



ISSN: 2456-4419

Impact Factor: (RJIF): 5.88

Yoga 2025; 10(2): 256-259

© 2025 Yoga

www.theyogicjournal.com

Received: 25-05-2025

Accepted: 01-07-2025

Dr. Vivek Kumar Singh

Associate Professor, Department
of Sports Sciences, Sports
University of Haryana, Sonapat,
Haryana, India

Satya Changmai

Research Scholar, Department of
Physical Education, Rajiv
Gandhi University, Arunachal
Pradesh, India

Dr. Richa Singh

Assistant Professor, Department
of Physical Education, K.R.
Girls, PG College, Mathura,
Uttar Pradesh, India

A controlled trial on the influence of varied pace of surya namaskar on body fat percentage among Jawahar Navodaya Vidyalaya Children's of Tinsukia District

Vivek Kumar Singh, Satya Changmai and Richa Singh

DOI: <http://doi.org/10.22271/yogic.2025.v10.i2d.1788>

Abstract

This controlled trial investigated the effect of different paces of Surya Namaskar practice on body fat% of male schoolchildren, age ranged from 13-16 years at Jawahar Navodaya Vidyalaya, Tinsukia District, Assam. Therefore, to achieve the objective of present study, 60 male students were selected randomly from Jawahar Navodaya Vidyalaya in Tinsukia District, Assam, and assigned randomly to four groups (n=15 each). Further subjects were distributed in experimental group-1, which practiced Surya Namaskar in one minute, experimental group-2, which practiced Surya Namaskar in two minute, experimental group-3, which practiced Surya Namaskar in three minutes, whereas one group served as control group, which did not receive any intervention. All three experimental groups received intervention for the period of six weeks. Body fat percentage was measured before and after the intervention, for this purpose four-site skinfold (subscapular, triceps, suprailiac, and biceps) was measured, for this purpose skinfold caliper was used, whereas, standard equations (Durnin-Rahaman with Siri's formula) were used to estimate body fat%. To test the effect of varied pace of Surya Namaskar on body fat% analysis of covariance (ANCOVA), was used ($\alpha=0.05$). Findings suggest, that significant effect was found on body fat% of all Surya Namaskar groups, where each group showed significant lower adjusted mean body fat% than the control group ($p<0.05$). Adjusted post-test means were, 14.90%, 14.92%, and 14.93% for the experimental group-1, experimental group -2 and experimental group -3, respectively, in comparison to 15.59% for control. Pairwise comparisons reflect no significant differences were found among three experimental groups. Based on finding, it can be concluded that, regular Surya Namaskar practice markedly reduces body fat percentage in adolescent boys, and variations in Surya Namaskar pace produce similar benefit in terms of reduction on body fat%.

Keywords: Surya Namaskar, Body Fat%, Siri's formula, JNV

Introduction

Childhood obesity and excess body fat are increasingly recognized as global public health challenges, with long-term implications for physical, mental, and metabolic health (World Health Organization, 2020) [23]. Alarming rise has been observed in childhood obesity, WHO data indicated that around 340 million children and adolescents of age ranged from 5-19 were overweight or obese in 2016 (WHO, 2020) [24]. In India, rise in urbanization, sedentary behavior, per capita income and lifestyle changes have contributed to an alarming and significant increase in childhood adiposity, even rural and semi-urban populations have shown the same trend (Ranjani *et al.*, 2016) [17]. Given the health risks associated with higher body fat percentage, including, insulin resistance, hypertension, and possibility of non-communicable diseases, it becomes imperative in country like India, to explore accessible, culturally relevant, and cost-effective interventions to counter the surge in body fat% among school-aged children. Several empirical studies conducted on impact of Surya Namaskar, suggested that, practicing Surya Namaskar with different pace may replicate the effect of aerobic exercise, capable of improving cardiovascular endurance, muscular strength, and body composition (Bhutkar *et al.*, 2011; Koley & Kaur, 2019) [1, 2, 12]. In contrast to gym-based workouts, Surya Namaskar

Corresponding Author:

Dr. Vivek Kumar Singh

Associate Professor, Department
of Sports Sciences, Sports
University of Haryana, Sonapat,
Haryana, India

requires no equipment can be performed in minimal space, and can be easily adapted into school curricula, especially in those institutions where resources are limited.

However, despite growing integration of Surya Namaskar into school wellness programs, a critical gap exists in the literature, regarding the effect of practicing Surya Namaskar with different pace (intensity) on physiological variables, such as body fat percentage. Emerging evidence suggests that the intensity and volume of Surya Namaskar practice can influence the human physiological. Where slower-paced practice may enhance flexibility and mindfulness, high-paced practice of Surya Namaskar can replicate the effect of moderate to vigorous aerobic exercise (Telles *et al.*, 2015) [20]. Further, faster-paced versions may induce a higher metabolic rate and carbohydrate expenditure, potentially leading to greater fat loss (Madan *et al.*, 2018) [13], but, systematic comparisons of different paces of Surya Namaskar and their specific effects on child adiposity is remain scarce, especially in context to schools of Assam reason. Therefore, to investigate the statistical effect of varied pace of Surya namaskar practice on body fat% of school children, Jawahar Navodaya Vidyalaya of Tinsukia district was selected. Due its, unique educational set-up, with residential schooling and well planned schedule, it was ideal place for implementing controlled training interventions.

Keeping the view on growing health risks, due to physical inactivity and excess intake of high calory diet, especially increased consumption of energy drinks in children, especially in tribal and underserved districts like Tinsukia, it became essential to identify the cost-effective and culturally accepted physical intervention. Effect of Surya Namaskar practice on various physiological and psychological variables has been investigated by the several researchers. In this context Bhutkar *et al.* (2011) [1, 2] in their study, demonstrated that daily Surya Namaskar practice for 12 weeks by college students, significantly improved their body composition and cardiovascular efficiency. Whereas, Sinha and Sinha (2014) [18] observed that, six weeks practice of Surya Namaskar has significantly reduced the weight and BMI in adolescents. Further in another study, Harinath *et al.* (2004) [9] found that yoga practices including Surya Namaskar led to favorable changes in lipid profiles and body composition, reflecting potential benefits for weight management and fat reduction. Whereas in context to school, Verma *et al.* (2016) [22] revealed in their study that, significant improvements in BMI, flexibility, and mental well-being are found due to intervention of yogic practices.

Thus, this research investigates an important, yet underexplored, dimension of Surya Namaskar in context to the school health: how the practice of different pace of Surya Namaskar influences body composition. It is expected that the results will unfold the evidence, which will help to prepare guidelines for optimizing yoga-based interventions in child health and education settings.

Methodology

The primary objective of this study was to examine the effects of different paces of Surya Namaskar practice on body fat% of school-aged children. For the purpose of present study, total 60 male subjects (students) age ranging from 13 to 16 were selected randomly, from the Jawahar Navodaya Vidyalaya of Tinsukia District, Assam. Further these subjects were then randomly distributed to four groups as follows:

1. Pace-1 experimental group (Group 1): Comprising 15 subjects, who underwent Surya Namaskar training at a

pace of one minute per cycle, repeated continuously for 30 minutes.

2. Pace-2 experimental group (group 2): Comprising 15 subjects, who underwent Surya Namaskar training at a pace of two minute per cycle, repeated continuously for 30 minutes.

3. Pace-3 experimental group (Group 3): Comprising 15 subjects, who underwent Surya Namaskar training at a pace of three minute per cycle, repeated continuously for 30 minutes.

4. Control group (Group 4): This group included 15 subjects, who did not participate in any form of Surya Namaskar training and served as the non-intervention control group.

Prior to the commencement of the study, all participants were explained about the nature and objective of the present study. Informed and voluntary consent was obtained from each participant. The participants were assured that their identity and data would remain confidential and that the information collected would be used strictly for academic and research purposes. To investigate the effect of varied pace of surya namaskar on body fat%, the Analysis of Covariance (ANCOVA) was employed at 0.05 level of significance.

To access the body fat% of the subjects, Durnin and Rahaman equation along with Siri Equation was used, further four site skinfold was measured, i e. Subscapular, Triceps, Suprailiac, and Biceps to get the body fat%. Whereas to investigate the effectiveness of varied pace of Surya namaskar, pre and post-test randomized group design was used, in which 60 subjects were randomly divided into four groups. Experimental Group - 1, 2 and 3 were given Yoga Intervention on different pace of surya namaskar whereas control Group performed their regular normal activity. All the subjects (All 4 Groups) were tested prior and after 6 (Six) weeks of yogic training with different pace of surya namaskar;

Table 1: Experimental design

Group	Subjects	Pre-test	Treatment	Post-test
Experimental group - 1 (G-1)	15	O1	T1	O2
Experimental group - 2 (G-2)	15	O1	T2	O2
Experimental group - 3 (G-3)	15	O1	T3	O2
Control group (G-4)	15	O1		O2

Table 2: Training protocol

	Exp. Group-1	Exp. Group-2	Exp. Group-3
Total time duration	30 minutes	30 minutes	30 minutes
Pace	1 minute	2 minutes	3 minutes
Total rounds	24	12	8
Round rest	6-1-6-1-6-1-6	3-1-3-1-3-1-3	2-1-2-1-2-1-2
Shanti path	3 minutes	3 minutes	3 minutes

Findings of the study

Table 3: Adjusted mean and standard error of different post-treatment groups in relation to body fat %

Treatment	Mean	Std. error	95% confidence interval	
			Lower bound	Upper bound
Experimental Group - 1	14.904	.113	14.678	15.131
Experimental Group - 2	14.923	.116	14.690	15.156
Experimental Group - 3	14.928	.114	14.700	15.155
Control Group	15.591	.115	15.361	15.821

The adjusted mean of experimental G-1 14.904, G-2 14.923, G-3 14.928 and control group is 15.591 respectively. And lower bound of experimental G-1 14.678, G-2 14.690, G-3

14.700 and 13.834 for control group. Whereas upper bound of experimental G-1 15.774, G-2 16.442, G-3 14.700 and 15.361 for control group in respect to fat%. Furthermore, the 95% confidence intervals for all experimental groups did not overlap substantially with the upper bound of the control group's confidence interval (15.821), suggesting a statistically meaningful reduction in body fat percentage due to the interventions.

Table 4: Levene's test of body fat %

F	df1	df2	Sig.
.673	3	56	.572

Levene's test of equality of error variances was employed to check the assumption of homogeneity of variances. Table shows a p-value of 0.572, which is much higher than the conventional threshold of 0.05, which furthermore suggests that the variances are equal across the groups, validating the use of ANCOVA.

Table 5: ANCOVA table for the post-treatment data in relation to body fat %

Source	Type I sum of squares	df	Mean square	F	Sig.	Partial eta squared
Fat % pre	191.520	1	191.520	996.436	.000	.948
Treatment	4.905	3	1.635	8.507	.000	.317
Error	10.571	55	.192			
Corrected total	206.996	59				

Table shows the F value for comparing the post treatment adjusted mean of the four groups (G-1, G-2, G-3 and control group). Since p value associated with F is 0.000 which is less than 0.05; hence F is significant. Thus, the null hypothesis of no difference among the adjusted post treatment group means for the data on fat% may be rejected at 5% level.

Table 6: Pairwise comparison among experimental group and control group on body fat %

(I) Treatment	(J) Treatment	Mean difference	Std. error	Sig.	95% confidence interval for difference	
					Lower bound	Upper bound
G-1	G-2	-.018	.162	1.000	-.461	.424
	G-3	-.024	.160	1.000	-.463	.416
	Control group	-.686*	.162	.001	-1.129	-.244
G-2	G-1	.018	.162	1.000	-.424	.461
	G-3	-.005	.164	1.000	-.453	.443
	Control group	-.668*	.166	.001	-1.124	-.213
G-3	G-1	.024	.160	1.000	-.416	.463
	G-2	.005	.164	1.000	-.443	.453
	Control group	-.663*	.160	.001	-1.102	-.224

Table-6, reveals that there is significant difference between experimental group-1 and control group, as the mean difference value, -0.686 is significant at 0.001 level of significance, whereas there is significant difference between experimental group-2 and control group, as the mean difference value, -0.668 is significant at 0.001 level of significance. Further, significant difference is also found between experimental group-3 and control group, as the mean difference value, -0.663 is significant at 0.001 level of significance. Whereas no significant difference is found between experimental group-1, group-2 and group-3. Therefore, it is concluded that all three pace of Surya Namaskar practice have similar effect on Body Fat% of school children's.

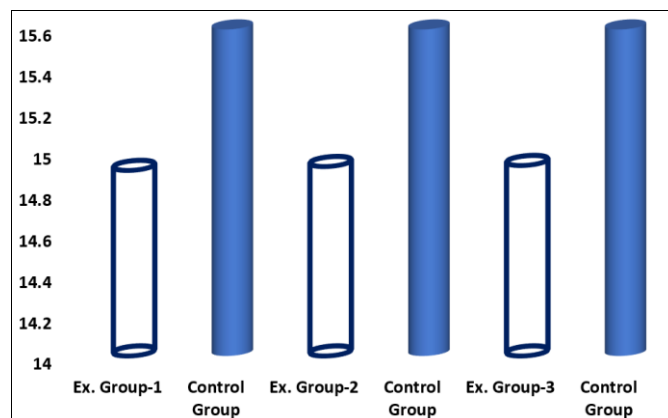


Fig 1: Graphical representation of mean among three experimental groups and control group in relation to body fat %

Discussion of findings

Present study aimed to examine the influence of varied paces of Surya Namaskar practice on the body fat percentage of school-aged children in the Tinsukia district. The findings revealed a statistically significant reduction in body fat percentage among the experimental groups practicing Surya Namaskar at different paces compared to the control group, indicating the effectiveness of this yogic practice in managing body composition in adolescents.

The significant reduction in body fat percentage observed among participants in Experimental Group 1 (1-minute pace), Group 2 (2-minute pace) and Group 3 (3-minute pace) compared to the control group aligns with earlier studies highlighting the beneficial effects of regular Surya Namaskar on body composition and fat reduction (Choudhary, 2019; Bhutkar *et al.*, 2011) [4, 1, 2]. As, Surya Namaskar is a sequence 12 dynamic postures that engage major muscle groups, promoting caloric expenditure, enhancing metabolism, and reduce body fat, when practiced regularly (Bhutkar *et al.*, 2011) [1, 2].

Study aims to investigate the effect of different pace of Surya Namaskar on body fat reduction, as it is evident from previous studies, that high intensity exercises have significantly reduced the muscle glycogen store, which further leads to fat oxidation. On same physiology Gharote, 1976 [7]; Muralidharan *et al.*, 2012 [16], concluded in their study that faster-paced Surya Namaskar (1-minute cycles) replicate effect like, moderate-intensity aerobic activity, which has improved cardiovascular fitness as well as reduce body fat. In contrast, low pace Surya Namaskar practice, may also lead to lower total energy expenditure during the same time frame. This finding may be supported by research conducted by Boudou *et al.*, 2003 [3], in their study, they have concluded that exercise intensity and duration are key factors in enhancing fat oxidation and change in body composition changes.

Interestingly, the study observed no significant difference between the different experimental groups (G-1, G-2, G-3). This suggests that while Surya Namaskar at varying paces contributes to fat reduction, the differences in pace (within the 1 to 3-minute range) might not lead to drastically different outcomes over a short intervention period of six weeks. This finding echoes prior research by Tran *et al.* (2001) [21], which suggested that while varying intensities in yoga can influence caloric burn, the overall benefits for body composition may converge over time with consistent practice.

In addition, no significant decrease in the percentage of body fat was observed in the control group, who did not practice

Surya Namaskar, which emphasises the role of physical activity in young people and the reduction of excess body fat accumulation (WHO, 2020) ^[25]. The contribution of physical inactivity to rising childhood obesity and related health risks is well established (Janssen & LeBlanc, 2010) ^[11].

The reduction in body fat percentage can be attributed to the dynamic and repetitive nature of Surya Namaskar, which combines aerobic, strength, and flexibility components. This multifaceted approach enhances metabolic rate, promotes fat oxidation, and improves muscle mass, contributing to favorable changes in body composition (Jakhotia *et al.*, 2015; Choudhury *et al.*, 2024) ^[10, 5].

Conclusion of the study

The aim of the present study was to find the effect of various pace of Surya Namaskar practice on body fat percentage among adolescent boys. The result indicates that regular practice of Surya Namaskar at any speed shows the significant reduction in body fat%, as compared to control group, who had not received any intervention. However, no significant difference was found between experimental groups, which indicates that the consistent practice of Surya Namaskar, irrespective of the pace, is effective in reducing body fat% in school-aged children.

These results support the efficacy of Surya Namaskar as a practical intervention for reducing body fat% in adolescents, findings are aligned with other studies, showing reduction in body fat% and improvements in physical health parameters, due to regular practice of Surya.

References

1. Bhutkar MV, Bhutkar PM, Taware GB, Surdi AD. How effective is Surya Namaskar in improving human performance? *Asian J Sports Med.* 2011;2(2):98-104.
2. Bhutkar MV, Bhutkar PM, Taware GB, Surdi AD. How effective is Surya Namaskar in improving physical fitness? *Asian J Sports Med.* 2011;2(4):259-266. DOI:10.5812/asjms.34799
3. Boudou P, Sobngwi E, Mauvais-Jarvis F, Vexiau P. Exercise training-induced triglyceride lowering negatively correlates with DEXA-derived abdominal visceral fat changes in obese type 2 diabetic men. *Diabetes Metab.* 2003;29(4):488-495.
4. Choudhary R. Impact of Surya Namaskar on body composition and flexibility. *Int J Yoga Allied Sci.* 2019;8(2):120-125.
5. Choudhury R, Sharma N, Lal M, Linyanage T, Goyal M. Exploring the influence of yogic asana practice on body fat percentage: A systematic review. *BIO Web Conf.* 2024;86:01010. DOI:10.1051/bioconf/20248601010
6. Durnin JVGA, Rahaman MM. The assessment of the amount of fat in the human body from measurements of skinfold thickness. *Br J Nutr.* 1967;21(3):681-689.
7. Gharote ML. Effects of yoga exercises on body efficiency. *Yoga Mimamsa.* 1976;18(1):1-8.
8. Government of India. National Education Policy 2020. Ministry of Human Resource Development; 2020.
9. Harinath K, Malhotra AS, Pal K, Prasad R, Kumar R, Kain TC, *et al.* Effects of Hatha Yoga and Omkar meditation on cardiorespiratory performance, psychological profile, and melatonin secretion. *J Altern Complement Med.* 2004;10(2):261-268.
10. Jakhotia K, Shimpi A, Rairikar S, Mhendale P, Hatekar R, Shyam A, *et al.* Suryanamaskar: An equivalent approach towards management of physical fitness in obese females. *Int J Yoga.* 2015;8:27-36.

DOI:10.4103/0973-6131.146053

11. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phys Act.* 2010;7:40. DOI:10.1186/1479-5868-7-40
12. Koley S, Kaur N. Effects of 6-week yoga training on body composition and flexibility in pre-adolescent children. *Indian J Yoga Exerc Sports Sci Phys Educ.* 2019;13(1):23-28.
13. Madan K, Yadav RK, Bhardwaj A, Mehta R. Effect of speed variations in Surya Namaskar practice on physiological responses: A comparative study. *J Yoga Phys Ther.* 2018;8(2):1000277.
14. Malkani R, Shukla R, Patel V. Effect of Surya Namaskar on body mass index and flexibility in school going children. *Int J Yogic Human Mov Sports Sci.* 2020;5(2):162-165.
15. Ministry of Health and Family Welfare. School Health Programme under Ayushman Bharat. Government of India; 2019.
16. Muralidharan K, Balakrishnan B. Effect of yogic practice on body mass index and blood pressure. *Int J Sci Res Publ.* 2012;2(12):1-4.
17. Ranjani H, Mehreen TS, Pradeepa R, Anjana RM, Garg R, Anand K, *et al.* Epidemiology of childhood overweight and obesity in India: A systematic review. *Indian J Med Res.* 2016;143(2):160-174. DOI:10.4103/0971-5916.180203
18. Sinha R, Sinha A. Impact of Surya Namaskar on BMI and emotional intelligence of adolescents. *Indian J Appl Res.* 2014;4(3):457-9.
19. Siri WE. Body composition from fluid spaces and density: Analysis of methods. In: National Academy of Sciences, editor. *Techniques for measuring body composition.* Washington, DC: NAS; c1956, p. 223-244.
20. Telles S, Sharma SK, Yadav A, Singh N, Balkrishna A. Comparative study of the metabolic cost of yoga and other physical activities. *J Phys Act Health.* 2015;12(9):1165-1171.
21. Tran MD, Holly RG, Lashbrook J, Amsterdam EA. Effects of Hatha yoga practice on the health-related aspects of physical fitness. *Prev Cardiol.* 2001;4(4):165-170.
22. Verma A, Shanker V, Singh M. Effects of yoga on physical and mental health of school children. *Int J Yoga Physiother Phys Educ.* 2016;1(1):1-3.
23. World Health Organization. Guidelines on physical activity and sedentary behaviour. Geneva: WHO; 2020.
24. World Health Organization. Obesity and overweight. 2020. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
25. World Health Organization. Physical activity. 2020. Available from: <https://www.who.int/news-room/fact-sheets/detail/physical-activity>