Original Article

Investigation of Yoga Pranayama and Vedic Mathematics on Mindfulness, Aggression and Emotion Regulation

Vasant Venkatraman Shastri, Alex Hankey, Bhawna Sharma[1], Sanjib Patra[2]

From the Division of Yoga and Physical Sciences, S-VYASA University, [2]Division of Yoga and Life Sciences, S-VYASA University, Bengaluru, [1]Department of Biology, Sri Sai Angels PU College, Chikmagalur, Karnataka, India

Abstract

Background: Competitive examinations, particularly in mathematics, have made emotional stress a major problem for preuniversity students, emotions like aggression toward fellow students and teachers increase. Mindfulness is a quality that reduces both emotional stress and aggression, so increasing mindfulness should be helpful. **Aims:** To study the effects of Yoga Pranayama (YP) and Vedic Mathematics (VM) on mindfulness, aggression, and emotion regulation. **Methods:** Participants were 12th graders attending a preuniversity college in Chikkamagaluru, India, of both genders. Exclusion criteria included major psychological problems. Three classes were arbitrarily assigned to one of three interventions, which consisted of 15 days each of 30 min daily instruction in YP, Group 1, VM, Group 2, or 30 min ordinary class work, Group 3, the control group. Assessments were made using the Mindfulness Attention Awareness Scale, the Nonphysical Aggression Scale from Pittsburgh Youth Study, and the Emotion Regulation Questionnaire. **Statistical Analysis Used:** SPSS 19.0. **Results:** Mindfulness, aggression, and negative emotional regulation changed significantly for the YP group, while mindfulness alone improved significantly for the VM group. No group changed on positive emotion regulation. Controls apparently improved on aggression. An interesting *post hoc* correlation analysis is also reported, among other things directly linking increased mindfulness to decreased aggression. **Conclusions:** The study showed positive effects of traditional methods of decreasing emotional pressure on students facing preuniversity mathematics examinations. Increasing mindfulness is considered a way of increasing emotion regulation, so the failure of this study to provide evidence for that is of interest.

Keywords: *Aggression, emotion regulation, mindfulness, Pranayama, Yoga*

Introduction

In recent years, stress has become a major factor affecting lives of children facing competitive professional examinations in the years before university.[1] This may be due to monotonous book-based teaching methods, which have created learning difficulties in education.[2] Mathematics is a subject that many students find very challenging and which can increase students' reported levels of stress[3] more than other subjects. Most high paid private sector jobs like basic engineering or other professional degrees require mathematics as a major subject. These circumstances have made emotional stress a major problem for students attempting to enter the college or university course of their choice.[4] Frustration can lead to increase in aggression[5] toward teachers and fellow students, and other antisocial behavior patterns.[6] In schools, competitive professional examinations select those entering higher education for various professions. Today, they put new pressures and workloads on schoolchildren that some even argue to be unnecessary. Reducing the effects of such pressures is a matter of national urgency.

The concept of mindfulness comes from the Pali concept of *sati*,[7] i.e., being aware of one's stream of consciousness, thinking patterns, and associated tendencies to action in the present moment.[8] Recent years have seen the publication of many studies on the quality of mind known as mindfulness[9] including studies of mindfulness training in schools.[10] Attempts have been made to design mindfulness-based education programs to improve the quality of teaching and learning.[11] Mindfulness is said to reduce aggression[12] and improve emotion regulation.[13,14] This study reports effects of two easily applied methods, Yoga Pranayama (YP) and Vedic Mathematics (VM), aiming to decrease

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Shastri VV, Hankey A, Sharma B, Patra S. Investigation of yoga pranayama and vedic mathematics on mindfulness, aggression and emotion regulation. Int J Yoga 2017;10:138-44.

Received: July, 2016. **Accepted:** September, 2016

Address for correspondence:
Mr. Vasant Venkatraman Shastri, S-VYASA, No. 19, Eknath Bhawan, Gavipuram Circle, K. G. Nagar, Bengaluru - 560 019, Karnataka, India.
E-mail: vasanthvshastri@gmail.com

Access this article online

Website: www.ijoy.org.in

DOI: 10.4103/0973-6131.213470

Quick Response Code:

© 2017 International Journal of Yoga | Published by Wolters Kluwer - Medknow

emotional stress and aggression and increase mindfulness in preuniversity students facing competitive entrance examinations particularly in mathematics. An integrated Yoga intervention including Yoga postures, breathing exercises, and relaxation which have been reported to improve both mindfulness and emotional balance,[15] as well as cognitive performance,[16] but to our knowledge, the effect of teaching mathematics according to the methods of VM has not been studied in this context nor have the effects of YP alone been evaluated for effects on mindfulness.

Yoga Pranayama

Pranayama is the fourth of the eight limbs of Yoga[17] and has a deeply settling influence on the mind[18] helping the subject be in the present, i.e., "mindful." It is, therefore, widely employed as a preparation for meditation.[8] It enlivens prana, or "subtle energy" in the tissues, now measured electrically at acupuncture points.[19] Its settling influence has been confirmed by such observations as test anxiety reduction, improved test performance,[20] and perceived stress reduction and improvement in cardiovascular parameters;[21,22] it also reduces aggression.[23] These results suggest that application of pranayama methods to decrease effects of stress in society might prove valuable. Teaching them in schools would make a highly beneficial life-long skill available[24] just as mindfulness-based interventions (MBI) are seen as achieving.[10]

Hence, so many studies have been published on various pranayama programs that its effects may be considered quite well standardized. It can be used as a comparison for another method requiring assessment for comparative effects. In this context, YP represents a recognized way of managing mild levels of stress, and so improving emotion regulation and decreasing tendencies to aggression. In particular, pranayama practice usually involves focusing on the breathing process bringing the mind to the present moment. Improving that ability will clearly be of value when taking tests and exams.

Vedic Mathematics

VM[25] presents a new method of problem-solving in high school mathematics comprising 16 sutras and 16 upasutras, which have been much appreciated wherever they have been applied.[26] According to Charak (2002) (Quoted on back cover of Glover [2005]), "They make arduous mathematical situations look terribly simple to solve. I have taught … the principles … to my students in B.Ed. classes. They found the techniques extremely simple, less time consuming, and less likely to lead to mistakes."[26] We have found that they offer students choice when performing calculations, thus introducing a "fun" element and increasing student enthusiasm. As a result, mathematics teachers in many different countries have extended their applications.[27]

The system's ability to empower students to choose how to perform calculations means that students can select their preferred method in arithmetic, algebra, geometry, etc. Its use helps to develop students' confidence and basic problem-solving abilities. Visualizing pictorial or algebraic patterns to solve problems increases students' enjoyment of the process.[28] Problem-solving calculations become a game.

This approach of VM allows teachers to give detailed reasons for the success of each method. In our estimate, a mature approach teaches VM not as a set of magical tricks but as teaching aids to communicate deeper aspects of a problem's structure and solution. In short, enabling students to visualize how and why each method works, resulting in added understanding, and increased confidence when faced with exam questions. A previously submitted paper has reported reductions in mathematics anxiety (Impact of Pranayama and VM on Math Anxiety and Cognitive Skills, submitted for publication). On this basis, we hypothesized that using VM would improve mindfulness and emotional regulation and reduce aggression in school students, particularly those in 11th and 12th grades.

Methods

Participants

Three classes totaling 243 students studying in 12th Standard at Sri Sai Angels Preuniversity College, Chikkamagaluru, India, were arbitrarily assigned to YP group (YP – 73 students), VM group (VM – 80 students), and control group (CG – 90 students).

Design

Three group, pre–post control design [Figure 1].

Data extraction

Pencil and paper tests on Mindfulness Attention Awareness Scale (MAAS), Nonphysical Aggression Scale from Pittsburgh Youth Study and Emotion Regulation Questionnaire (ERQ) as described below were given at baseline and after the 15-day intervention workshops.

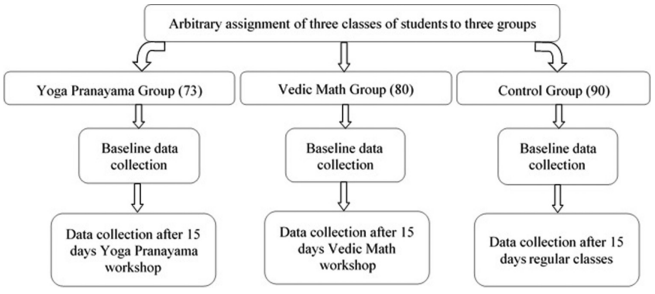

Figure 1: Three classes of 12th grade preuniversity students were arbitrarily assigned to one of three interventions: Yoga Pranayama, Vedic Mathematics, and Controls. Baseline data were collected following which the respective intervention was given for 15 days to each group. Postdata were collected after the intervention

Interventions

Students in the YP and VM groups participated in half hour workshops on their respective topics every day for 15 days [Table 1]. Controls had their usual conventional mathematics classwork routine, whereas the first two groups received respective workshops in addition to that. All three groups' workshops/classes were taken by the first author who is fully qualified to instruct in all these subjects. Comparison of conventional mathematics methods and VM methods is shown in the Appendix.

The YP intervention workshops were conducted with students in a comfortable sitting position. The first two are technically Yoga purification exercises (Kriyas), while the third, Sectional Breathing, is closely related to certain Western approaches to improve the quality of breathing. The next three are classic YPs found in classic texts (Hatha YP, Nagendra, 2003) as is the more demanding final exercise, Bhramari Pranayama, in which eyes, ears, and mouth are covered by fingers.

In the VM intervention workshops, standard topics in 11th and 12th grade mathematics syllabus were taught according to standard VM procedures. Table 1 displays representative examples, details of three are set out in the Appendix. The first employs "vertically and crosswise" to solve an example of simultaneous equations. The second simplifies integration of a reciprocal quadratic function (factorizable) using "transpose and apply." The third example offers a multiple choice question on integrating reciprocal quadratic functions that cannot be factorized.

Table 1: Intervention

Yoga Pranayama and breathing exercises (Kriya)	Vedic Mathematics rules and topics taught
Bhastrika-Kriya	One more than one before squaring, cubing
Kapalabhati Kriya	Vertically and crosswise, addition and subtraction, transpose and apply multiplication, determinants, simultaneous equations
Sectional breathing, abdominal breathing, thoracic breathing, upper lobar breathing, full yogic breathing	Proportionately, by alternate elimination and retention, the first by the first and last by the last factorization
Chandra anuloma viloma, surya anuloma viloma pranayama	Paravartya partial fractions, conics
Nadi Shuddi-alternate nostril breathing	Differential calculus
	Integration and quadratic equation
Bhramari	Addition and subtraction, the first by the first and last by the last, by alternate elimination and retention
	Highest common factors

This represents the most difficult kind of problem in this level of mathematics in India since it requires understanding functions such as inverse hyperbolic functions that are less familiar to the student. Even good students incur conceptual problems, time loss, and errors when attempting these problems. In the workshops, VM sutras, "vertically and crosswise," "transpose and apply," and "addition and subtraction," were all separately utilized in demonstrating alternative approaches to solving simultaneous equations, emphasizing the choice now being offered to students. Integration of reciprocal quadratic functions requires closer inspection and use of recommended VM time-saving patterns.

Assessment instruments used

Mindfulness attention awareness scale

The MAAS instrument[29] is a single-factor 15-item questionnaire. Total score on its six-point scale (1 = almost always to 6 = almost never) can vary from 15 to 90, but normal scale score is taken as the average over the 15 items. Higher scores reflect higher levels of dispositional mindfulness. Researchers report MAAS reliability in university samples as 0.82.[29] The instrument has been validated in college, community adults, and cancer patient populations in different studies.[30,31] Mindfulness as measured by the MAAS is held to connect consciousness to emotional regulation, behavior regulation, and well-being.

Nonphysical aggression scale from Pittsburgh youth study

The Nonphysical Aggression Scale from Pittsburgh Youth Study[32,33] measures the nonphysical aggressive behavior of children, validated by a longitudinal study of 1517 inner-city boys in Pittsburgh, Pennsylvania, starting from 1987. The study regularly measured risk factors involved in disruptive, delinquent, drug-related, and antisocial behavior of adolescent and preadolescent boys in the beginning, and on half yearly assessment, and later extended assessments to include the female population.[34,35]

Nonphysical Aggression Scale is 16 items of measuring nonphysical aggressive behaviors, such as arguing, bragging, seeking attention, disobeying parents or teachers, not getting along with others, swearing, and sulking. It has Internal Consistency 0.85 on a sample of 6-, 9-, and 12-year-old males followed into adulthood. Its 3-point scale ranges from 0 = not true to 2 = very true.

Emotion regulation questionnaire

The ERQ[36] consists of 10 items on a 7-point scale (1 = strongly disagree to 7 = strongly agree). It measures two important aspects of emotion such as emotional experience and emotional expression, both pointing to control and management of emotion. Questions concerning positive and negative emotions assess individual differences connected to cognitive reappraisal and expressive suppression. Average

value of Cronbach's alpha is 0.79 for reappraisal and 0.73 for suppression. Test–retest reliability was 0.69 for both the scales. Reappraisal items are nos. 1, 3, 5, 7, 8, 10 and suppression items are numbers 2, 4, 6, 9. Scale scores are obtained by adding response values for each item on that scale.

Statistical analysis

IBM SPSS Statistics for Windows, Version 19.0, manufactured by IBM Corporation, Armonk, NY, was used to analyze data. The data were found to be normally distributed, so preliminary group comparisons were RM ANOVAs with *post hoc* Bonferroni correction for each of the four scales. Since this was found statistically significant, the predata for the three groups were compared and found not to be statistically significantly different on any of the tests. Next, paired sample *t*-tests were used to compare pre–post within group differences, and then group time interaction tests were used to compare differences between experimental and control groups.

Results

Demographic variables and age were not significantly different for the three groups. The RM ANOVAs were statistically significant for the tests of mindfulness, F (2, 240) = 19.88, $P < 0.001$, and aggression, F (2,240) = 14.49, $P < 0.001$, but not for either positive or negative ERQ scales. Experimental results are set out in Tables 2 and 3. Table 2 presents pre- and post-intervention values of the three groups on the four different scales, giving statistical significance of within-group pre–post differences. Table 3 sets out between-group comparisons of Table 2's within-group differences, i.e., group-time interaction effects, giving their significances, as explained in Table 3 caption. Table 2 shows that mindfulness, aggression, and negative emotion regulation changed significantly for the YP group ($P \leq 0.001$ for mindfulness and aggression; $P \leq 0.028$ for negative emotion regulation), while for the VM group, only mindfulness improved significantly, $P \leq 0.001$ [Table 2 and Figure 2], though changes in aggression may have showed a weak trend toward improvement ($P = 0.15$). No group changed significantly on positive emotion regulation. Controls seemed to improve on aggression, $P \leq 0.030$ (paired sample *t*-test) [Table 2 and Figure 3]. Effect sizes (Cohen's d) were for the YP group, 0.93 (mindfulness), 0.78 (aggression), and for the VM group, 0.29 (mindfulness).

Table 3 shows Group-Time interaction differences and significances. Mindfulness and aggression changed significantly more for the YP group than for VM and control groups, $P \leq 0.001$ [Figure 4a and b], but within-group changes on positive and negative emotion regulation scores were not significantly different between the three groups.

Discussion

Reported results are not entirely as hypothesized. The YP group performed best overall on the tests, possibly because the sequence of YP practices settles the mind and may bear some similarity to MBI. The VM group was observed to increase by a small amount in mindfulness with high significance but was not observed to decrease significantly in aggression as had been hypothesized. Increased confidence in

Table 2: Pre- and post-values of the variables

Test	Group								
	Yoga Pranayama (73)			Vedic Mathematics (80)			Controls (90)		
	Pre	Post	*t*	Pre	Post	*t*	Pre	Post	*t*
Mindfulness	57.85±9.45	67.75±11.52***	−8.72	56.50±11.72	60.19±13.56***	−3.92	60.39±10.96	61.53±11.87	−1.23
Aggression	11.64±4.31	8.4±4.03***	7.29	11.53±4.34	11.01±4.55	1.50	11.18±3.96	10.39±4.3*	2.21
Emotion regulation (positive)	27.18±5.77	26.48±6.59	0.62	29.53±5.67	28.73±6.10	1.09	27.64±5.67	27.23±5.37	0.61
Emotion regulation (negatives)	18.77±4.5	17.51±4.88*	2.24	20.25±4.60	19.84±4.58	0.80	18.53±5.28	18.39±5.34	0.30

Table 2 presents mean, SD and significances of within-group changes for the three groups. Significance values are indicated by ***$P \leq 0.001$, *$P \leq 0.05$. SD=Standard deviation

Table 3: Within-group differences and significances of between-group comparisons

Test	Group		
	Yoga Pranayama	Vedic Mathematics	Control
Mindfulness	9.88±9.77***	3.69±8.40***	1.14±8.82***
Aggression	−3.28±3.82***	−0.51±3.16***	−0.79±3.39***
Emotion regulation questionnaire (positive)	−0.44±6.7	−0.8±6.56	−0.41±6.42
Emotion regulation questionnaire (negative)	−1.26±4.79	−0.41±4.62	−0.14±4.6

Table 3 presents group time interactions, i.e., changes in means (post-pre) and their SDs for the three study groups together with the significances between groups. Significance values are indicated by ***$P \leq 0.001$. Those under Vedic Mathematics are significance of differences with the Yoga Pranayama group while those under controls are also significances with the Yoga Pranayama group. For none of the four variables did the differences between the Vedic Mathematics and control groups reach significance. SD=Standard deviation

a single subject, mathematics, may not necessarily translate into decreases in self-reported feelings of aggression, particularly as the learning environment did not change for teaching other subjects, and the learning environment has been found to be a significant factor in stress generation.[37]

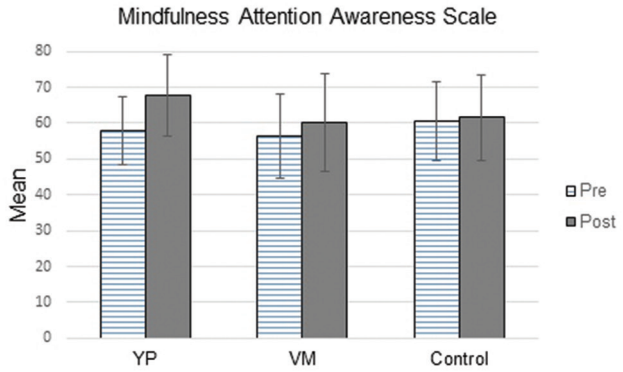

Figure 2: Shows Mindfulness Attention Awareness Scale pre–post mean scores with a significant increase in Yoga Pranayama and Vedic Mathematics ($P \leq 0.001$) groups. All bars and attached error lines represent means ± standard deviations

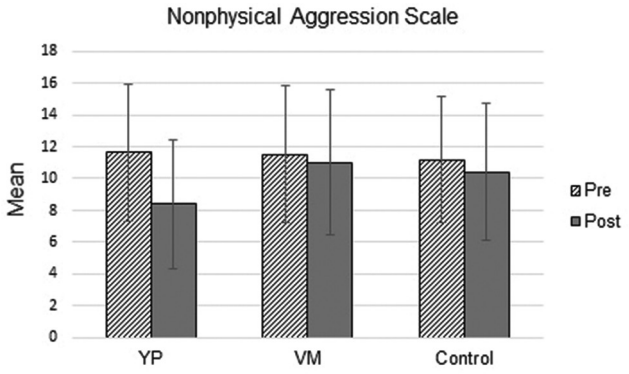

Figure 3: Depicts pre- and post-mean scores of the three study groups on the Nonphysical Aggression Scale from Pittsburgh Youth Study. All bars and attached error lines represent means ± standard deviations. Decreases for Yoga Pranayama (−3.25, $P \leq 0.001$) and Control (−0.79, $P = 0.030$) groups attained reportable significance, $P \leq 0.05$

A possible reason for the observed increase in mindfulness in the VM group may be that giving students choice of how to perform calculations enhances their ability to reflect internally on their own preferences, thus increasing their capacity for a more internally directed orientation of awareness. It can also be argued that adding a fun element to the learning process involving pattern recognition, a right hemisphere activity,[38] may have improved participants' capacity for being in the present moment.[39] Another possible reason is that reductions in mathematics anxiety may make mindfulness easier to maintain.

The YP group improved far more in mindfulness than the other two groups ($P = 0.0001$ in both cases), and alone decreased highly significantly in aggression and significantly on negative emotion regulation. Several studies have reported increases in emotional regulation resulting from mindfulness training.[40] For one group to both increase in a measure of mindfulness and decrease in aggression and negative emotion is consistent with these results. In support of this, Yoga, including nadi-shodana pranayama as used in this study, has been found to be very effective in changing the levels of key endocrine molecules associated with stress such as epinephrine and norepinephrine.[41] This may explain its effectiveness in decreasing self-reported aggression on the Nonphysical Aggression Scale from Pittsburgh Youth Study.

The observed effect of YP on mindfulness is important. Although the practice is not specifically designed to increase mindfulness, it is extremely calming and centering for participants' awareness, and evidently increases mindfulness as a beneficial side effect.[8] Further studies of this could prove helpful.

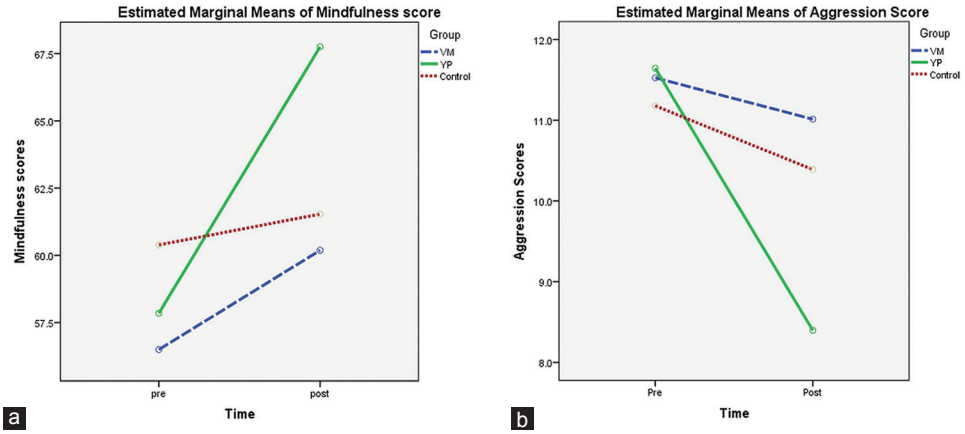

Figure 4: (a) Group-time interaction effects on mindfulness scores. At time 1, i.e., pre, all the three groups are not significantly different from each other on mean mindfulness scores. At time 2, i.e., post, Yoga Pranayama group is significantly higher on mean mindfulness score from Vedic Mathematics ($P = 0.001$) and control ($P = 0.005$) groups. (b) Group-time interaction effects on Nonphysical Aggression scale. At time 1, i.e., pre, all the three groups are not significantly different from each other on mean aggression scores. At time 2, i.e., post, Yoga Pranayama groups mean aggression score is significantly lower from Vedic Mathematics ($P = 0.001$) and control ($P = 0.011$) groups

Yogic *Kapalabhati Kriya* washes away carbon dioxide and increases oxygen concentration, also revitalizes the functions of brain cells. *Nāḍī Śuddhi* brings sympathetic and parasympathetic balance in the nervous system and balance in anabolic and catabolic processes which would lead to clarity of mind and concentration.[17] Hence, this could be the reason to find the overall improvement in YP group.

In contrast, controls' observed decrease in aggression seems anomalous. When 12 group comparisons are made in a single study, one change reaching $P < 0.05$ by chance is not unusual.

As regards possible connections between MAAS measured mindfulness and emotion and behavior regulation, we performed various correlations between premeasurements of our 243 participants in a *post hoc* analysis. Correlations between mindfulness and aggression reached significance, Pearson's $r = -0.45$, $P < 0.0001$, for prevalues, with similar values for postvalues, while those between prevalues of mindfulness and negative ERQ were $r = -0.214$, $P = 0.001$, while postvalues showed $r = -0.236$, $P = 0.001$. While the first is clearly expected, the second result is interesting in that those with higher scores on mindfulness felt less need to hide negative feelings, possibly indicating that their general levels of negativity were less and equally that negative feelings may block mindful awareness.[42] The same might also be said about the first correlation, those with high levels of outward aggression, presumably originating in internal frustration, may be less capable of being in present moment states of mindfulness.[12]

However, a similar analysis of correlations between the ERQ positive and ERQ negative scales yielded extraordinary results: Pearson's $r = 0.24$, $P < 0.0002$, prevalues, and $r = 0.35$, $P < 0.0001$ postvalues. Positive correlations between supposedly independent scales, even correlations of this magnitude, are not to be expected. The interpretation of this correlation is difficult but may mean that the test needs revalidation in India, where English may not be English speakers' mother tongue.

The strengths of the study include the number of participants for pre–post within group changes and intergroup comparisons. Moreover, it specifically supports the idea that YP can improve participants' quality of mindfulness[8] and help in students' management of aggression issues.[23] The main weakness was the assignment of participants to groups by an arbitrary choice of which class took which intervention, rather than by a fully randomized assignment to different groups. Although the latter would have made the study technically superior, each class was naturally heterogeneous and had similar baseline sociodemographic characteristics; there is no reason to believe that it would have changed the overall findings and conclusions.

Results of the study were sufficiently promising to encourage further research, particularly in light of the measurements on mathematics anxiety and other variables (submitted for publication). It is hoped that funds for larger, fully randomized studies will be forthcoming.

Conclusions

While VM has been found highly effective in enhancing 12th grade exam results, it seems less effective on variables reported in this study. YP techniques, on the other hand, could be useful in schools and preuniversity colleges to produce more settled states of mind such as those associated with mindfulness and also to reduce symptoms of aggression that seem to result from examination pressures during the 12th grade year of high school/ preuniversity college when such stressors are at their peak.

Acknowledgment

We would like to thank Sri Sai Angels School for providing subjects, place, and equipment to carry out the study. Authors would like to acknowledge Mr. Manjunath BS for technical support during data collection.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kadapatti MG, Vijayalaxmi AH. Stressor of academic stress – A study on pre-university students. Indian J Sci Res 2012;3:171-5.
2. Penso S. Pedagogical content knowledge: How do student teachers identify and describe the causes of their pupils' learning difficulties? Asia Pac J Teach Educ 2002;30:25-37.
3. Geist E. The anti-anxiety curriculum: Combating math anxiety in the classroom. J Instrum Psychol 2010;37:24-31.
4. Spangler G, Pekrun R, Kramer K, Hofmann H. Students' emotions, physiological reactions, and coping in academic exams. Anxiety Stress Coping 2002;15:413-32.
5. Gustafson R. Frustration and successful vs. unsuccessful aggression: A test of Berkowitz' completion hypothesis. Aggress Behav 1989;15:5-12.
6. Veenstra R, Lindenberg S, Oldehinkel AJ, De Winter AF, Ormel J. Temperament, environment, and antisocial behavior in a population sample of preadolescent boys and girls. Int J Behav Dev 2006;30:422-32.
7. Wikipedia. Available from: https://www.en.wikipedia.org/wiki/Sati_(Buddhism). [Last updated on 2016 Jun 01; Last cited on 2016 Jul 06].
8. Brown RP, Gerbarg PL. Yoga breathing, meditation, and longevity. Ann N Y Acad Sci 2009;1172:54-62.
9. Raski MP. Mindfulness: What it is and how it is impacting healthcare. UBC Med J 2015;7:56-9.
10. Felver JC, Celis-de Hoyos CE, Tezanos K, Singh NN. A systematic review of mindfulness-based interventions for youth in school settings. Mindfulness 2015;7:34-45.
11. Schonert-Reichl KA, Lawlor MS. The effects of a

mindfulness-based education program on pre- and early adolescents' well-being and social and emotional competence. Mindfulness 2010;1:137-51.
12. Borders A, Earleywine M, Jajodia A. Could mindfulness decrease anger, hostility, and aggression by decreasing rumination? Aggress Behav 2010;36:28-44.
13. Lutz J, Herwig U, Opialla S, Hittmeyer A, Jäncke L, Rufer M, *et al.* Mindfulness and emotion regulation – An fMRI study. Soc Cogn Affect Neurosci 2014;9:776-85.
14. Hülsheger UR, Alberts HJ, Feinholdt A, Lang JW. Benefits of mindfulness at work: The role of mindfulness in emotion regulation, emotional exhaustion, and job satisfaction. J Appl Psychol 2013;98:310-25.
15. Sauer-Zavala SE, Walsh EC, Eisenlohr-Moul TA, Lykins EL. Comparing mindfulness-based intervention strategies: Differential effects of sitting meditation, body scan, and mindful yoga. Mindfulness 2013;4:383-8.
16. Saoji A, Mohanty S, Vinchurkar SA. Effect of a single session of a yogic meditation technique on cognitive performance in medical students: A Randomized Crossover Trial. J Relig Health 2016. Available from: http://link.springer.com/article/10.1007%2Fs10943-016-0195-x. [Last cited on 2016 Oct 23].
17. Nagendra HR. Pranayama. Bangalore: Swami Vivekananda Yoga Prakashana; 2005.
18. Burke A, Marconett S. The role of breath in yogic traditions: Alternate nostril breathing. Biofeedback 2007;36:67-9.
19. Sharma B, Hankey A, Nagendra HR, Meenakshy KB. Inter-operator variability of electrodermal measure at Jing Well points using AcuGraph 3. J Acupunct Meridian Stud 2014;7:44-51.
20. Nemati A. The effect of pranayama on test anxiety and test performance. Int J Yoga 2013;6:55-60.
21. Sharma VK, Trakroo M, Subramaniam V, Rajajeyakumar M, Bhavanani AB, Sahai A. Effect of fast and slow pranayama on perceived stress and cardiovascular parameters in young health-care students. Int J Yoga 2013;6:104-10.
22. Sivapriya DV, Suba Malani S, Thirumeni S. Effect of nadi shodhana pranayama on respiratory parameters in school students. Recent Res Sci Technol 2010;2:32-9.
23. Deshpande S, Nagendra HR, Raghuram N. A randomized control trial of the effect of yoga on verbal aggressiveness in normal healthy volunteers. Int J Yoga 2008;1:76-82.
24. Khalsa SB, Hickey-Schultz L, Cohen D, Steiner N, Cope S. Evaluation of the mental health benefits of yoga in a secondary school: A Preliminary Randomized Controlled Trial. J Behav Health Serv Res 2012;39:80-90.
25. Tirthaji BK. Agrawala VS, editor. Vedic Mathematics. Delhi, India: Motilal Banarsidass; 1992.
26. Glover JT. Vedic Mathematics for Schools Book. 1st ed., Vol. 3. Delhi: Motilal Banarsidass; 2005.
27. Williams K. Vedic Mathematics Teacher's Manual. Revised Edition. Castle Douglas, Scotland: Inspiration Books; 2009.
28. Zazkis R, Liljedahk P. Generalization of patterns: The tension between algebraic thinking and algebraic notation. Educ Stud Math 2002;49:379-402.
29. Brown KW, Ryan RM. The benefits of being present: Mindfulness and its role in psychological well-being. J Pers Soc Psychol 2003;84:822-48.
30. Carlson LE, Brown KW. Validation of the mindful attention awareness scale in a cancer population. J Psychosom Res 2005;58:29-33.
31. Brown KW. Mindful Attention Awareness Scale (MAAS), Trait Version. Virginia Commonwealth University. p. 1-5. Available from: http://www.kirkwarrenbrown.vcu.edu/wp-content/scales/MAAStraitresearch-ready+intro.pdf. [Last cited on 2016 Jul 05].
32. Loeber R, Farrington DP, Stouthamer-Loeber M, Van Kammen WB. Antisocial Behavior and Mental Health Problems: Explanatory Factors in Childhood and Adolescence. Reprint. Mahwah, NJ: Psychology Press; 1998.
33. Dahlberg LL, Toal SB, Swahn M, Behrens CB. Measuring Violence-Related Attitudes, Behaviors, and Influences among Youths: A Compendium of Assessment Tools. 2nd ed. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2005. p. 184-5. Available from: http://www.cdc.gov/violenceprevention/pdf/yv_compendium.pdf. [Last cited on 2016 Jul 06].
34. Loeber R, Farrington DP, Stouthamer-Loeber M, Moffitt TE, Caspi A, Lynam D. Male mental health problems, psychopathy, and personality traits: Key findings from the first 14 years of the Pittsburgh Youth Study. Clin Child Fam Psychol Rev 2001;4:273-97.
35. Loeber R, Stouthamer-Loeber M, Farrington DP, Lahey BB, Keenan K, White HR. Editorial introduction: Three longitudinal studies of children's development in Pittsburgh: the Developmental Trends Study, the Pittsburgh Youth Study, and the Pittsburgh Girls Study. Crim Behav Ment Health 2002;12:1-23.
36. Gross JJ, John OP. Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. J Pers Soc Psychol 2003;85:348-62.
37. LePine JA, LePine MA, Jackson CL. Challenge and hindrance stress: Relationships with exhaustion, motivation to learn, and learning performance. J Appl Psychol 2004;89:883-91.
38. Roser ME, Fiser J, Aslin RN, Gazzaniga MS. Right hemisphere dominance in visual statistical learning. J Cogn Neurosci 2011;23:1088-99.
39. Ostafin BD, Kassman KT. Stepping out of history: Mindfulness improves insight problem solving. Conscious Cogn 2012;21:1031-6.
40. Hayes AM, Feldman G. Clarifying the construct of mindfulness in the context of emotion regulation and the process of change in therapy. Clin Psychol Sci Pract 2004;11:255-62.
41. Selvamurthy W, Sridharan K, Ray US, Tiwary RS, Hegde KS, Radhakrishan U, *et al.* A new physiological approach to control essential hypertension. Indian J Physiol Pharmacol 1998;42:205-13.
42. Garland EL, Hanley A, Farb NA, Froeliger BE. State mindfulness during meditation predicts enhanced cognitive reappraisal. Mindfulness (N Y) 2015;6:234-42.