SENSE, 2014, Vol. 4 (4), 7-13

UDC: 233.852.5Y: 616.2
Original Scientific Paper

Development of a simplified yogic measure (*bhramari* time) of lung function in normal children - a correlational study

Vikas Rawat[1], Rajesh S.K., Raghuram Nagarathna
University Vivekananda
Bangalore, India

Abstract: *Yoga being accepted for use in schools there is a need for developing a scientifically acceptable standardized tool to assess the progress of their practices that can be used in yoga classes for children. The present study was designed to validate the acceptability of bhramari time (BHT) by checking its correlation with Peak expiratory flow rate (PEFR) in healthy South Indian Children. Three hundred and eighty six healthy school children who attended yoga based Personality Development Camp were recruited for the study. Sample consist of 229 males and 157 females with a mean age of 12.78 years (SD=1.69). Anthropometric measurements, BHT and PEFR were recorded. As hypothesized, BHT was significantly and positively correlated with PEFR (r=.35, p<0.01), Height (r=.29, p<0.01), Weight(r=.17, p<0.01) and Age (r=.22, p<0.01). Our study suggests that BHT can be recommended for use in mass camps as an acceptable scientifically validated yogic tool in young population to assess the progress of their practices in each class.*

Key words: *yoga, bhramari time, lungs function*

Introduction

Yoga in its original form consists of a system of physical, psychological and ethical practices; although of ancient origin, it transcends cultures and languages (Nagarathna, Nagendra, 2001). The popularity of yoga is evident with emerging interest and research in the therapeutic applications of yoga in prevention and management of psycho-physical conditions. Further, estimated prevalence of practicing Yoga has doubled from 1997 to 2002, corresponding to 10.4 million adults in the U.S (Barnes, Powell-Griner, McFann, Nahin, 2004). Recent studies suggest that implementation of yoga is acceptable and feasible in a secondary school setting and has the potential of playing a protective or preventive role in maintaining mental health (Khalsa et al, 2012). Further, findings suggest that a school-based yoga intervention is acceptable to youth, teachers, and school administrators in serving chronically stressed and disadvantaged youth (Mendelson et al, 2010). Research literature suggests that yoga improves children's physical and mental well-being as it helps them improve their resilience, mood, and self-regulation skills pertaining to emotions and stress (Hagen, Nayar, 2014).

Furthermore, yoga training improves lung function, strength of inspiratory and expiratory muscles as well as skeletal muscle strength and endurance of students (Mandanmohan, Jatiya, Udupa, Bhavanani, 2003). Several studies have shown that regular yoga practice increases the vital capacity, timed vital capacity, maximum voluntary ventilation, breath holding time and maximal inspiratory and expiratory pressures (Vedala, Mane & Paul, 2014). Yoga training has shown positive effect on improving lung function and exercise capacity in patients with chronic obstructive pulmonary disease (Raub, 2002). Pulmonary

[1] Corresponding author: vikasrawat.svyasa@gmail.com

functions and diffusion capacity in patients of bronchial asthma before and after yogic intervention has shown increased respiratory stamina (Soni, Singh, Munish, Singh, 2012).

Measurements of ventilator function is useful for assessment of physical fitness in children and adults and also for diagnosis and follow up during management of conditions with increased airway resistance, such as asthma, chronic bronchitis, and emphysema (Petty, 2006). Peak expiratory flow rate (PEFR) which is a measure of the maximum flow achieved during an expiration delivered with maximal force starting from the level of maximal lung inflation (Pedersen, 1997) recording is an essential measure in the evaluation of ventilator function. Various types of instruments including hand held mini PFR meters are available to measure PEFR (Holcroft, Eisen, Sama, Wegman, 2003). A simple, but reliable, method of measuring the ventilator function of the lungs has long been sought.

Yoga lays emphasis on manipulation of breath movement (*Pranayama*), which contributes to positive neurophysiologic responses (Vialatte, Bakardjian, Prasad, Cichocki, 2009). Yoga breathing exercises, as an adjunct treatment improves pulmonary functions in both normal volunteers (Mandanmohan, Jatiya, Udupa, Bhavanani, 2003) and in patients with bronchial asthma (Vedala, Mane & Paul, 2014). Yogic breathing technique called *Bhramari* Pranayama (Bhpr), engages in producing a pulsating constant low pitch sound imitating the buzzing of female bumble bee (Rajesh, Ilavarasu, Srinivasan, 2014).

With yoga being accepted for use in schools there is a need for developing a scientifically acceptable standardized tool to assess the progress of their practices that can be used in yoga classes for children that keeps their interest going. Bhramari time that involves measuring the slow exhalation time while making a low pitched humming sound like that of a female honey bee has been used in our yoga based personality camps for children and adults over many years as a tool to assess the progress of the practices. The present study was designed to validate the acceptability of bhramari time by checking its correlation with PEFR in healthy South Indian Children.

Methods

Participants

Three hundred and eighty six healthy school children who attended yoga based Personality Development Camp in summer holidays in the serene campus of SVYASA University, Bengaluru were randomly selected from a pool of 625 children. Children with a history of asthma, a recent history of respiratory infection with or without persistent cough within the past two weeks and those with any major disability or illness were excluded from the study. Participants in this study had no formal training in yogic techniques.

Consent and ethical clearance

Signed informed consent was obtained from the parent or guardian of the child at the time of registration after they had read the proposal of this simple non interventional study that involves non invasive data collection. All procedures were reviewed and accepted by the institutional ethical committee of SVYASA University. The children were explained in detail about the nature of the study and the voluntary nature of participation and were not provided with any incentives for their participation.

Measurements

Demographic data

The weight (KG) was recorded using a standard electronic weighing scale. The participants were asked to remove as much outerwear as possible. Further they were asked to remove the shoes and step up onto the weighing scale and stand still over the center of the scale with body weight evenly distributed between both feet. Standing height (cm) was measured without shoes and without traction using standard scale.

Procedure for bhramari time measurement

The procedure was performed in a spacious room during the morning hours between 9 AM to 11 AM in the month of April Between third to fifth days after the inauguration of the camp. *Bhramari* breathing technique: The term *Bhramari* is Sanskrit word signifies a female bee. This is a pranayama technique wherein after a deep inhalation the participant exhales through the nasal airways with the mouth closed, emulating the buzzing of bumblebees in a constant low pitch (Rajesh, Ilavarasu & Srinivasan, 2014). Subjects sat on a comfortable cushion on the floor of the experimental room, in a crossed leg posture keeping the spine erect, with eyes-closed and practiced three rounds of bhramari pranayama which was taught to them in the classes on pranayama for three days before the child was taken up for the study. The purpose and technique of the *Bhramari breathing time* was explained to the child followed by demonstration of the correct manner of performing. They were closely observed to ensure that they maintained the procedure correctly. Three trials were performed and the time duration of the exhalation was measured using a stop watch. The best of the three readings was taken as the final Bhramari Time (BHT).

Procedure for PEFR Measurement

A mini PEFR meter (Clement Clarke) was used to check the PEFR of these children. The purpose and technique of performing PEFR was explained along with a demonstration of the correct manner of performing the test. When subjects had understood the method and were able to perform correctly, they were made to give the test in the standing position. They were closely observed to ensure that they maintained an airtight seal between their lips and the mouthpiece of the instrument (Holcroft, Eisen, Sama, Wegman, 2003). The highest value of the three readings was recorded as the final PEFR value.

Data analysis

All statistical analyses were performed using the Statistical Package for Social Sciences (version 16.0). Pearson correlations were used to examine the association between height, weight, PFR and BHT. Independent-samples t-tests were performed to compare groups.

Results

Three hundred ninety one subjects who satisfied the inclusion and exclusion criteria included in the study. Five students were excluded due to missing data. Final sample consist of 229 males and 157 females. Table I shows detail demographic profile. Participants age ranged from 9 to 16 years with a mean age of 12.78 years (SD=1.69). Table II gives Distribution of Weight, Height, Peak Expiratory Flow Rate (PEFR) and Bhramari Time (BHT) in different Age groups. BHT, PEFR, height and weight increased progressively with age. Table III shows the zero-order correlations on all variables. As hypothesized, BHT was significantly and positively correlated with PEFR ($r=.35$, $p<0.01$), Height ($r=.29$, $p<0.01$), Weight($r=.17$, $p<0.01$) and Age ($r=.22$, $p<0.01$). Further, PEFR had significant positive correlation with Height ($r=.64$, $p<0.01$), Weight ($r=.53$, $p<0.01$) and Age ($r=.53$, $p<0.01$).

Independent-samples t-tests were performed to determine whether statistically significant differences existed in height, weight, PFR and BHT between boys and girls. Table IV shows the gender differences. The average values of BHT for all age groups ranged from 3 to 34 sec for boys and 5 –26 seconds for girls. The PEFR values for boys ranged between 160 – 510 L/min and girls between 160 –410 L/min. Gender wise analysis has shown no difference in any variables except on PFR. Boys scored significantly higher PEFR than girls.

Table 1. Demographic details

N	Age	Weight (Kg)	Height (Cm)	PFR (L/min)	BHT (Sec)
386	12,78±1,69	43,39±11,70	149,80±12,20	291,30±62,75	13,13±4,98

Table 2. Distribution of Weight, Height, Peak Flow Rate and Bhramari Time in different Age groups.

Age	N	Weight (Kg)	Height (Cm)	PFR (L/min)	BHT (Sec)
9	10	26,75±4,53	135,30±11,75	216,00±33,73	9,60±2,84
10	32	31,82±7,85	134,45±8,52	236,25±44,49	11,00±2,95
11	46	35,74±8,31	140,33±8,41	262,39±44,93	12,59±4,42
12	71	39,40±9,40	145,43±9,92	271,30±50,99	12,78±4,79
13	93	46,96±11,37	152,27±8,92	295,65±51,92	12,91±5,27
14	71	47,10±9,46	156,04±8,36	317,83±56,28	14,17±5,14
15	45	52,95±8,27	161,27±9,56	334,09±63,33	14,14±5,41
16	18	51,30±9,92	161,56±5,65	357,78±79,52	15,28±5,95

Table 3. Zero-order between Bhramari Time, Peak Flow Rate, Height, Weight and Age (N=386)

	PFR	Height	Weight	Age
BHT	.35**	.29**	.17**	.22**
PFR		.64**	.52**	.53**
Height			.74**	.68**
Weight				.57**
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 4. Comparison of boys and girls on all variables

Gender	N	Weight	Height	PEFR	BHT	Age
Boys	229	43,39±12,43	149,91±13,15	297,60±66,69	13,18±5,31	12,66±1,69
Girls	157	43,37±10,56	149.64±10,67	282,10±55,45 **	13,06±4,48	12,97±1,68
**p=0,02						

Discussion

This study sets out to examine the relationship between PEFR and *Bhramri Time* among school children in order to establish the utility of this yogic tool for use in mass programs and by individuals as a test of their progress in the practice of yoga. The significant relationship between *Bhramri Time* and PEFR confirmed our primary hypothesis. Further, the relationship between *Bhramri Time* and Anthropometric data also has shown significance. Height had the strongest relationships with other variables. Overall, the study showed that in healthy children PEFR (Ebomoyi, Iyawe, 2005) and BHT significantly increases with height, weight and age, which is in agreement with the report of other studies.

PEFR is a measure of a dynamic factor during exhalation as it takes into account the rate of movement of air in and out of the lungs and is considered the best single index of ventilatory function (Pedersen, 1997). Unfortunately, it is time consuming, fatiguing, difficult to obtain acceptable data by novices and needs a good instrument (although simple and portable). BHT is a useful test that is cost effective as it needs no instruments and acceptable while teaching yoga to children in a school or a camp environment because of the playful nature of the test that promotes self encouragement to continue the practices.

Potential limitations of this research must also be considered. We have used only PEFR using a mini PEFR instrument which is a measure of forced expiratory volume in first second (FEV_1) while BHT is a measure of slow vital capacity (SVC). It would have been ideal to compare all measures of lung function using a spirometer to establish the utility of the BHT. Secondly, the sample included was healthy young children in a yoga camp environment which may be difficult to generalize for all children and adults.

Conclusion

Despite these limitations, the present study confirmed our primary hypothesis i.e. BHT correlated positively with PEFR. To our knowledge, this is the first study to understand the relationship between BHT and PEFR. BHT can be enhanced by training. Practice of yoga based breathing practice can increase pulmonary function which in turn leads to enhancement of BHT (Vedala, Mane, Paul, 2014). Our study suggests that BHT can be recommended for use in mass camps as an acceptable scientifically validated yogic tool in young population to assess the progress of their practices in each class. Studies comparing BHT with other variables of lung function may be carried out in future to confirm the validity and reliability of this observation.

References:

1. Barnes, P. M., Powell-Griner, E., McFann, K., & Nahin, R. L. (2004). Complementary and alternative medicine use among adults: United States, 2002. *Advance data*, (343), 1-19.
2. Ebomoyi M.I., & Iyawe V.I. (2005) Variations of peak expiratory flow rate with anthropometric determinants in a population of healthy adult Nigerians, *Nigerian Journal of Physiological Sciences*, 20(1-2), 85-89.
3. Hagen I., & Nayar U.S. (2014). Yoga for Children and Young People's Mental Health and Well-Being: Research Review and Reflections on the Mental Health Potentials of Yoga*. Frontiers in Psychiatry,* 5:35.
4. Holcroft, C. A., Eisen, E. A., Sama, S. R., & Wegman, D. H. (2003). Measurement characteristics of peak expiratory flow. *Chest*, *124*, 501-510.
5. Jatiya, L., Udupa, K., & Bhavanani, A. B., with Mandanmohan. (2003). Effect of yoga training on handgrip, respiratory pressures and pulmonary function. *Indian journal of physiology and pharmacology, 47*(4), 387-392.
6. Khalsa, S. B. S., Hickey-Schultz, L., Cohen, D., Steiner, N., & Cope, S. (2012). Evaluation of the mental health benefits of yoga in a secondary school: A preliminary randomized controlled trial. *Journal of Behavioral Health Services and Research*, *39*(1), 80-90.
7. Mendelson, T., Greenberg, M. T., Dariotis, J. K., Gould, L. F., Rhoades, B. L., & Leaf, P. J. (2010). Feasibility and preliminary outcomes of a school-based mindfulness intervention for urban youth. *Journal of Abnormal Child Psychology*, *38*(7), 985-994.
8. Nagarathna, R., & Nagendra, H.R. (2001). *Integrated Approach of Yoga Therapy for positive health*. Bangalore: Swami Vivekananda Yoga Prakashana;
9. Petty, T. L. (2006). The history of COPD Early historical landmarks. *International Journal of COPD*, *1*(1), 3-14.
10. Pedersen, O. F. (1997). The Peak Flow Working Group: physiological determinants of peak expiratory flow. *The European respiratory journal. Supplement*, *24*, 11S-16S.
11. Rajesh, S.K., Ilavarasu, J.V., & Srinivasan, T.M. Effect of Bhramari Pranayama on response inhibition: Evidence from the stop signal task. *International Journal of Yoga, 7*:138-41
12. Raub, J. A. (2002). Psychophysiologic effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: a literature review. *Journal of alternative and complementary medicine (New York, N.Y.)*, *8*(6), 797-812.
13. Soni, R., Singh, K., Munish, K., & Singh, S. (2012). Study of the effect of yoga training on diffusion capacity in chronic obstructive pulmonary disease patients: A controlled trial. *International Journal of Yoga*, 5(2), p.123.
14. Vedala, S.R., Mane, A.B., & Paul, C.N. (2014). Pulmonary functions in yogic and sedentary population. *International Journal of Yoga*; 7:155-9

15. Vialatte, F. B., Bakardjian, H., Prasad, R., & Cichocki, A. (2009). EEG paroxysmal gamma waves during Bhramari Pranayama: a yoga breathing technique. *Consciousness and cognition*, *18*(4), 977-988.

Received: August 3, 2014
Accepted: September 1, 2014