle. So mobility is being interrupted in normal life for these problems. Above research studies on Surya Namaskara or dynamic exercises were more benefited to improve on trunk and spine flexibility.

Table 2: Group means in BMI, % of BF and LBM among Gr. E and Gr. C after three months treatment

Variable	Type of Test	Gr. E (N=33)			Gr. C (N=30)		
		Mean	S.D	$t_{.05}$	Mean	S.D	$t_{.05}$
BMI	Pre-test	22.01	2.7	2.05	22.07	2.81	0.09
	Post-test	21.49	2.49		21.96	2.6	
%BF	Pre-test	14.94	2.11	6.49	15.47	1.4	0.42
	Post-test	12.85	1.12		15.43	1.5	
LBM	Pre-test	40.79	2.46	4.18	42.18	3.05	0.44
	Post-test	41.24	2.49		42.17	2.93	

Significant at .05 level of confidence

Table 2, represents the mean values of pre and post-test for BMI of Gr. E and Gr. C. The mean values of pre-test and post-test of Gr. E were 22.01 and 21.49 respectively in BMI. On the other hand, mean values of pre-test and post-test of Gr. C were 22.07 and 21.96 respectively in BMI. The t-value of BMI of Gr. E was 2.05 and the t value of Gr. E in relation to improvement of BMI was significant at .05 level of confidence after three months treatment. The t-value of BMI of Gr. C was 0.09. To be significant at .05 level of confidence the t-value should be greater than 2.04. The t-value of Gr. C in BMI was not improved significantly at .05 level of confidence after three months treatment. Table-2, also represents the mean values of pre-test and post-test for %BF of Gr. E and Gr. C. The mean values of pre-test and post-test of Gr. E were 14.94 and 12.85 respectively in %BF. On the other hand, mean values of pre-test and post-test of Gr. C were 15.47 and 15.43 respectively in %BF. The t-value of %BF of Gr. E was 6.49 and the t-value of Gr. E in relation to improvement of %BF was significant at .05 level of confidence after three months treatment. The t-value of %BF of Gr. C was 0.42. To be significant at .05 level of confidence, the t-value should be greater than 2.04. The t-value of Gr. C was not improved significantly at .05 level of confidence after three months treatment. In consideration of

LBM, Table-2, represents the mean values of pre-test and post-test for LBM of Gr. E and Gr. C. The mean values of pre-test and post-test of Gr. E were 40.79 and 41.24 respectively in LBM. On the other hand, mean values of pre-test and post-test of Gr. C were 42.18 and 42.17 respectively in LBM. The t-value of LBM of Gr. E was 4.18 and the t-value of Gr. E in relation to improvement of LBM was significant at .05 level of confidence after three months treatment. The t-value of LBM of Gr. C was 0.44. To be significant at .05 level of confidence, the t-value should be greater than 2.04. The t-value of Gr. C was not improved significantly at .05 level of confidence after three months treatment.

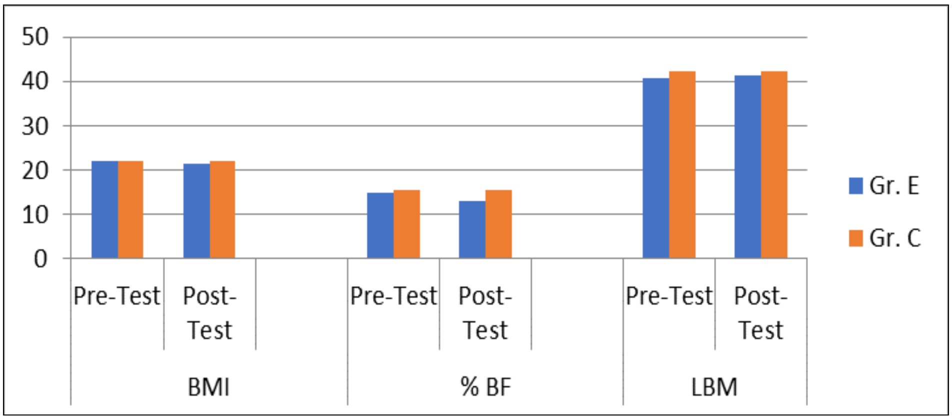

Fig 2: A comparison of means of pre and post test data on BMI, %BF and LBM among Gr. E and Gr. C.

From the findings of the study showed that BMI of experimental group was improved after three months practiced of Surya Namaskara. Ghosh S and Mukherjee, A (2023) [5] concluded that the BMI improved among obese children after six weeks hatha yogic training programme. Sancheti PK, *et al*. (2015) [16] observed that there was a considerable reduction in BMI after eight weeks Surya Namaskara training programme. Bhutkar *et al*. (2011) [3] found that the BMI significantly decreased among experimental group of females after six months treatment of Surya Namaskara. Mean values of BMI almost similar to present study. Nongkhai *et al*. (2021) [11] revealed that the average body mass index of a yoga intervention group decreased significantly at week eighth and week twelfth. Shukla, S. (2010) observed that Surya Namaskara practice help to considerable reduction in BMI among teen age female experimental group.

In the present study also showed that the percentage of body fat was improved among college girls after three months treatment of Surya Namaskara. Bhutkar *et al*. (2011) [3] revealed that the %BF significantly decreased among experimental group of females after six months suryanamaskara treatment. Pal *et al*. (2024) [12] revealed that the body fat percentage was improved among non-professional Surya Namaskara group with compared to professional suryanamaskara group after six weeks treatment programme. Nongkhai *et al*. (2021) [11] demonstrated that the results of mean values of body fat mass decreased significantly among yoga intervention group at week 8th and week 12th. Shukla, S. (2010) found that the results of experimental group reduced in body fat after six weeks Surya Namaskara practiced. Sancheti PK, *et al*. (2015) [16] revealed that the modest decrease in body fat were observed after eight weeks Surya Namaskara practiced. From the findings of the present study revealed that the lean body mass of experimental group was improved after three months treatment. Bhutkar *et al*. (2011) [3] showed that the results of the LBM significantly improved among experimental group after six months treatment of Surya Namaskara. Pal *et al*. (2024) [12] found that the results of bone mass was improved among non-professional Surya Namaskara group with compared to professional Surya Namaskara group after six weeks treatment programme. Surya Namaskara, as a dynamic yoga sequence, contributes to caloric expenditure, which aids in weight management and BMI improvement and body fat reduction. Sometimes, yogic practitioners do the practice Surya Namaskara as for worming-up before practicing yogic activities. It helps to prepare physical and mental condition for achieving yogic state.

Table 3: Group means increase in anxiety and stress among Gr. E and Gr. C after three months treatment

Variable	Type of Test	Gr. E (N=33)			Gr. C (N=30)		
		Mean	**S.D**	**$t_{.05}$**	**Mean**	**S.D**	**$t_{.05}$**
Anxiety	Pre-test	18.76	2.19	2.08	18.2	2.28	0.03
	Post-test	13.64	2.12		18.67	2.02	
Stress	Pre-test	13.3	1.94	2.46	13.33	1.72	
	Post-test	9	1.35		13.46	1.7	0.03

Significant at .05 level of confidence

Table 3, represents the mean values of pre and post-test for Anxiety of Gr. E and Gr. C. The mean values of pre-test and post-test of Gr. E were 18.76 and 13.64 respectively in anxiety. On the other hand, mean values of pre-test and post-test of Gr. C were 18.2 and 18.67 respectively in anxiety. The t-value of Gr. E was 2.08 and the t value of Gr. E in relation to improvement of anxiety was significant at .05 level of confidence after three months treatment. The t-value of anxiety of Gr. C was 0.03. To be significant at .05 level of confidence the t-value should be greater than 2.04. The t-value of Gr. C in anxiety was not improved significantly at .05 level of confidence after three months treatment. Table-3, also represents the mean values of pre and post-test for stress of Gr. E and Gr. C. The mean values of pre-test and post-test of Gr. E were 13.3 and 9 respectively in stress. On the other hand, mean values of pre-test and post-test of Gr. C were 13.33 and 13.46 respectively in stress. The t-value of Gr. E was 2.46 and the t value of Gr. E in relation to improvement of stress was significant at .05 level of confidence after three months treatment. The t-value of stress of Gr. C was 0.03. To be significant at .05 level of confidence the t-value should be greater than 2.04. The t-value of Gr. C in stress was not improved significantly at .05 level of confidence after three months treatment.

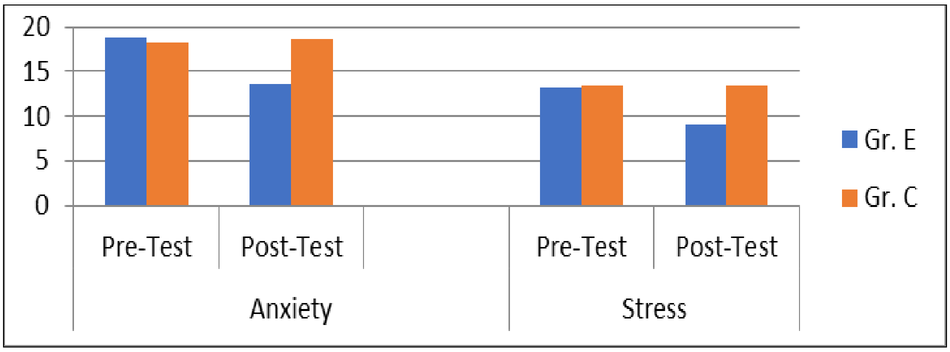

Fig 3: A comparison of means of pre and post-test data on anxiety and stress among Gr. E and Gr. C.

Surya Namaskara, a combination of asanas, Pranayama and meditation, it play great role for the reduce of Flexibility which has been reported by Shejwal *et al.* (2015) [18] concluded that the Surya Namaskara played effective role to reduced somatic stress, among college students. Stec K, *et al.* (2023) [19] observed that the results of anxiety and stress level were reduced by Surya Namaskara practiced among male school students. Jaiganesh K, Srinivasan P and Duraisamy (2022) [7] revealed that Surya Namaskara with or without Yoga Nidra helped to reduce stress but Surya Namaskara combined with Yoga Nidra is more effective to reduced stress than Surya Namaskara alone. Sharma MK, (2014) [17] concluded that yogic practices (suryanamaskar) provides the individual with refreshing experiences, and manage the stress to a great level. Agre S, Agrawal R and Ishrat S, (2021) [1] concluded that 2-weeks intervention of Surya Namaskara has made a significant difference in reducing stress and improving R-dispositions. Suwannakul B, Sangkarit N and Thammachai A (2025) [21] showed that Surya Namaskara as a treatment improved the perceived stress among university students after eight week experimental phase. Petruzzello SJ (2012) [14] concluded that a meta analysis on state and trait anxiety may be more benefited after a ten-week training programme and each session not less than twenty-one minutes.

In this study, Surya Namaskara reduced mental anxiety and stress significantly after three months treatment. Surya Namaskara have a greater impact on the mind and the senses than other exercises with the result that Surya Namaskara help to develop one's physical and mental powers to make the mind clam and control the anxiety and stress. Yoga involves and includes eight paths (i.e. astanga yoga, yama, niyama, asana, pranayama, pratyahara, dharana, dhyana and Samadhi). The astanga yoga based on idealistic approach, a real road to attain god consciousness, self-consciousness and self-concept. Surya Namaskara helps an individual overcome these emotions to facilitate a calm peaceful mind and healthy and stress free body. Surya Namaskara promotes relaxation, develops self-concept, self-confidence, positive attitude and reduces stress as well as anxiety.

Finally, Surya Namaskara combine effects of physical, mental, pranic and spiritual harmony. Regular practice of Surya Namaskara helps to prepare physical fitness, mental calmness and spiritual upliftment.

Conclusion

The results of this study indicate the following conclusions:

- **Flexibility:** A three-month practice of Surya Namaskara led to a significant improvement in trunk and spine flexibility among the college girls in the experimental group.
- **Body Composition:** There were notable improvements in body composition, including significant reductions in body mass index (BMI) and body fat percentage (%BF), along with an increase in lean body mass (LBM), after three months of Surya Namaskara practice.
- **Mental Health:** The experimental group also experienced a significant decrease in anxiety and mental stress levels following the three-month Surya Namaskara program.

In summary, Surya Namaskara proves to be a beneficial practice for enhancing both physical fitness and mental health, specifically by improving flexibility, optimizing body composition, and reducing anxiety and stress.

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