

Association of yogic breathing with perceived stress and conception of strengths and difficulties in teenagers

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Abstract

Background: Mental health problems are increasing at an alarming rate throughout the world, and teenagers are no exception. They experience high levels of stress in their formative years which often leads to poor social behavior. In the present study, we examine the effect of Sudarshan Kriya Yoga (SKY), a yogic breathing technique on perceived stress and social behavior of school going teenagers.

Method: A cross-sectional survey was conducted. Teenagers who practiced SKY daily constituted the study group and teenagers who did not practice any form of yoga or meditation formed the control group. Child Perceived Stress scale (C-PSS) and Strength and Difficulty questionnaire (SDQ) were used to evaluate the mental health and social behavior of both groups.

Results: Lower stress scores were observed among students who practiced SKY compared to their peers. A significant difference was observed between the groups with respect to emotional problems, conduct problems, peer problems, and pro-social behavior. Gender wise comparison highlighted that the females from the SKY group scored lower on emotional problems sub-scale compared to their counterparts from control group. Results also highlighted an improved peer to peer interaction among both boys and girls in the SKY group.

Conclusion: The results indicate the practice of SKY is associated with reduced stress, improved self-awareness, and social behavior.

Keywords

Yogic breathing, Sudarshan Kriya, mental health, stress, SDQ, C-PSS

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Introduction

Mental well-being is defined as the state where an individual can realize their abilities, exhibit resilience to stress, be productive, and contribute to the society. In today's world, teenagers face numerous challenges: high academic pressure, complex social, and personal relationships and emotional alterations which result in an experience of anxiety and depression (Morgan et al., 2008; World Health Organization [WHO], 2020). Due to paucity of experience in dealing with life stressors, many teenagers lack a fully developed set of relevant coping skills (Chapman & Mullis, 1999). Moreover, teens and adolescents have hard time in regulating emotions because brain structures like amygdala and ventral striatum have slower maturation process (Martin & Ochsner, 2016). Research studies reveal that negative experiences and stress have a detrimental effect on the physiological as well as psychological well-being of human beings (Biggs et al., 2017). During teenage, which is a period of physical and emotional development, acute or chronic stress may lead to irreversible consequences for physical, emotional, reproductive, cardiovascular, and immune systems (Pervanidou & Chrousos, 2012).

Over the last few decades, there has been a growing interest in research on benefits of yoga and meditation on mental health and well-being. National Health Interview Survey, USA reported mind-body therapies such as yoga and meditation being among the top 10 complementary and integrative medicine practices (Section on Integrative Medicine, 2016). Another global review on mind-body therapies indicated improved mental-health, coping skills, and self-regulation among children and youth with the practice of holistic therapies such as yoga and meditation (Section on Integrative Medicine, 2016). A systematic review highlighted the efficacy of yoga practice in a school setting, as a strategy to improve child and teen mental health in the United States and India. However the authors state that most studies included in the review were preliminary in nature and require further investigation as solutions to improve mental health conditions in children and adolescents (Khalsa & Butzer, 2016). Another study from rural western Massachusetts demonstrated a large decrease in depression, anger, and fatigue among students after practicing school-based yoga in comparison to physical education (Felder et al., 2019). Several existing studies have delineated the health benefits of mindfulness based interventions for youth (Cillesen et al., 2019; Creswell et al., 2019; Rogers et al., 2017).

In an Indian context most studies on effect of yogic interventions on teenagers are on cognitive benefits of yoga rather than mental health and social behavior. India is the youngest country in the world and has a robust education system with 74.4% literacy (Chadda, 2018). Indian education system is one of the largest in the world and has a high academic rigor (Plecher, 2020). In 2017, over 1.6 million teenagers in India appeared in high school exams with 90% success rate. A study conducted on high school students in India reported that 63.5% of the study population was stressed due to academic and parental pressure (Deb et al., 2015). Teen mental health is an emerging concern in India with around 10,159 students committing suicide due to lack of good grades (Armstrong & Vijayakumar, 2018). There are very few studies that investigate mental health in a school setting in India, making this study unique in its investigation.

Yogic breathing techniques (Pranayama) are effective in enhancing emotional stability, thereby improving psychological functions of an individual (Sengupta, 2012). Pranayama increases activity in cortical areas of brain and reduces activity in the limbic brain, hence bringing tranquility and equanimity in the system (Betal, 2015). Sudarshan Kriya Yoga (SKY) is one such yogic breathing technique which was found effective in improving psychological and physiological outcomes in adults. They include clinical and sub-clinical anxiety and depression, perceived stress, and post-traumatic stress to name a few (Goldstein et al., 2016). SKY is also helpful in managing extreme emotions like violence and anger, enhancing a positive attitude to

life (Kanchibhotla et al., 2020), and reducing impulsive and harmful behaviors (Ghahremani et al., 2013).

Breathing is an important physiological function. The impact of its modulations on human mind-body systems is an area of interest for several researchers. There is less information on how the breathing modulation effects the mental well-being in adolescents. Teenagers spend a majority of time at school, away from home. Therefore, it is essential to incorporate mind-body interventions in the education system, so that it can cater to the mental health of the students, especially in a country like India where there is tremendous academic competition and the pressure to excel is very high. Our study investigates the benefits of Sudarshan Kriya Yoga (SKY) on the mental well-being and social behavior of teenagers in an Indian educational system which is exam-centric. The exam based module creates pressure among the students to excel in their academics hampering their emotional and social well-being (Cheney et al., 2005). The study investigates association of SKY, an ancient yogic breathing, and its association in reducing stress levels among the teenagers and improves their social and emotional well-being.

Material and methods

Study design

A cross-sectional study design consisting a control and an experimental group was adopted. To minimize interference, separate schools were selected for the experimental and control arm. Two schools where students had incorporated regular practice of SKY for the last 1 year were enrolled in the experimental group. Two similar schools where no form of yoga and meditation techniques was taught as a part of curriculum were enrolled in the control group. It was ensured through a questionnaire that the students in control group did not have a personal practice of yoga or meditation. Any student practicing yoga, meditation or SKY in the control group was excluded from the analysis. The tests were administered at a single time point. No baseline data was collected before intervention practice. The study hypothesis was that regular practice of SKY has a positive effect on perceived stress levels, social behavior, and emotional stability among the teenagers.

Subjects

Study data was collected from July 2019 to August 2019. The experimental group consisted of 237 students who had been practicing SKY for the past 1 year. The control group consisted of 218 students who did not practice any form of yoga or mediation. The average age of students in both groups was 14 years. Other demographic factors such as curriculum (CBSE Syllabus), teacher-student ratio, and socio-economic status were matched. Students with any learning disabilities were excluded from the study. All students were given an informed consent explaining the purpose and procedure of the study. Consent of the school principal and guardians was obtained. The study was approved by the institutional ethical committee of Sri Sri Institute for Advanced research with registration number SSIAR/IEC/07.

Intervention

The experimental group had undergone a 4 day workshop to learn the SKY technique at the start of their academic year. The workshops were facilitated by experienced instructors trained by the Art of Living. The participants were provided a personal SKY practice during the 4 day workshop that could be practiced daily at home. The students in the experimental group practiced SKY daily as a

part of the school assembly in the morning for 25 minutes. In case they missed the school practice, they were encouraged to practice SKY at their home for 25 minutes. All the students practiced SKY for a year as instructed.

SKY is a cyclic rhythmic breathing technique with its roots in traditional yoga. The 25 minutes process includes three yogic components – pranayama (McCraty & Zayas, 2014), Om chanting, and Sudarshan Kriya. The pranayama is done using the Ujjayi breath. Ujjayi involves experiencing the conscious sensation of the breath touching the throat. This slow breathing technique is performed at a rate of two to four breaths per minute (bpm). This technique improves lung capacity allowing more passage of air through the lungs (Tomar & Singh, 2011). ‘Om’ is chanted three times with prolonged exhalation. Lastly, Sudarshan Kriya rhythmic breathing is done with slow (20 bpm), medium (40–50 bpm), and fast (60–80 bpm) breaths. The entire technique is done in a seated posture and eyes closed.

Test measures

Mental well-being and social behavior was assessed using Child Perceived stress scale (PSS) and Strength and Difficulty questionnaire (SDQ) respectively. Instructions for all the tests were clearly mentioned before administration.

Child Perceived Stress Scale (PSS). Child PSS is a 14 item questionnaire with responses scored from 0 to 3 on a Likert scale. The stress perception includes feeling of being rushed or worried about not having enough time to do a desired activity, the pressure of academic performance, poor quality of friendships, and poor relationships with parents. The response ‘never’ is scored 0 and ‘a lot’ is scored 3. Perceived Stress score is obtained by adding the responses to all questions (White, 2014).

Strength and Difficulty Questionnaire (SDQ). Strength and difficulties questionnaire (SDQ) is a 25 question screening instrument created by Goodman R to assess the positive and negative attitudes of children between ages 3 and 17 years (Goodman, 1997). The measure is divided into five sub-domains category namely emotional issues, conduct problems, peer-problems, hyperactivity, and pro-social behavior. All questions are scored on a 3-point scale with 0 indicating ‘not true’, 1 indicating ‘somewhat true’, and 2 indicating ‘certainly true’. Higher scores on the pro-social subdomain reflect good social behavior. On the contrary higher scores in the other four subdomains reflect difficulties. The total difficulty score can be obtained by adding the scores on the first four sub-domains. The participant population is further categorized based on the total scores; overall and for each subdomain of SDQ. Participants scoring ≤ 15 are designated in normal category, 16 to 19 designated in borderline category and ≥ 20 in abnormal category. Subjects in abnormal category may be suffering from mental illness and require immediate attention.

Data analysis

Uni-variate analysis of variance was carried out considering SKY practice and gender groups as two independent variables, while respective scores obtained from each part were considered as the dependent variable. Subsequently, pair wise comparisons of various scores were carried out for different combinations of gender and type of schools. Two tailed *t* test was applied for significance level of 0.05 at 95% confidence interval. To ensure that multiple comparisons do not enhance chances of type 1 errors, post hoc tests were carried out wherever applicable and corrections were applied. Descriptive statistics were calculated to get averages and standard deviation with respect to genders and type of school.

Table 1. Participants demography (N=455) n (%).

Characteristics	Type	SKY group (N=237)	Control group (N=218)	All participants
Gender n (%)	M	107 (45.1)	105 (48)	212
	F	129 (54.9)	113 (52)	242
Age (years)	Mean (SD)	14 (0.77)	14 (0.74)	14
	Min	13	13	13
	Max	16	17	17

Table 2. Perceived stress scale mean scores, *p* value for SKY and control group.

	SKY group (N=237)	Control group (N=218)	<i>p</i> value
Mean score (SD)	15.36 (4.9)	17.03 (4.4)	<.001**
Male	14.95 (5.02)	17.28 (4.2)	<.05*
Female	15.7 (4.78)	16.8 (4.6)	<.05*

Note. **p* value < .05- significant. ***p* value < .001- significant.

Results

Table 1 depicts the demographic details of students from the two groups. The male to female ratio in SKY and control groups were, 45:55 and 48:52 respectively.

Table 2 depicts the Perceived stress scores obtained by two groups. Perceived stress score was higher amongst the control group (17.03) compared to teenagers who practice SKY (15.36) with a statistical significance of <.001. Males in the SKY group scored 14.95 on perceived stress scale compared to 17.28 in the control group. Reliability scores were calculated using Cronbach's Alpha was 0.593 for overall, 0.503 for control group, and 0.642 for SKY group.

Table 3 depicts the results for the Strength and Difficulty questionnaire. The population is divided into normal, borderline, and abnormal categories based on the scores and corresponding population percentage values are depicted in Table 3.

The SKY group had significantly lower percentage of participants in the abnormal category for the overall SDQ scores and three subdomains: emotional problems, conduct problems, and peer-problems. Both the groups had similar trends for pro-social behavior and SKY group had a higher percentage of abnormal children in hyperactivity sub domain. Reliability scores calculated by Cronbach's Alpha were 0.615 for overall population, 0.590 for control group and 0.636 for SKY group.

Gender based analysis between the two groups is shown in Table 4. About 13.1% of the males from SKY group, and 15.5% of the males from control group were in abnormal category for SDQ. However, the difference was not significant ($p=.58$). In the female population, 10% from SKY group and 14.9% from control group were in the abnormal population with a *p*-value of <.001. The abnormal category had a higher percentage of males from the control group for the emotional and conduct problems subdomain, while the opposite trend was seen for the prosocial behavior subdomain.

To understand the dose response of the intervention on the stress levels and strength and difficulties, correlation of the scores was performed with the frequency of practice as shown in Table 5. The frequency of practice was divided into two categories. Category 1 had students who

Table 3. Percentage of population % (n) in abnormal, normal, and borderline categories for SDQ questionnaire: SKY and control group.

Scale	Category	SKY group % (n)	Control group % (n)	p value
SDQ total	Normal	65.4 (155)	61.8 (134)	.026
	Borderline	23.2 (55)	23.0 (50)	
	Abnormal	11.4 (27)	15.2 (33)	
Emotional problems	Normal	85.7 (203)	77.4 (168)	.002*
	Borderline	7.6 (18)	9.2 (20)	
	Abnormal	6.8 (16)	13.4 (29)	
Conduct problems	Normal	92.8 (220)	87.6 (190)	.007*
	Borderline	5.1 (12)	7.8 (17)	
	Abnormal	2.1 (5)	4.6 (10)	
Hyperactivity	Normal	72.2 (171)	83.9 (182)	.059
	Borderline	13.9 (33)	7.4 (16)	
	Abnormal	13.9 (33)	8.8 (19)	
Peer-problems	Normal	94.1(223)	88.9 (193)	.012*
	Borderline	5.1 (12)	6.5 (14)	
	Abnormal	0.8 (2)	4.6 (10)	
Pro-social behavior	Normal	89.5 (212)	89.9 (195)	.44
	Borderline	5.5 (13)	4.1 (9)	
	Abnormal	5.1 (12)	6.0 (13)	

Note. *p value < .05- significant. **p value < .001- significant.

Table 4. Percentage of population -%(n)- in abnormal, normal, and borderline categories for SDQ questionnaire: SKY and control group. Male and Female population.

Scale	Category	Male SKY group % (n)	Male control group % (n)	p value	Female SKY group % (n)	Female control group % (n)	p value
SDQ total	Normal	62.6 (67)	68.9 (71)	.58	67.6 (88)	55.2 (63)	<.001**
	Borderline	24.3 (26)	15.5 (16)		22.3 (29)	28.0 (32)	
	Abnormal	13.1 (14)	15.5 (16)		10 (13)	14.9 (17)	
Emotional problems	Normal	90.6 (97)	82.5 (85)	.02*	81.5 (106)	71.0 (81)	.02*
	Borderline	4.6 (5)	8.7 (9)		10 (13)	9.6 (11)	
	Abnormal	4.6 (5)	8.7 (9)		8.4 (11)	17.5 (20)	
Peer-problems	Normal	95.3 (102)	84.4 (87)	.105	90.7 (118)	89.4 (102)	.05
	Borderline	2.8 (3)	8.7 (9)		6.9 (9)	7.0 (8)	
	Abnormal	1.87 (2)	6.8 (7)		2.3 (3)	1.7 (2)	
Hyperactivity	Normal	71.9 (77)	84.4 (87)	.303	72.3 (94)	82.4 (94)	.102
	Borderline	15.8 (17)	5.8 (6)		12.3 (16)	7.8 (9)	
	Abnormal	12.1 (13)	9.7 (10)		15.3 (20)	7.8 (9)	
Conduct problems	Normal	92.5 (99)	84.4 (87)	.02*	95.3 (124)	91.2 (104)	.16
	Borderline	6.5 (7)	8.7 (9)		3.8 (5)	4.3 (5)	
	Abnormal	0.9 (1)	6.8 (7)		0.7 (1)	2.6 (3)	
Pro-social behavior	Normal	90.6 (97)	85.4 (88)	.03*	88.4 (115)	92.1 (105)	.23
	Borderline	3.7 (4)	2.9 (3)		6.9 (9)	5.2 (6)	
	Abnormal	5.6 (6)	11.6 (12)		4.6 (6)	0.8 (1)	

Note. *p value < .05- significant. **p value < .001- significant.

Table 5. Relation between PSS scores, SDQ, and frequency of practice.

	Category 1	Category 2
Frequency of practice % (N)	88.9 (185)	11.1 (23)
PSS score mean (SD)	15.27 (4.91)	15 (5.033)
SDS overall score	13.3 (5.077)	12.08 (5.29)

practiced more than four to five times/week. Category 2 had students who practiced two to three times/week or less. There were no students in SKY group who did not practice at all. The data for frequency of practice was missing for 29 participants although the question was asked in the questionnaire. About 88.9% of the experimental group lies in Category 1, implying that most teenagers were able to consistently practice SKY. The perceived stress scores and strengths and difficulty scores were calculated for the two categories. The mean scores for C-PSS and SDQ among the two categories were similar. However, a statistical comparison cannot be made because the population size varied drastically between the two groups, and might have caused some aberration in the results.

Discussion

The present study investigates the association of regular practice of yogic breathing with the mental well-being and social behavior of teenagers. To the best of our knowledge, this is the first study assessing the mental and social benefits of SKY on teenagers in an Indian school-setting. Consistent with our initial hypothesis, our results corroborate that students who practiced SKY scored significantly lower on the stress measure. SKY group also had better scores on perception of strength and difficulties. Within the SKY group it was found that 88.9% of teenagers practiced SKY for more than four to five times/week which indicate its ease of practice and suitability for the teen population.

Perceived stress

The SKY group obtained significantly lower scores for perceived stress ($p < 0.001$). Subjects from both genders scored lower than their counterparts in the control group. In a research study on adults, analysis of EEG and ECG signals among regular practitioners of SKY showed significant reduction in stress and improvement in brain functions (Chandra et al., 2017). Our study was cross-sectional and the results demonstrate lower stress scores in the SKY group compared to the control group. This is in congruence with a growing body of literature which supports improvement in stress levels post yoga and mindfulness based interventions in youths (Berger & Stein, 2009; Conboy et al., 2013; Daly et al., 2015; Frank et al., 2017; Goldberg, 2004; Mendelson et al., 2010; Wang & Hagins, 2016). Previous research on the impact of SKY on college students has shown reduction in elevated lipid profile and improved lymphocyte levels, which are usually impaired under stress (Subramanian et al., 2012). However, very few researches in the past have compared the benefits of SKY yogic breathing on teen mental well-being. While our study group reported significantly lower scores for perceived stress compared to control after practice of yogic breathing SKY (Frank et al., 2017), in his study on adolescent from California demonstrated a significant improvement in stress coping strategies following yoga based wellness program module in a school setting. Another meta-analysis of 24 studies on mindfulness based intervention and mental health

outcomes in school setting indicated a significant contribution of the intervention on mental health of students (Carsley et al., 2018).

Perception of strength and difficulty

Our study reported that 11% of the SKY group fell under abnormal category in comparison to 15% of the control group population (overall SDQ score). Students scoring high on SDQ require immediate attention for mental and social health. The percentage of children in the abnormal category is significantly lower in the SKY population for all the subdomains, except in the hyperactivity scale. The increase in hyperactivity scores among the teenagers, though not significant, might be due to the higher physical activity level of students who practice SKY. This may be explained by increased energy levels one experiences practicing yogic techniques (Field, 2016). A significant difference in the emotional problems sub-domain was observed between the two groups. The percentage of students in abnormal category for the emotional problems sub-domain was lower for SKY group. The results indicate that SKY practice was associated with improved emotional stability in teens. The number of participants in abnormal category of peer-problems and conduct-issues subdomains were also low among SKY group students. Studies on brain functioning in adults show SKY improves mental and social well-being by creating a state of relaxed awareness (Zope & Zope, 2013). We also observed that 17.5% of the females in the control group had high scores in emotional issues sub-domain. However, amongst the SKY group only 8.4% females had high scores in that sub-domain. Due to hormonal imbalance and puberty, it's often seen that a large number of adolescents, especially girls, face difficulties in handling their emotions (Burnett et al., 2011). Both males and females in the SKY group have improved scores on the conduct issues sub-domain when compared to the control group. A study finding from the United States quoted enhanced social-emotional well-being in middle school students after experiencing Transcendental meditation (Valosek et al., 2019). An Australian study supported the benefits of guided meditation for children who had mental health challenges and showed improved outcomes for emotional issues, conduct problems, hyperactivity-inattention, and peer problems outcomes (Slaviero & Dip, 2017). A systematic review suggests improvement in cognitive performance, stress, resilience, and emotional problems domains with mindfulness based interventions (Zenner et al., 2014).

A quasi experimental study assessed the effects of week-long residential meditation retreat on adolescent's emotional functioning and self-regulation also discovered that adolescent who participated in the retreat showed improvement in their emotional functioning, depressive symptoms, positive affection, and gratitude (Galla, 2017). However, to implement such holistic practices in the school setting there requires reliable outcomes for the programs. A review that assessed evidence from 15 peer-reviewed studies on school based meditation workshops with respect to three outcomes: social competence, well-being, and academic achievement, quoted that transcendental meditation had a higher impact compared to other meditation programs. The authors also proposed that meditation increases student success by improving emotional regulation and cognitive functioning (Waters et al., 2015). Students studying in the United States rural high school, reported improved self-image and a greater respect for the body, after practicing yoga for a semester instead of physical education (Butzer et al., 2017).

In our study to assess the dose response, the SKY group was divided into two groups based on their frequency of practice: those who practiced more than four to five times/week and those who practice less than two to three times/week. It was also found that within the SKY group there was not a large impact of the frequency of practice however a statistical comparison could not be made between the two categories because of drastic difference in the population size.

Though the benefits of yoga and meditation are widely accepted very few schools in the Indian education have enabled the regular practice in the curriculum. Increase in stress levels due to competition and social pressure has created the need to explore holistic practices in Indian educational system in order to protect mental and emotional well-being of students.

Indian education system is rigorous and demanding. It caters to students from a wide variety of socio-economic backgrounds. Many students from rural India are first generation children in their family to receive formal education. From tribal areas to cosmopolitan cities, the diversity of students in Indian education system is astounding. This study was conducted in Bangalore which is a metro city in India, representative of most large cities in India, both culturally and socio-economically. Bangalore, known as silicon valley of India is similar to several international cities in the life style and attitudes of its inhabitants. The schools are known for their rigor and create students who go on to become successful global citizens. However this also comes with its drawbacks of creating extreme pressure on children to succeed and excel in a highly competitive environment. This creates strain on their mental health. Although awareness around adult mental health care is growing in India, teen mental health is still not given much importance. This is evident as a scientific database search on Yoga and youth in India generates 45% studies focussed on only cognitive benefits of yoga. Teen mental health is a grave concern (Chadda, 2018; Harikrishnan et al., 2017; Malla et al., 2018; Reddy, 2019) and our study, although cross-sectional, fills the gap in literature. It investigates the efficacy of a yoga based practice in a school setting on mental wellbeing and social health of the teens. The results indicate a favorable influence of SKY on the teen mental and social well-being. The results of the study can create opportunities for holistic techniques to be included at a larger scale in a school setting.

Limitations and future work

The study was a cross-sectional, one time self-reported assessment hence we cannot rule out any bias, that is, associated with self-reported assessments. This is a single point study, therefore no baseline data was collected before the intervention in the experimental or the control group. Further scope includes a study with pre post data collection to understand changes in mental well-ness of students after the intervention. The baseline data can present a better understanding regarding the role of intervention on improving in mental and social well-being among teenagers. The intervention can also be tested on the school staff for their mental, physical well-being, and better performance in the school. Lastly, to ensure reproducibility of the intervention, a larger study group needs to be considered.

Conclusion

The present study demonstrates a high correlation between the SKY technique and reduced stress, improved mental well-being and emotional stability among teenagers. Students are under constant pressure to excel, hence incorporating holistic practices like SKY in the education system can help teenagers cope with difficulties and improve their quality of life.

Authors' note

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List of abbreviations

1. SKY, Sudarshan Kriya Yoga
2. PSS, Perceived Stress Scale
3. SDQ, Strength and Difficulty Questionnaire


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