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Comparison of Breath Holding Capacity between Indian Classical and Contemporary Singers Using Breath Hold Test: Observational Study

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ABSTRACT

Breath Management is currently a very important topic in the singing community. Taking into consideration the earlier studies, singing requires a higher rate of breath energy than speaking does, as well as the elongation of the breath cycle and breath holding capacity. Breath holding capacity was measured using Sabraze's breath hold test. 94 subjects, In group A: 47 subjects and in group B: 47 subjects were recruited in this study by convenient sampling. Stopwatch. Our results reveal better breath holding capacity amongst Indian classical singers than contemporary singers ($p<0.05$).Indian classical singers were found to have better breath holding capacity than contemporary singers

Introduction

Life is absolutely dependent upon the act of breathing. Breathing is considered the most important of all the functions of the body as all other functions depend upon it[1]Breath-holding time (BHT) may be considered as one of indicators of efficiency of breathing function. BHT is defined as the time taken by the subject to hold his breath as long as he can.[16] Normal voluntary breath-holding time is 45-55 seconds. Respiration can be voluntarily inhibited for some time, but eventually, the voluntary control is overridden.[16] during voluntary breath-holding, tissues continue to use oxygen and produce carbon dioxide. Therefore, during breath-holding, arterial pO_2 falls and pCO_2 rises, resulting in a state of asphyxia.[16]

Since both these factors are powerful respiratory stimulants, a point is reached where the respiratory drive becomes so strong that the person cannot hold the breath any longer.[16] The point at which breathing can no longer be voluntarily inhibited is called the breaking point. Thus, BHT is the time duration from the time of inhibition of breathing till the breaking point.[1]The breaking point is generally reached when alveolar pO_2 is 56 mmHg and alveolar pCO_2 is 49 mmHg. Either an increase in pCO_2 or a decrease in pO_2 can affect respiration through respiratory centres, thus influencing BHT. [16]

Physiology of Breathing in Singing

Any study of the physiology of vocal production will reveal the complexity of the various anatomical parts and the intricate co-ordination needed for these parts to produce sounds.[5]All musical instruments have something which activates the vibrator, the vibrator itself & a resonator.[5]

The body is the instrument for human sound production & has as its activator the Breath / Respiratory system; a primary activator; the vocal folds; and a resonator consisting of the upper part of the larynx & mouth with the intervening pharynx being the most important of all.[5] The singer, unlike inanimate musical instruments, has one additional & very important element, an articulatory mechanism for forming words.[5]

Air from the lungs flows through the glottis causing the vocal folds to vibrate; the pharynx resonates, intensifies & modifies these vibrations and finally words are added by means of the articulatory structures. These structures also have other functions to perform and can prove antagonistic to the processes of singing.[5]

Indian Classical Music

Indian classical music is a genre of South Asian music. Indian classical music is essentially monophonic, meaning only single note or mode is sung at a time. Indian classical music focuses on expanding these notes, thus expounding more melodious, emotional and spiritual aspect. Indian classical music is practiced in a single pitch without any amplification.

Contemporary Music

The contemporary music is primarily polyphonic, meaning different notes are sounded at the same time. Hence the concept of the contemporary music lies on the "harmony" created by the different notes. In contemporary music there are different instruments sounding different notes being sung at the same time. The contemporary singers use much of amplification system.

Aims and Objectives

Aim: To compare the breath holding capacity between Indian classical singers and contemporary singers.

Objectives

To find out the significance of breath holding capacity in Indian classical singers.

To find out the significance of breath holding capacity in Indian contemporary singers.

To find out the importance of breath management in both the both categories.

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Methodology and Materials

Study design: Observational Study
Study area: Singing academies in Mumbai
Study population: Indian classical and contemporary singers
Sample size: 94 (47 in group A and 47 in group B)
Sampling method: Convenient sampling
Study duration: 6 months

Inclusion criteria

• Normal healthy individuals; both males and females; aged between 20 to 40 years.10
• Indian classical singers having more than 5 years of pure classical music education and undergoing regular practice.
• Contemporary singers having more than 5 years of pure contemporary music education and undergoing regular practice.

Exclusion criteria

• Individuals practicing both Indian classical and contemporary musical forms simultaneously and have not ceased practicing one of the musical forms.
• Individuals performing regular physical activities like exercises, gym, athletic activity, swimming, diving.
• Individuals having any respiratory disease
• Individuals taking regular medications.

Materials Required

• Nose clip, Stopwatch

Outcome Measure

• Breath Hold Test

Procedure

• Ethical committee clearance was obtained and permission was taken from the Principal of SKNCOPT.
• Permission from the head of the music academies was obtained.
• Subject's written consent was taken & those fulfilling the inclusion criteria were recruited for the study.
• The subjects were divided into two groups:

Group A. Classical singers Group B. Contemporary singers. Subject`s demographic data – Age, gender, category of music, course of learning & duration of rehearsal were documented.

The subject`s breath holding capacity was then calculated individually using Sabraze's breath hold test.[3]

Results

The present study recruited 94 participants divided in two groups; 47 in each group, in group A: classical singers (37 females & 10 males) and group B: contemporary singers (31 females & 16 males) respectively.

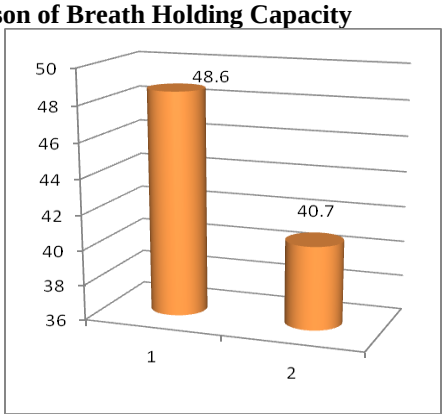
Participant`s age, course of learning in years, hours of rehearsals per day and breath holding capacity were taken into consideration.

The data was statistically analyzed using Graph pad In Stat software.

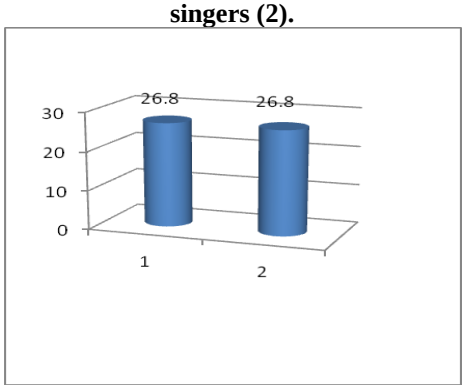
The data of breath hold test had passed normality in both the groups; hence unpaired t test was used to compare the breath holding capacity between two groups.

Indian classical singers were found to have better breath holding capacity than contemporary singers with mean difference of 7.98 seconds & p value (0.01); which was found to be significant.

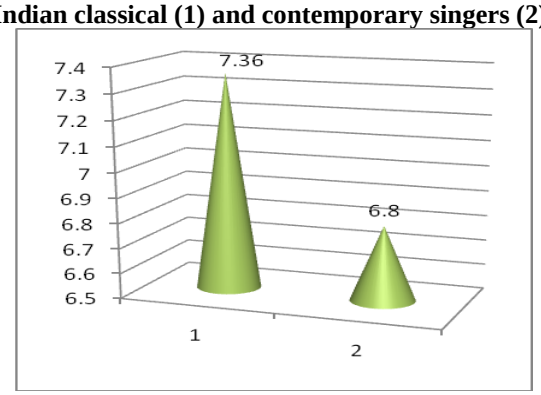
Comparison of Breath Holding Capacity



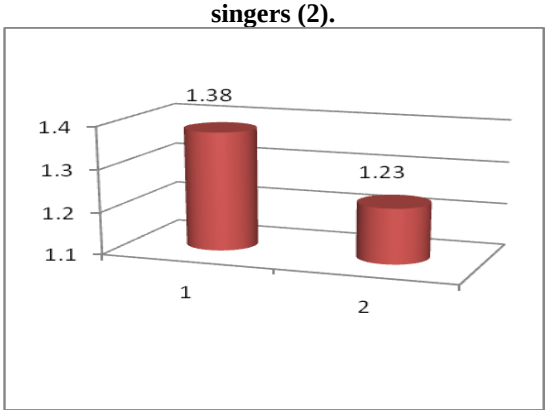
Graph 1. Shows Comparison of breath holding capacity (sec.) between Indian classical (1) and contemporary singers (2).



Graph 2. Comparison of mean age (years) between Indian classical (1) and contemporary singers (2).



Graph 3. Comparison of average duration of learning (years) between Indian classical (1) and contemporary singers (2).



Graph 4.Comparison of average hours of rehearsals between Indian classical (1) and contemporary singers (2).

Comparison of Breath Holding Capacity

	Classical				Contemporary			
Statistics	**Age**	**Course of learning (yrs)**	**Hours of rehearsal**	**BHT (sec)**	**Age**	**Course of learning (yrs)**	**Hours of rehearsal**	**BHT (sec)**
Average	26.8	7.36	1.38	48.7	27.4	6.8	1.23	40.72
SD	6.06	3.35	0.53	11.32	6.11	1.77	0.43	11.32

Discussion

The present study shows that there is a significant difference between the breath holding capacities of Classical & Contemporary singers with better breath holding capacity amongst Classical singers.

M. J. Parkes 2005, stated that breath holding is distinct from eupnoea, because at large inflation volumes there may be some contribution from voluntary muscles to hold the chest open at a chosen volume against recoil.[8]Breath holding cannot be explained simply by closure of the glottis and airway, because it is easy to continue the breath holding with these structures open.[8] The precise activity of the diaphragm, intercostals & accessory muscles during breath holding has not been definitely established, but the diaphragm may contribute as the 'holding muscle'[8]

Ekberg, 1982 stated that activation of laryngeal musculature is continuous throughout life as the vocal folds are constantly being held open to varying degrees for air exchange for respiration, closed for airway protection during swallowing or for chest stabilization during lifting by breath holding during exertion.[7]During voice production the larynx moves up due to the action of the thyrohyoid muscle in particular. As the larynx is moved upwards, the angle between the cricoids & thyroid cartilages changes adding to lengthening of the vocal folds. Also for voice production the vocal folds must be held in the midline with the adequate tension & closure for expiratory airflow between vocal folds.[7]

Breath hold: The ventricular folds and the vocal folds are closed tightly during a breath hold, when the arytenoids cartilages tilt anteriorly towards the thyroid cartilage. This closure produces the highest pressures in the pharynx and involves the highest level of thyroarytenoid activation than any other task.[7] In order to control the voice one has to put out exactly the amount of breath needed to produce desirable voice[1]. The breath needs to be as focused as a laser beam. Quality of exhalation controls the quality of the sound, the volume and partially controls the pitch and the tone. The exhalation is governed by inhalation.[1,2]

In case of singers, if they want to be and stay in tune, the muscle memory developed by them around breathing is the mechanical basis of doing so.[1,2] The existence of 'reserve tank of air' is invaluable for singers as they hold notes a little bit longer or sing into the ends of long phrases with strong tone and good support.[2] Normally while breathing, a group of core muscles relax during exhalation. In order to hold the breath (prevent exhalation) one must maintain the diaphragm and other accessory muscles in a state of contraction.[2]

Human body is the instrument for human sound production & has as its activator the Respiratory system; a primary activator; the vocal folds; and a resonator consisting of the upper part of the larynx & mouth with the intervening pharynx being the most important of all.[5] The singer, unlike inanimate musical instruments, has one additional & very important element, an articulatory mechanism for forming words.[5] Air from the lungs flows through the glottis causing the vocal folds to vibrate; the pharynx resonates, intensifies & modifies these vibrations and finally words are added by means of the articulatory structures. These structures also have other functions to perform and can prove antagonistic to the processes of singing.[5]

Professional classical singers often advocate for the advantages of an active control of the abdomen on singing performance. This is presumed to prevent shortening of the diaphragm, elevate the rib cage & thus promote efficient generation of sub glottal pressure during phonation.[4] In contrast to untrained individuals, classical singers used greater % of abdominal contribution to lung volume during singing and greater asynchrony between movements of the rib cage and abdomen.[4]

No significant differences were observed between the patterns of respiratory kinematics of untrained individuals & classical singers during quiet breathing although there was a trend for greater abdominal contribution in classical singers than untrained individuals.[4] In present study, the breath hold test in classical singers showed better breath holding time when compared to the contemporary singers. This discrimination is based on the monophonic nature of the classical music and polyphonic nature of the contemporary music. In Indian classical music, only single note or mode is sung at a time; hence it focuses on expanding these notes. Whereas in contemporary music different notes are sounded at the same time; hence its concept lies on the harmony created by different notes.

Conclusion

This study shows that there is a difference between the breath holding capacities of Indian classical and contemporary singers; with higher breath holding time amongst Indian classical singers.

Acknowledgements

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Conflict of interest

Conflict of interest declared none.

Clinical implication

As breath management is one of the most important factors in singing, various breathing techniques, deep breathing exercises, breath holding techniques, Pranayamas & strengthening exercises of intercostals, abdominals and lower back muscles should be included in regular practice sessions along with singing.

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