Effect of Surya Namaskara on Mental Health, Self-control and Mindfulness of Adolescent School Children.

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Research Article

Keywords: Surya Namsakara, Adolescent School children, Self-control, Mindfulness, Mental Health

Posted Date: October 11th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-955629/v1>

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Version of Record: A version of this preprint was published at Complementary Therapies in Clinical Practice on November 9th, 2022. See the published version at <https://doi.org/10.1016/j.ctcp.2022.101691>.

Abstract

Background

A big portion of adolescent school children suffers from mental health problems. Low self-control and mindfulness are positively associated with poor mental health. Therefore, the present study was designed to assess the effect of Surya Namaskara (SN) on mental health, self-control, and mindfulness among school children.

Method

63(39 female and 24 male) students (mean age = 14.24 years and SD = 0.42 years) studying at 9th grade in a private school in Karnataka, India were recruited as participants of the study. The design of the present study was a non-randomized two arms design. Students in grade 9 section 'A' (N= 33) were selected as the intervention group. Whereas, students in grade 9 section 'B' (N = 30) were considered as a control group. Students in the intervention group were given SN for 15 days. The participants were administered the Brief Self-control Scale (BSCS), Mindfulness, Attention and Awareness Scale for Adolescents (MAAS-A), and General Health Questionnaire-12 (GHQ-12) questionnaires on the baseline and after 15 days of intervention.

Results

Findings of the present study showed a significant difference in MAAS-A scores [$F(1, 54) = 18.47, p < 0.001, \eta_p^2 = 0.26$] in within group comparison. There was also a significant interaction (Times*Groups) for BSCS [$F(1, 54) = 4.89, p = 0.031, \eta_p^2 = 0.08$] and MAAS-A [$F(1, 54) = 6.63, p = 0.013, \eta_p^2 = 0.12$] scores. Post-hoc analysis showed SN group has significantly high post BSCS score ($p = 0.005$) and MAAS-A score ($p = 0.005$) compared to control group. Similarly, there was a significant high BSCS score ($p = 0.003$) and MAAS-A score ($p < 0.001$) after SN intervention compare to their respective pre scores. There was no significant change in the GHQ-12 scores in both groups in pre-post comparison.

Conclusion

The finding of the present study showed that SN improves self-control and mindfulness in adolescent school children. However, the results of the current study should be confirmed by future studies with robust research design, a large sample size, and advanced tools.

Background

Mental health problems are one of the leading causes of disabilities among children and adolescents. 10 to 20% of adolescents and children worldwide suffer from mental health disorders^{1,2}. A systematic review and meta-analysis by Malhotra & Patra³ reported 23.33% of children and adolescents in India are having psychological illnesses. Mental health problems in adolescents lead to poor academic performance, the repetition of the grade, and drop out from the school⁴. Adolescents with mental health problems also have poor self-rated health, substance misused, early sexual activity, family/peer problems, and developmental-behavioral problems^{1,2}. In its worse, mental health disorders can be resulted in suicide. Suicide is the fourth major cause of death in 15 to 19 years old⁵. Mental health disorders like depression, anxiety, psychosocial distress, loneliness, and anxiety-related insomnia are common among children and adolescents^{4,6-8}.

Academic pressure, parental expectation, life stress, low socioeconomic conditions are some of the major causes of mental health problems in children and adolescents⁹⁻¹¹. Apart from these causes, psychological factors like low self-control and low mindfulness also adversely affect the mental health of children and adolescents.

Self-control is the ability to inhibit impulses and delay gratification^{12,13}. It is also defined as a cognitive process that allows individuals to self-regulate their behavior in order to achieve personal goals¹⁴. Individuals with high self-control are emotionally balanced, have better physical and mental health as well as interpersonal relationship^{15,16}. On the other hand, low self-control is positively associated with poor mental health, substance abuse, criminal behavior, poor interpersonal relationship, and poor academic performance¹⁷. It also adversely affects emotional well-being and social relationship¹⁸⁻¹⁹.

Likewise, mindfulness is defined as the awareness that is developed from paying attention to whatever arises in the present moment with an open and discriminating mind²⁰. Mindfulness is an act of developing moment-to-moment awareness and relating all the life experiences (positive, negative, and neutral) in the open and receptive way²¹. Mindfulness is positively correlated with psychological health and subjective well-being^{22,23}. A meta-analysis showed individuals with high mindfulness tend to have positive health-related behavior (healthy eating, sleep, and physical activity)²⁴. On the contrary, mindfulness is negatively associated with substance use, depression, and post-traumatic stress disorder²⁵. Even studies showed low mindfulness in adolescents is positively correlated with stress, anxiety, depression, low executive function, and poor academic performance²⁶⁻²⁸. Thus, there is a requirement of intervention to improve the mental health, self-control, and mindfulness of adolescents.

Yoga can be an effective intervention to enhance adolescent mental health, self-control, and mindfulness. Yoga is a mindfulness-based practice, originated in the Indian sub-continent five thousand years back. The practice of yoga involves sustained attention to physical sensations, breathing and mental activity, restful postures, breathing exercises, and periods of meditative awareness²⁹. It contains a contemplative element which is conceptualized as "mindfulness in motion"³⁰. The right practice of yoga with conceptual understanding enhances the overall health and well-being of individuals as well as brings mental peace and calmness. A scientific study showed yoga significantly reduces stress and anxiety³¹. It also decreases depression and improves the quality of life³². Yoga

practice was found to be effective in improving self-control³³. It even improved the self-control of youth at risk and incarcerated³⁴. Studies also reported practice of yoga increases mindfulness³⁵⁻³⁷.

In addition, Rashedi et al.³⁸ reported yoga to be an effective practice to enhance positive behavior in children. Yoga helps children and young people to cope with stress and enhances their physical and psychological wellbeing³⁹⁻⁴². It reduces anxiety, depression, and global psychological stress of school students⁴³. Even teachers reported that yoga significantly reduces depression symptoms, behavioral symptoms, and internalizing symptoms of children with emotional and behavioral disorders⁴⁴.

Yoga practice comprises several practices including *Surya Namaskara* (sun salutation), *asana* (postures), *pranayama* (breath regulation), and *dhyana* (meditation). Surya Namaskara (SN) is one of the basic components of yoga practice. It contains a series of 12 postures. These postures are performed in a cyclical flow. SN's postures are even practiced with breath coordination and chanting mantra. Scientific studies reported the efficacy of SN on improving cardiorespiratory fitness, handgrip strength, flexibility, and endurance as well as helping in weight management among adults and children⁴⁵⁻⁴⁸. It also enhances the R disposition of physical relaxation, mental quietness, awareness and joy, and reduces sleepiness and stress disposition of somatic stress, worry, and negative emotion⁴⁹. It is effective in reducing stress and state anxiety⁵⁰. An intensive literature review showed no study to assess the effect of SN on the mental health, self-control, and mindfulness of school children. Therefore, the present study was planned to evaluate the effect of SN on the mental health, self-control, and mindfulness of adolescent students.

Methods

63(39 females and 24 males) students (mean age = 14.24 years and SD = 0.42 years) studying at 9th grade in a private school in Puttur, Karnataka, India were recruited as participants of the study. The design of the present study was a non-randomized two arms design. Students at grade 9 section 'A' (n= 33; 21 females and 12 males) were selected as the intervention group. Whereas, students studying at grade 9 section 'B' (n = 30; 18 females and 12 males) were considered as a control group. The participants were administered BRIF Self-control Scale (BSCS), Mindfulness, Attention and Awareness Scale for Adolescent (MAAS-A), and General Health Questionnaire-12 (GHQ-12) questionnaires on the baseline and after 15 days of intervention. The numbers of students included in the final analysis from both groups are given in trial profile (Figure 1).

Assessment Tools

General Health Questionnaire (GHQ-12)

The GHQ-12⁵¹; a subset of the GHQ-28 is a screening questionnaire for detecting depression, anxiety, and social dysfunction. It is a valid tool to identify probable mood and anxiety disorders in adolescent school children^{52,53}. It contains 12 items and each item is rated from one (often) to four (Never). The likert method of scoring was used in this study. Firstly, the answer codes for questions 1, 2, 3, 4, 5, 8, and 9 were re-coded in reverse terms (i.e. 1 to 4; 2 to 3; 3 to 2; and 4 to 1) and individual total scores in the GHQ -12 was obtained by summing up all the individual item scores and deducting the sum by 11. The higher score indicates the worse condition.

Brief Self-Control Scale (BSCS)

The BSCS is a 13-item self-report questionnaire to assess the individuals' self-control¹⁷. Participants rate how well each item (e.g., "I blurt out whatever is on my mind") describes them on a 5-point scale ranging from 1 = Not at all like me to 5 = Very much like me. The BSCS is highly reliable and valid tool with high internal consistency (Cronbach alpha = 0.83- 0.85) and test-retest reliability (Cronbach alpha = 0.87) to measure the self-control school students¹⁷. The total score of BSCS was obtained by reversing the score for 2, 3, 4, 5, 7, 9, 10, and 12 items and summing up all individual item score.

Mindful, Attention and Awareness Scale for Adolescent (MAAS-A)

The MAAS-A is an adjusted version of the Mindfulness, Attention, and Awareness Scale (MAAS) developed by Brown & Ryan⁵⁴. One Item ("I drive places on 'automatic pilot' and then wonder why I went there.") was removed from MAAS since it was inappropriate to adolescents⁵⁵. It is a valid tool to assess the mindfulness of adolescents aged 14 to 18 years⁵⁵. This instrument consists of 14 items, which assess the quality of attention and awareness that individuals apply to their daily lives. These items are rated on a 6-point Likert scale ranging from 1 (almost always) to 6 (almost never). Participants' responses to each item are summed to create a total score. The total score can range from 14 to 84. A high score indicates a high degree of mindfulness.

Intervention

Surya Namaskara

Participants in the experimental group were given an hour of SN training for six days a week for two weeks. The session was started with chanting OM for three rounds. Then, warm-up exercise (jogging, side bending, twisting, and forward & backward bending) was given for five minutes, which was followed by

practice of twelve poses SN along with breathing. At the end of the session, five minutes of silent relaxation in a supine position was given. The instruction for 12 steps SN was given as follows: Join your hands in front of chest; adopt Namaskara mudra (Salutation Pose). (1) Inhale deeply and raise your arms. Slowly bend backward, stretching arms and keep your elbows straight (Hasthauddhanasana - Raised Arms Posed). (2) Exhale slowly bent forward, keep your palms by the side of your feet, and try to bring your forehead to your knees or shins (Padahasthasana - Hand to Feet Posture). (3) Inhale and move the right leg away from the body in one big step backward and keep the right knee on the mat. Keep hands and feet firmly on the ground, with the left foot between the hands. Raise your head (Ashwasancalana – Equestrian Pose). (4) With exhalation take the left leg back and keep it together with the right leg. Keep arms straight; slightly lower your hips so that your body will be in a straight line, look forward (Chaturanga Dandasana- Four-Limbed-Staff Pose). (5) With inhalation bend your knees and keep on the mat then rest your hip on the heels, forehead on the mat, and stretch your arms forward (Shashankasana; Rabbit posture). (6) With inhalation move your body forward, keep your knees firm on the mat. Exhale and put your chest on the mat in between your palms. Slightly raise your hips, keep your forearms straight and closer to the chest (Astanga Namaskarasana – Eight Limbed Salutation Pose). (7) Inhale and raise your trunk and bend backward as much as possible, bending the spine to the maximum (Bhujangasana, Cobra Pose). (8) Exhale and raise hips, keep your heels on the mat, elbows straight, push body backward (Parvatasana, Mountain Pose). (9) With inhalation bend your knee and keep on the mat then rest your hips on the heels, forehead on the mat and stretch your arms forward (Shashankasana, Rabbit Pose). (10) Inhale and move the right leg forward in one big step and keep your right foot in between the palms. Keep hands and feet firmly on the ground and left knee on the mat (Ashwasancalana - Equestrian Pose). (11) Exhale slowly and bring your left leg forward together with your right leg, bent forward, keep your palms by the side of your feet, and try to bring your forehead to your knees or shins (Padahasthasana Hand to feet Pose). (12) Inhale and raise the arms. Slowly bend backward, stretch your arms, and keep your elbows straight (Hasthauddhanasana - Raised Arm Posed). Exhale and bring the hands down and join your palms in front of your chest; adopt Namaskara Mudra (Pranamasana, Salutation Pose).

Whereas the control group was not given any intervention and was involved in activities they were doing on regular basis.

Data Analysis

Statistical analysis was done by using IBM Statistical Package for Social Sciences (SPSS) software (version 22). The obtained data were compared using a repeated-measures analysis of variance (RM-ANOVA) followed by Bonferroni adjusted posthoc analyses. The RM-ANOVA had two within-subjects factor 1: times, pre and post, and factor 2: groups, SN and control. All statistical analysis was computed with two-tailed. Parametric tests (i.e., repeated-measures ANOVA followed by multiple posthoc tests) were used since the distribution of data does not impact the accuracy of results when the sample size is greater than 30⁵⁶.

Results

Final analysis included 56 [SN (n = 30; 21 females and 9 males) and control (n = 26; 17 females and 9 males)] participants. Three participants from the intervention group and four from the control group were excluded from the final analysis for post data being not available. Excluded participants were absent on the day of post-data collection. The group means ± SD, Cohen's d, and p-value for different variables are given in table 1. ANOVA value for within-subjects factor (times), between-subjects factor (groups), and interaction between two (Groups*times) for different variables are given in table 2.

Table 1

The mean ± Standard Deviation scores of the Brief Self-control Scale (BSCS), the Mindfulness, Attention and Awareness Scale for Adolescent (MAAS-A) and the General Health Questionnaire-12 (GHQ-12), P values and Cohen's d.

Variables	Within Group Analysis				Between group Analysis	
	Surya Namaskara		Control		P Value	Cohen's d
	PRE	POST	PRE	POST		
BSCS	40.50±6.13	44.90±6.41**	40.53±5.69	40.31±5.24	0.005	0.78
MAAS-A	52.17±11.97	63.37±13.18**	51.46±11.22	54.27±9.70	0.005	0.78
GHQ-12	18.83±2.04	19.80±2.95	18.69±2.29	19.46±2.70	0.66	-
**p<.01						

Table 2

ANOVA Table for the Brief Self-control Scale (BSCS), the Mindfulness, Attention and Awareness Scale for Adolescents (MAAS-A) and the General Health Questionnaire-12 (GHQ-12), P values and Cohen's d.

Variables	Factors					
	Within Subjects Group		Between Subjects Group		Groups*Times	
	F (1, 54)	P	F (1, 54)	P	F (1, 54)	p
BSCS	3.96	0.052	3.66	0.061	4.89	0.032
MAAS-A	18.47	< 0.001	3.36	0.072	6.31	0.013
GHQ-12	3.77	0.057	0.22	0.64	0.05	0.83

Findings of the present study showed a significant difference in MAAS-A scores [$F(1, 54) = 18.47, p < 0.001, \eta_p^2 = 0.26$] in within group comparison. There was also a significant interaction (Times*Groups) for BSCS [$F(1, 54) = 4.89, p = 0.031, \eta_p^2 = 0.08$] and MAAS [$F(1, 54) = 6.63, p = 0.013, \eta_p^2 = 0.12$] scores. No significant difference was observed in any of the variables in between group analyses.

Post-hoc analysis showed SN group has significantly high post BSCS score [$p = 0.005, 95\% \text{ of CI } (-7.76 - -1.42)$] and MAAS-A score [$p = 0.005, 95\% \text{ of CI } (-15.39 - -2.87)$] compared to control group. Similarly, there was a significant high BSCS score [$p = 0.003, 95\% \text{ of CI } (-7.26 - -1.52)$] score and MAAS score [$p < 0.001, 95\% \text{ of CI } (-15.65 - -6.75)$] after SN intervention compare to their respective pre scores. There was no significant change in the GHQ-12 scores in both groups in pre-post comparison.

Discussion

The present study was conducted with the aim to assess the effect of 15 days SN on mental health, self-control, and mindfulness of adolescents' school children. The findings of the present study showed that SN significantly improves adolescent school children's self-control and mindfulness in comparison to the control group. However, there was not any significant change in mental health after SN intervention.

The finding of the current study showed significant improvement in self-control after SN in between-groups comparison and pre-post comparison. An intensive literature search showed no prior study to evaluate the effect of SN or yoga practice on adolescents' self-control. As per our knowledge, this is the first study to assess the effect of yogic practice on the self-control of adolescents' school children. This study is not directly comparable with the previous study. However, previously Ramadoss & Bose³⁴ and Danielly & Silverthorne³³ showed yoga improves self-control. However, these studies differ from the present study in terms of intervention and population. Ramadoss & Bose³⁴ conducted research on vulnerable youth and intervention was a transformative life skills program that consists of yoga poses, pranayama, and meditation. While the population of Danielly & Silverthorne's³³ study was female inmates, and the intervention was yoga. Danielly & Silverthorne³³ also reported that improvement in self-control after yoga was statistically insignificant.

The exact mechanism behind the improvement in self-control after SN or yoga intervention has not been yet understood clearly. However, earlier studies have shown that yoga enhances executive functions^{57,58}. It also increases the volume of the frontal cortex that is associated with self-control and restriction of impulsivity^{59,60}. Studies showed self-control is a high-level function that incorporates control of impulsivity, self-regulation, delay of gratification, executive function, and willpower which are basically control by the frontal cortex^{61,62}. Therefore, an increase in the volume of the frontal lobe of the brain can be the possible mechanism behind the improvement of self-control after SN intervention.

Similarly, between groups and within-group analyses showed a significant improvement in MAAS-A score after SN. Previously study done by Gaiswinkler & Unterrainer, Erkin & Senuzun Aykar and Brisbon & Lowery also showed that yoga intervention significantly increases mindfulness³⁵⁻³⁷. However, the population of Gaiswinkler & Unterrainer³⁵ was in the age range of 18 to 68 years and the design of the study was cross-sectional. Similarly, Erkin & Senuzun Aykar's³⁶ study participants were nursing professionals. While Brisbon & Lowery³⁷ research participants were advance and beginner yoga practitioners in the age range of 21 to 65 years.

SN, itself is a part of mindfulness-based practice i.e. Yoga. The practice of yoga involves sustained attention to physical sensations, breathing, and mental activity, and periods of meditative awareness²⁹. Yoga practice also increases sustain attention and selective attention³⁹. These can be the possible reasons for improving mindfulness after SN.

The result of the current study showed no improvement in the mental health outcomes of school children after SN intervention. This finding is inconsistent with the results of earlier research. A prior study reported yoga significantly reduces adolescents' anxiety, depression, and psychological distress⁶³. A review by Hagen & Nayer⁶⁴ also conformed yoga reduces stress, depression, and anxiety as well as improved the mental well-being of adolescents. However, the intervention of Frank et al.⁶³ study was the transformative life skills program that compromises yoga postures, breathing practices, and meditation and the duration of intervention was an entire first semester of the school year. This inconsistency of the present study with prior studies could be because of a short period of intervention. In the future, prospective research can be conducted to observe the exact effect of SN on adolescent mental health and well-being.

Though the findings of the present study showed no improvement in mental health outcomes of adolescents' school children after SN, a significant improvement in adolescents' self-control and mindfulness are remarkable findings. Research has reported self-control is positively associated with academic performance, emotional well-being, and social relationship, whereas negatively correlated with substance abuse and criminal behavior^{17,18}. Likewise, mindfulness is negatively associated with depression, anxiety, fatigue, substance abuse, and confusion, while positively correlated with better academic performance, life satisfaction, and self-esteem^{25,28,65}. Thus, based on the results of the present study, the practice of SN can be given to teenagers' school

children to improve their self-control and mindfulness which could ultimately enhance their emotional and mental well-being as well as academic performance. It could also prevent and protect adolescents from involving in substance abuse and criminal behavior. Based on the present study, the mental health professionals can discuss the benefits of yoga in their clinic with the parents and teachers of adolescents having poor self-control, mindfulness, and psychological difficulties, and encourage them to arrange regular yoga sessions for their children.

Limitations of Study and suggestion for future study

The major limitations of the present study are research design, sample size, duration of the intervention, and assessment tools. The design of the current study was none randomize two arms design. This design is unable to minimize selection bias and the effect of confounding variables. Thus, randomized control trials can be conducted in the future to address the limitation of research design in the present research. The sample size of the present study was small. Thus, it would be difficult to generalize the finding of the present study. Future studies can be conducted with large sample size; even a multi-centric study can be conducted to assess the effect of SN on self-control, mindfulness, and mental health outcomes. The duration of the present study was only 15 days, which may not be enough to assess the exact effect of SN in self-control, mindfulness, and mental health outcomes of adolescent school children. Therefore, perspective research can be conducted in the future to assess the exact effect of SN. The present study was also limited by the tools; only self-reported questionnaires were used to assess the self-control, mindfulness, and mental health of adolescent school children. Future studies can be conducted using advanced tools like functional magnetic resonance imaging (fMRI) and electro encephalon graph (EEG) to assess the effect of SN in adolescent school children.

Conclusions

The finding of the present study showed that SN improved self-control and mindfulness in adolescent school children. On the basis of the present finding, SN can be taught to adolescent school children to enhance their self-control and mindfulness which can ultimately prevent them from severe mental health problems and enhance their overall well-being. However, the results of the current study should be confirmed by future studies with robust research design, a large sample size, and advanced tools.

Declarations

Authors' Contributions

NP conceptualized the study and wrote the manuscript. MS collected the data and gave intervention. BP analyzed data and critically evaluated the manuscript. All authors read and approved the final manuscript.

Conflicts of interest:

We, the authors declare that there are no conflicts of interest.

Prior publication:

No

Financial support and sponsorship:

Nil.

Ethical Consideration:

This manuscript does not contain clinical studies and patient data. This includes healthy participants. However, all procedures performed in the present study were in accordance with the 1964 Helsinki Declaration and its later amendments.

Informed consent:

The written consent was obtained from the principal of school and parents gave informed consent after receiving information from school principal.

Data Availability statement:

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Figures

Figure 1

Trial Profile

Figure 2

12 Steps Surya Namaskar Source: Dr. Viral Thakkar (2017), Surya Namskar- The 12 Commandments of sun!. Retrieved from: <https://goqii.com/blog/surya-namaskar-the-12-commandments-of-sun/>