VOCAL EXERCISES AND VOCAL HEALTH IN CARNATIC AND HINDUSTANI SINGERS - A SURVEY

Registration No. 05SLP017

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A Dissertation Submitted in part fulfillment of Master's degree
(Speech Language Pathology)
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APRIL 2007

Dedicated to Lord Raghavendra

My Anna

&

My, guide Savithri ma'm

Certificate

This is to certify that this Dissertation entitled **"Vocal exercises and Vocal health in Carnatic and Hindustani singers** - A **Survey"** is a bonafide work in part fulfillment for the degree of master of (Speech-Language Pathology) of the student (Registration No. 05SLP017). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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Declaration

This Dissertation entitled **"Vocal exercises and Vocal health in Carnatic and Hindustani singers - A Survey"** is the result of my own study under the guidance of Prof. S. R. Savithri, Professor and Head, Department of Speech-Language Sciences, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier in any other University for the award of any Diploma or Degree.

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CHAPTER 1

Introduction

Voice - sings of despair, of prayerful hope until it finally erupts into the quickened pulses of courage and determination. One can't hear this masterpiece of musical creation interpreted by a great singer without being touched to tears. It is not a powerful instrument, this human voice, nor a technically perfect one. A trumpet can blow louder, a violin can play faster, and an oboe can spin longer melodies. Still, it is unsurpassed in expressivity, depth and soulfulness of tone, truly the queen of instruments. Voice colors every word we say with emotional undertones, with pathos or humble resignation, with energy or deadly fear, with pervasiveness or deceit. We use this instrument daily and still know very little about it!! (Brodnitz, 1988).

Regarded as musical instrument, voice consists of an actuator (energy produced by respiratory apparatus), a vibrator (the vocal folds) and resonator (vocal tract). This instrument must be capable of producing the required pitch, loudness, duration and timbre and respond to demands of highest level in relation to musical phrasing and articulation of text.

Singing is considered as sensory motor phenomenon that requires particular balanced physical skills (Bunch, 1982). A sensitive performer achieves singing as an art when these skills are developed. Singing is such a human and moving act both for those who do it and for those who listen to it. Hence, singers are considered artists in the truest

sense, as they combine concept, melody, and text and stage movement making it all seem effortless and get capable of winning audience appreciation.

Music is an art form that involves organized audible sounds and silence. It is usually expressed in terms of pitch (which includes melody and harmony), rhythm (which includes tempo and meter), and the quality of sound (which includes timbre, articulation, dynamics, and texture). Music may also involve generative forms in time through the construction of patterns and combinations of natural stimuli, principally sound. Music may be used for artistic or aesthetic, communicative, entertainment, or ceremonial purposes. The definition of what constitutes music varies according to culture and social context.

Indian music is distinguished from other musical systems in terms of its origin and its implication. Music is considered as a gift of God and part of fourfold goals of life. This sociocentric view has its widespread effect. Till today classical music in all its forms is used to worship, praise/hail the glory of formless, so much so that even ragas and notes have their own God. The basic conceptual material is from Vedas. No other musical system has such a definite and strong background as Indian music (Satyanarayanan, 1983).

Carnatic music, also known as *karnataka sangitam* is one of the two styles of Indian classical music, the other being Hindustani music. The Carnatic system is the art form of southern India and Hindustani is the art form of northern India.

In general they have the same basis, being melodic and governed by rules of two main elements: *ra: ga*, the modes or melodic formulae, and *ta.la*, the rhythmic cycles. The term 'ra:ga' (In Sanskrit) means 'affection, happy feelings, color, mood'. In music, it means a set of notes arranged in ascending and descending order within the octave. 'ta:la' refers to the beat set for a particular composition (a measure of time). Ta:la:s have cycles of a defined number of beats and rarely change within a song. They have specific components, which in combinations can give rise to the variety to exist (over 108), allowing different compositions to have different rhythms.

The ancient music literature described features of vocal training in terms of pitch selection, vocal exercises etc., However, the effectiveness of these methods have not been scientifically studied and there are no set standards or regulations in the form of vocal techniques to be followed by music teachers. The physical demands of singing necessitate optimal health, beginning with adequate rest, aerobic exercises, moderate diet and avoidance of smoking. Knowledge of vocal hygiene is very vital for singers. Also, limited research has been carried out in the areas of practices, methods of training and general lifestyles of classical singers. Therefore, there is a need to profile these aspects of classical singers that would aid in voice care and management.

Thus, the aims of the present study are to investigate vocal exercises performed by Hindustani and Carnatic singers, knowledge about vocal mechanism and vocal hygiene in these singers and vocal and non vocal habits that are used by these singers.

The results of the study have multiple implications and are as follows:

First of all, the results would provide information on the vocal exercises used by the Carnatic and Hindustani singers. Till date vocal exercises used by Western singers were considered as standards. However, this study will provide specific information about Carnatic and Hindustani singers.

Second, the results of the study will provide information about knowledge of vocal mechanism and vocal hygiene. This will inform us as to what training needs to be imparted to singers on vocal mechanism and vocal hygiene if they are not using one already.

Finally, it will also provide information on the vocal and non vocal habits used by these singers. This information will be useful to prepare vocal hygiene tips.

CHAPTER 2

Review of literature

In order to acquire musical skills, singers work to enhance their vocal ability by spending considerable time practicing their music. Every professional singer has to develop series of vocal exercises that is best suited for their voice, which will result in a good voice. Voice practice enhances vocal endurance and forms basis for voice culture (Luchsinger & Arnold, 1965). The voice of a singer has to be trained according to the system and the type of music he/she chooses to perform. A singer must discover his/her own vocal limits and carefully use the voice in the extremes of the ranges in order to protect their voice. Singers also modify their habits and lifestyles in a manner that would help preserve their singing voice.

Requirements of a good voice

Each individual has a unique natural frequency which depends upon his/her age, sex, size of vocal organs etc., Five ingredients of a physiologically gifted voice according toTitze(1998) are as follows:

- A wide cricothyroid space
- Strong cricothyroid and thyroarytenoid muscles
- Thick mucosa with optimal fiber - liquid concentration
- Symmetry between right and left vocal folds
- Ability to activate adjacent muscles selectively.

A wide cricothyroid space is likely to be a benefit in obtaining a wide pitch range. Strong cricothyroid and thyroarytenoid muscle system are the second gift because these are the muscles that produce length and tension changes in the vocal fold. A strong thyroarytenoid muscle allows the bulk of vocal fold to be utilized at both high and low pitches. The third gift is a thick mucosa with an optimal fiber-liquid concentration. The mucosa needs to remain loose under all conditions of tension applied to either the ligament or the thyroarytenoid muscle. It needs to propagate the mucosal wave. The fourth gift is the symmetry between right and left vocal folds, and more generally, across the entire larynx. With a high degree of symmetry, the geometry and tensions in the vocal fold will be balanced. Whenever there is a significant asymmetry, on the other hand, chaos theory tells us that small changes in pitch, loudness, or vowel can trigger a sudden shift to more complex oscillatory patterns. The result may be a voice with lots of instability (cracks, uneven timbre and loudness, and clicks at onset and offset). The fifth gift is the ability to activate adjacent muscles selectively. Fine differential control of adjacent (especially antagonists) muscles allow for easy voice onset-offset, easy pitch change, easy vibrato or trill and many other fine control maneuvers in singing. (www.ncvs.org).

The specialties (probably ideal voice) of western classical singers (opera) according to Sundberg (1990) are in terms of breathing habits, phonatory controls and articulatory abilities (formants and resonance).

Regarding Indian music, Bharath muni in his treatise 'Natyashastra' described six essential qualities of Indian singers' voice. According to him, the voice must be adequately loud to reach a long distance, it should be musical and steady, must be excellent even in high registers, must be smooth and not harsh, should be properly balanced in its quality and the voice must be sweet in all the three octaves (Durga, 1997).

Perkins (1978) opined, "During a concert, a vocalist not only requires having a good and appealing voice, but also has to compete with other accompanying instruments. Achieving adequate loudness with minimal vocal effort is of paramount concern for the professional vocalist whose livelihood depends on maintenance of a healthy voice under most stressful conditions".

Vocal exercises

Mackenzie (1886) reported that physical exercises bring about increase in vital capacity. Luschinger & Arnold (1965) reported that there is no doubt that suitable voice and breathing exercises improve general well being and resistance to respiratory disease. They reported that deeper respiration which is required by singing produces increased ventilation of blood in lungs.

Ling (1976) proposed breathing, phonation and articulation exercises in that order.

Proctor (1980) reported that a singer should start of a soft phonation in the mid range, do a crescendo and decrescendo and then sustain the tone for as long as possible. By doing this simple exercise one could gradually learn to increase the duration of the tone from 20 to 25 to 30 to 35 or longer, maintaining good tone quality. He has also reported that two aspects are very essential; deep breathing and careful application of the abdominal muscles. Habitual seeking a full lung volume before beginning to sing and the recognition of the fact that singing at volumes from Total Lung Capacity (T.L.C) down to a little below Functional Residual Capacity (F.R.C) is more comfortable than at the volume from Functional Residual Capacity (F.R.C) to Residual Volume (R.V).

Titze (1992, 1994, and 1996) reported that healthy vocalization is based on flexibility and control rather than brute force. A vocalist can engage in laryngeal and respiratory stretching exercises by gliding over a large range of pitches and intensities. Arpeggios, scales and glissandos have been designed for this purpose. As in any skilled motor task, exercises are specifically designed to increase accuracy of targeting, stability of posturing, speed of transitions and dynamic range. Applied to vocal pitch, accuracy of targeting is practiced by attacking notes at precise pitches, stability of posturing is practiced by long, sustained notes, often with crescendos and decrescendos; speed of transition is practiced by rapid scales or arpeggios and dynamic range (pitch range a singer can use) is extended by jumping quickly between high and low notes. Training can extend the useful pitch range for any singer. Lip and tongue trills are common as vocal warm ups. The purpose of this exercise is to loosen the orofacial muscles and getting the sensation of vibration established in the front of the mouth and in lips. A singer should

start lip trill with a low pitch. The singer should slowly raise the pitch and maintain the trill as he/she raises the pitch. An alternate is tongue trill. In practicing tongue trill, tongue can be alternatively moved from one side of the mouth to another (laterally). It can also be moved alternatively from inside to outside of the mouth (tongue protrusion and retraction). Trill should be produced in both ascending and descending pitch. A singer will learn the minimum pressure (Phonation Threshold Pressure) required to produce a trill, especially as the pitch is raised. Messa Di Voce is also one of the common vocal warm ups. The aim of this exercise is to maintain a good coordination of the tensor muscles (cricothyroid and thyroarytenoid) and adductor-abductor muscles of the vocal folds. Messa Di Voce engages the layers of vocal fold tissue and helps the singer to match tension in muscle to tension in ligament, tests symmetry of crescendo and decrescendo control under changing lung pressures and makes all intrinsic muscles of larynx work in co-ordination with changing lung pressure and makes all intrinsic muscles of larynx work in coordination with changing lung pressure. While practicing this exercise, pitch should be constant and loudness should be increased initially and then decreased.

Titze (1994) reported that although breath control in speech/singing is based on the same physiologic principles as breath control for any activity, there is the problem of asymmetry in breathing cycle. The singer is required to inhale at irregular intervals that are musically or linguistically determined. Given the unusual demand on a system that prefers to work automatically it is not surprising that some training is necessary. In the inspiratory phase abdominal muscles need to be trained to relax quickly and completely

to allow maximum downward movement of the diaphragm. The abdominal muscles are used extensively to provide breath support (adequate subglottic pressure) in the expiratory phase. Singers also should be trained to manage excess subglottic pressure in the early stages of expiration especially if the phrase to be sung is long. The two prevalent approaches to the establishment of breath support during singing are pear shape up and pear shape down approach. In pear shape up approach, primary emphasis is on keeping the ribcage high and stable. The theory is that with minimum contraction and expansion of the ribcage, the softer tissues underneath the ribcage do the pumping of air. This presumably saves energy by preventing a 'heaving' effect of the ribcage during expansion and contraction (Hixon & Hoffman, 1979). In the pear shape down approach, less emphasis is placed on ribcage movement/position; but more emphasis is placed on maintaining stable abdominal pressure. It prevents ribcage and trachea from crowding the larynx and producing shallow sound.

Elliott, Sundberg & Gramming (1994) investigated if vocal warm-ups prior to singing yielded the same effect as warming up other parts of the body. They noted that many singers subjectively indicated improved vocal functioning following warm-ups.

Miller (1996) reported that there was a uniform concept of breath management in the International Italianate school called as Appoggio. It is a system for combining and balancing muscles and organs of the trunk and neck, controlling their relationships to the supraglottal resonators. With regard to breath management, appoggio maintains for a remarkable period of time a posture near that which pertained at the beginning of the

inspiratory phase of the breath cycle. This initial posture ensures cooperative muscle activity in the pectoral, epigastric and umbilical regions and diaphragmatic control. The total torso is involved. The powerful abdominal musculature undergrids the breath mechanism. Breath holding exercises teach one to hold breath and have little to do with lung expansion or with muscle coordination during phonation. Also, in order for the inhalation to be efficient, it must be silent.

Miller (1996) reported that physical exercises especially jogging are thought to develop the body for the physical events of singing. Such activities are fine if they ensure excellent, general physical condition and if they are not strenuously carried out past the age when the physical exercises should be cut back. Physical activities that produce flexibility and suppleness for light movement are best for the singer. Running outdoors in cold weather causes respiratory problems in some singers and should be avoided by them.

Amir, Amir & Michaeli (2005) investigated effect of vocal warm up on voice quality of trained singers using acoustic measurements of voice quality (frequency and amplitude perturbation and noise indices). They included 21 young female singers who had mean years of training as 5.4 years. The warm up exercises done by these singers included body posture alignment and relaxation exercises, breathing exercises and voice productions and placement at different pitches, registers and amplitude levels using a variety of syllables sung in different pitches. Average warm up duration was 11 minutes. Using Multidimensional Voice Profile (MDVP), the pitch perturbation measures, amplitude perturbation measures and noise indices were analyzed. Under pitch

perturbation, jitter, Relative Average Perturbation (RAP) and Pitch Perturbation Quotient (PPQ) were extracted. Under amplitude perturbation, shimmer and Amplitude Perturbation Quotient (APQ) were extracted. Under noise measures, Noise Handicap Index (NHI) and Voice Turbulence Index (VTI) were extracted. Results of their study indicated that all the above mentioned parameters improved with vocal warm ups. In addition, results support importance of incorporating different exercises into warm up routine, which target not only laryngeal muscles but also breathing, posture and relaxation exercises.

Sharanya (2006) investigated common vocal practices and non vocal habits in Carnatic singers. The results of the study revealed that specific vocal exercises taught for improving vocal efficiency and endurance was practiced by 33.3% of males and 70% of females. Exercises for improving breath support for singing was practiced 36.7 % of males and 63.3% of females. Exercises to improve ornamentations/gamakam were practiced by 93.3% of males and 86.7% of females. There was no specific warm up exercises practiced by these singers. Most singers used 'a:ka:rasa:dagam' *(the practice of vowel /a/ in ascending and descending note at different speeds)* exercises to enhance ornamentation aspects of their singing. The singers also used vowel /a/ in ascending and descending note as a warm up exercise.

Murbe, Zahnert, Kuhlisch & Sundberg (2006) did a longitudinal study on effects of professional singing education on vocal vibrato. Twenty two singing students (13 females and 9 males) with mean age of 24 years were examined at the beginning of and after 3 years of professional singing education. Subjects sang an ascending - descending

triad pattern in slow tempo on vowel /a/ at a comfortable pitch level twice at soft (piano) and twice at medium (mezzo-forte) loudness. The top note of the triad pattern was sustained for approximately 5 seconds. The mean and the standard deviation (S.D) of vibrato rate were measured for this note. Results revealed that after 3 years of training, voices with vibrato slower than 5.2 Hz were found to have a faster vibrato and voices with vibrato faster than 5.8 Hz were found to have slower vibrato. Standard deviation of vibrato rate was higher in soft than in medium loudness, particularly before the education. Mean vibrato rate was found to be 5.5 Hz. Results confirmed the view that the singers with the fastest and slowest vibrato before training had reached a more normal vibrato rate after 3 years of training.

Durga & Dorna (2007) made a comparative analysis of aspects of voice production for singing in the two styles - Western and Indian. They comment that in India, a singer chooses his/her a:dha:ra sruti (base pitch), which is the pitch he/she is most comfortable with while singing. In the past, the method of selecting base pitch was based on trial and error. Recently, research has been made to fix the optimal pitch which would be the basic *sa* note. The experiment was done taking the entire vocal range from the lowest note to the highest note the voice can produce. The *sa* is then fixed for the singer to have audibility up to reaching two notes in the *mandra sthayi* (lower octave) and two notes in the *tara sthayi* (higher octave) after *tara* (high) *sa*, totaling to 12 notes. Another method to find the frequency of the natural speaking voice of the person and fixing the pitch of the singing voice a semitone or a tone higher. Also, some teachers ask the student to sing a song of their choice. Children will naturally sing in the pitch that

they find most comfortable or most suitable for themselves. The teacher can thus take this hint and fix their base pitch accordingly. Exercises involving extending the range of voice include making a student practice on higher notes and increasing range note by note. The exercise should continue upward until the student feels strain in the voice. As soon as this feeling arises, the exercise should be stopped. By regular training, higher and higher notes will be executed without strain and range will be thus extended without pressure. Diaphragmatic breathing is suggested by imitating initial phase of yawning. Also, imagining breathing in and enjoying the smell of a flower helps in correct inhalation for singing. In India, singing is performed while sitting on the floor cross legged. In order to enhance proper breathing in this posture, the back should be completely erect not stiff. In Indian music, the vowel *la/* enjoys special importance. Aka:ra passages which play a predominant role in improvisation, are built upon the vowel *la/.* In Caraatic music more solfa exercises (svara:s also refer to the solfege of Carnatic music, which consist of seven notes, "sa-ri-ga-ma-pa-da-ni") are prescribed for voice training, whereas aka:ra and other vocalizes are preferred in Hindustani music. Indian singers use glutteral articulation for the execution of ornamentation.

Samashitha, Trupthi, Subramanium & Yesudian (2007) did a comparative study of pitch of 'Dhatu varase' *(these are zigzag sequences that increase student's overall command of notes. Playing two notes that are separated by one or several intervening notes that are part of the ra.ga scale. For example pa ga or ma ra or ga sa. Dhatu svara.s are melodic enhancements of a raga)* in Carnatic music. They reported 'Dhatu varase' can also be used as a warm up exercise.

Vocal Health

Sataloff & Thayer (2002) did a pilot survey of vocal health in young singers. A questionnaire addressing vocal habits and hygiene was offered to 571 young choirs, up to 25 years of age, who sing at least weekly, 129 (22.6%), responded. More than half of the respondents had experienced vocal difficulty particularly older adolescents.

Boominathan, Nagarajan, Sharadha & Sharanya (2004) profiled the vocal and non-vocal habits of Carnatic singers. A questionnaire (25 questions) was administered on 45 subjects (31 males and 14 females). All the subjects were performing Carnatic vocalist students. The questionnaire addressed issues of duration of learning per week, practice periods per day, dietary habits, and use of recreational drugs, types of vocal exercises to relax voice, non vocal habits and outlook of singer's attitude towards their profession. The results of the study revealed that 46.66% of singers attended about 3 classes per week on average extending for duration of more than an hour per class. Professional singers in this study regularly practiced for about 11/2 to 2 hours a day. These practices included a:ka:rasa:dagam and sustaining on a single note for a long duration. The singers reported that such exercises give roundness of tone, richness of timbre and transparency and strength to voice and also enhances breath support for singing, respectively. A significant change in pitch of singing over years of musical training was observed in males due to pubertal changes whereas there was no significant change observed in females. Among dietary habits 57.14% males and 61.76% females included spiced foods, very hot/cold beverages in their diet, 90% of males avoided specific food items like citrus, sour items like tamarind, curds and non- vegetarian diet. None of the singers were

smokers surprisingly and only 2% were indulged in social drinking. Over 55% of the singers were habituated to throat clearing especially during concerts. Less than 20% indulged in whispering and mimicry. Males indulged more in outdoor games whereas females practiced yoga and pra:na:ya:ma. Male and female singers differed significantly in their choice of recreational drugs.

Boominathan, Muthukumaran & Jayashree (2007) investigated vocal hygiene practices among different levels of professional voice users. A total of 400 subjects in the age range of 25-45 years participated in the study. They included politicians, vendors, teachers and singers. There were 100 singers (54 males and 46 females). A questionnaire containing 7 questions with both open ended and forced choice questions addressing issues of voice problems, frequency of voice problems, vocal and non vocal habits was administered. The results of the study indicated that 59% of singers reported to have voice problems; 37% of singers reported that they had long lasting voice problems (duration more than a week); indicators of voice problems as reported by singers were sore throat (22%), change in voice quality (18%), double toned voice (10%), inability to sing in tune with pitch or inability to sing in an appropriate pitch (9%), throat pain, irritation and cough (9%), voice fatigue (3%), loss of voice (3%) and loss of intelligibility and clarity while singing (3%); common abusive non vocal habits prevalent in singers were consumption of alcohol (26%), smoking (9%), consumption of tea and coffee (64%), tobacco chewing (9%) and preference of carbonated soft drinks (53%); all the subjects indulged in throat clearing and singing for long durations; common practices to prevent voice problems in singers included consumption of milk/pepper/ginger/turmeric

(37%), drinking warm water (21%), voice rest (22%), speaking soft (10%), steam inhalation (7%), salt water gargling (2%) and taking honey/adimathuram (herbal medicine) (16%); professionals sought for a consultation to treat voice problem by singers were general physician (24%), ENT (55%), home remedies (16%) and don't know (6%) and finally only 38% of singers were aware of speech/voice therapy.

There have been considerably less Indian studies on vocal exercises performed by Indian classical singers. Also, the above studies have focused on vocal exercises and vocal and non-vocal habits of Carnatic singers. However, they have not focused on warm up exercises and physical exercises. Also they have not studied the knowledge of vocal hygiene in singers. Hence the present study was planned to investigate vocal exercises, vocal and non-vocal habits and singers' knowledge on vocal hygiene in both Carnatic as well as Hindustani singers.

CHAPTER 3

Method

Subjects: A total of 50 Camatic singers (25 males and 25 females) and 50 Hindustani singers (25 males and 25 females) in the age range of 20 - 60 years participated in the study. All the singers had passed their junior exam and were under regular practice. 90% of the singers were professionals. They did not have any speech/voice problem as evaluated by the investigator.

Questionnaire: A 4-part questionnaire containing 43 questions was prepared to investigate the vocal exercises performed by Camatic and Hindustani singers and their vocal health. There were open ended questions as well as few forced choice questions. Part 1 of the questionnaire included 4 questions on demographic data; part 2 included 9 questions on vocal exercises performed by the singers to improve their breath support, frequency range, vibrato, warm up exercises, warm down exercises, other physical exercises and selection of 'a:dha:ra sruti' (base pitch). Part 3 of the questionnaire addressed 15 questions related to singers' knowledge about vocal anatomy and also their knowledge on vocal hygiene practices, part 4 of the questionnaire (15 questions) aimed at collecting information on vocal and non-vocal habits of the Camatic and Hindustani singers. The questionnaire is presented below.

Questionnaire

Part - 1: Demographic data

- Name:
- Age /Gender:
- Type of music you perform:
  - Carnatic
  - Hindustani
- Current status of your singing career:
  - Give performances once a week
  - Give performances once in a month
  - Give performances once in 2-3 months

Part - 2: Vocal exercises

- What exercises do you do to improve your breath support?
- What kind of exercises do you do to improve your frequency range?
- Do you do any exercises to improve "gamakam" (vibrato) in your singing? If yes; how?
- Do you warm up your voice before you sing? If yes; how?

  Yes-

  No-
- Do you warm down your voice after singing? If yes; how?

  Yes-

  No-

- Do you do any other exercises like 'yoga', 'walking', 'gym', 'aerobics'?

- How do you select 'a:dha:ra sruti' (base pitch) for a pupil?

- Do you change the 'a:dha:ra sruti' (base pitch) in course of training?

- What are the criteria for changing 'a:dha:ra sruti'(base pitch)?

Part - 3: Knowledge of vocal mechanism and vocal hygiene

- Do you know what is larynx/ voice box?

- How is voice produced?

- Does straining your voice lead to damage of your larynx?

- Do you know what voice rest is? And its importance?

- Is 'whispering' a wrong habit? If yes, do you know why?

- Do you sing even when you have infections (e.g. cold/cough)?

- Certain medications affect your voice. Say true or false

- Did you have any voice problems in the past that required a visit to a physician? If yes, describe problems and treatments (laryngitis, nodules, polyps, cancers etc.)

- Common practices to prevent voice problems
    - drink warm water
      voice rest
    - speak soft
      steam inhalation
    - salt water gargling
      herbal/ ayurvedic medicines
      others (specify)

- Do you travel a lot for your performances? How many kilometers do you travel in a month?

- Do you give adequate rest to your body and voice before performances?

- Do you live in a smoky environment?

- Do you sing with adequate amplification system?

- Do you know what you can do and where you can seek help for voice problems?

- Are you aware of speech/voice therapy? What does this mean?

Part - 4: Vocal and Non - vocal habits

- Number of years of training:

- How many times do you practice in a day?

  once a day
  twice a day
  more than twice a day

- How many hours a day does your practice last for?
  - 2 hours
  - 3 hours
  - More than 3 hours (specify:_____)

  In performance:_____hours.

- How long does each practice last?
  - 30 minutes
  - 45 minutes
  - 1 hour
  - Greater than 1 hour (specify:_____)

- Do you give gaps/breaks in between your successive practice? If yes, how much time?

- When do you practice?
  - Early morning (before 6 a.m)
  - Morning
  - Evening
  - Night

- If you are a music teacher, how long do you teach?

- Do you have habit of speaking/singing loudly?

- How often do you clear your throat?

  Less frequently (once in a day/twice in a day)

  More frequently (once in 30 min/once in 1 hour)

- How many hours do you sleep in a day?

How many cups of coffee/tea or other caffeine containing drinks do you drink in a day?

How many glasses of water do you drink in a day?

Do you eat or drink any of the following before singing?

chocolate

nuts

- spiced foods

milk

- coffee
- alcohol

beetle chewing

- mint/pepper/ginger

others (specify)

Do you consume alcohol? If yes, how many drinks in a day?

Do you smoke? If yes, how many cigarettes do you smoke in a day?

Smoking history :

Never

- Quit. When?_____

How many years have you smoked?

Procedure: The questionnaire was administered to the singers personally through interview. The investigator recorded the responses. The questionnaire was also sent through post and e-mail to singers who were distant.

Data Analysis: Questions from part 2 (questions on vocal exercises) and part 4 (questions addressing vocal and non-vocal habits) were taken up for descriptive analysis. Questions on part 3 (knowledge of vocal anatomy and vocal hygiene practices) were rated on a 5 point rating scale.

0 - Poor

1 - Below average

2 - Average/ fair

3 - Above average

4 - Good.

If the subjects answered 12 or more questions as 'yes' out of the 15 questions they were rated as 'good' which means that they have a good knowledge about vocal anatomy and knowledge on vocal hygiene.

If the subjects answered 9 or more questions but less than 12, out of 15, as 'yes', they were rated as 'above average' which means that they have more knowledge about the vocal anatomy and knowledge on vocal hygiene.

Similarly, a score of 6-9/15 was rated as 'average' or 'fair' and 3-6/15 was rated **as** 'below average' and <3/15 was rated as 'poor'.

Statistical analysis: Descriptive statistics was used.

CHAPTER 4

Results

Part 1: Demographic data

Chronological age of singers: A total of 50 Carnatic singers (25 males and 25 females) and 50 Hindustani singers (25 males and 25 females) participated in the study. Table 1 shows the mean ages of male and female Camatic and Hindustani singers.

Gender\Type of music	Camatic	Hindustani
Male singers	33 (20-59)	38(21-60)
Female singers	34 (20-58)	28 (20-42)

Table 1: Mean age (in years) of male and female Camatic and Hindustani singers.

Current status of the singers' career: The current status of the singers' career had been categorized into three groups. Singers who gave performances once a week, singers who gave performances once in a month and singers who gave performances once in 2-3 months. Table 2 shows the percentage of male and female Camatic and Hindustani singers who fall into these three categories.

Sl.No	Career status	Camatic		Hindustani	
		Males	Females	Males	Females
1.	Once a week	32	32	32	32
2.	Once in a month	44	32	44	36
3.	Once in 2-3 months	24	36	24	32

Table 2: Career status of male and female Camatic and Hindustani singers (in %).

Results indicated that greater percentage of Carnatic male singers (44%) gave performances once a month. Similarly, greater percentage of Hindustani male singers (44%) gave performances once a month. Among females, greater percentage of Carnatic singers (36%) gave performances once in 2-3 months whereas among Hindustani singers 36% of the singers gave performances once in a month. Interestingly equal percentage of male and female Carnatic and Hindustani singers (32%) gave performances once a week.

Part 2: Vocal Exercises performed by Hindustani and Carnatic singers

Male singers: The vocal exercises included exercises that improved frequency range *(pitch range - the distance between one's highest and lowest frequency),* breath support *(efficient and appropriate use of breath stream for phonation),* vibrato *(a pulsating characteristic of tone due to regular, barely perceptible rapid fluctuations in pitch, timbre and/or intensity and is used to add expression),* warm up *(warm-ups, as in weight training, are used to stretch the muscles to prepare them for work without injury and are hypothesized to improve performance),* warm down *(although unfortunately and frequently ignored, vocal warm-downs may also be used to prevent damage to the vocal cords. During speaking and singing, blood flow to the larynx is increased. Stopping immediately after prolonged speaking or singing may contribute to a pooling of blood in the larynx, weighing the vocal cords down. Damage may result as one attempts to speak on these potentially swollen folds. The simple practice of gentle, relaxed humming can serve as an excellent form of warming-down)* and physical exercises *(physical exercise is the performance of some activity in order to develop or maintain physical fitness and overall health. It is often directed toward also honing athletic ability or skill; activities*

providing physical exercise include aerobics, housework, sports, walking, yoga, dancing). Table 3 shows the various vocal exercises used by the male singers.

Sl.No	Exercises	Exercises
1.	Breath support	Pra:na:ya:ma *(it commonly used to describe various yogic breathing exercises that help give the practitioner control of the breath),* yoga, meditation, deep breathing, open mouth singing, maximum phonation duration (MPD), omka:r *(chanting the sacred syllable Om or Aum is called as omka.r chanting),* ra:ga practice, a:ka:rasa:dagam, kapa:labhati (is a breathing technique specifically used for cleansing), practice of 'taans' in one breath and art of living exercises.
2.	Frequency range	A:ka:rasa:dagam, practice in low and high 'stha:yi (pitch), practice in different octave frequencies, ra:ga practice, svara *(a note)* practice, humming in different pitches, practicing 'varna' *(a song)* and practicing basic phrases.
3.	Vibrato	A:ka:rasa:dagam, svara practice, practicing phrases with vibrato, imitating, practicing 'kana:s' *(they are short grace notes above or below the main note, produced by the inflection of voice)and* practicing i:ka:ra and u:ka:ra *(practice of vowel /if and /u/ in ascending and descending note).*
4.	Warm up	Sustaining on /sa pa sa/, a:ka:rasa:dagam, singing ra:ga, singing softly, practicing basic phrases, practicing in different pitches, and practicing 'varna'.
5.	Warm down	Taking voice rest after singing, listening to 'sruti' *(pitch)* after singing, taking water after singing and speaking less after singing.
6.	Physical exercises	Yoga, walking, meditation, art of living exercises and outdoor games.

Table 3: Vocal exercises used by male singers.

Ninety two percent of Hindustani singers and 88% of Carnatic singers practiced exercises to improve their breath support. 92% of Hindustani singers and 96% of Camatic singers practiced exercises to improve their frequency range. Exercises to improve

vibrato were equally practiced by both Hindustani and Camatic singers (84%). 56% of Hindustani singers and 68% of Camatic singers practiced warm up exercises. 12% of Hindustani singers and 16% of Camatic singers practiced warm down exercises. 76% of Hindustani singers and 56% of Camatic singers practiced physical exercises like yoga, walking, meditation, art of living exercises and playing outdoor games. Figure 1 shows the percentage of male singers who used the exercises.

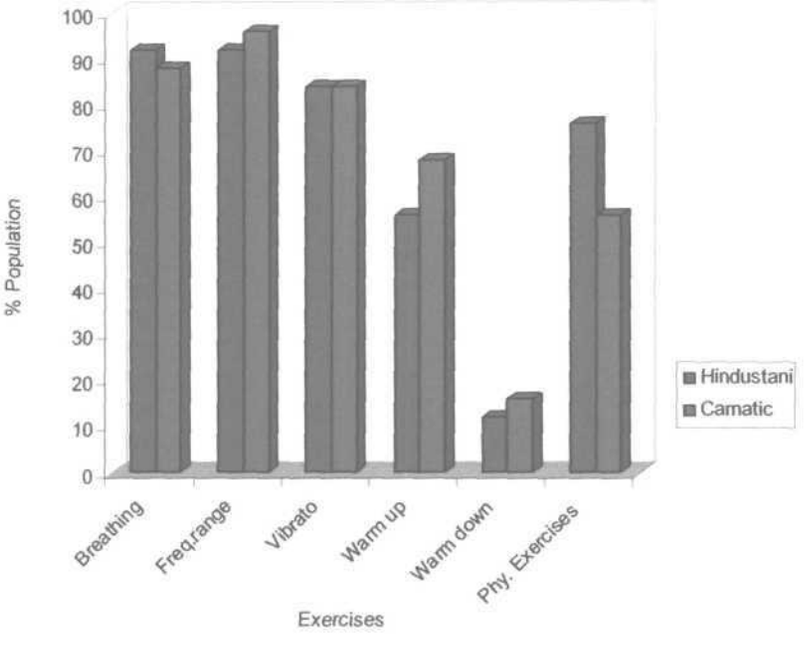


Figure1: Percentage of vocal exercises used by male singers.

Female singers: The vocal exercises included exercises that improved frequency range, breath support, vibrato, warm up, warm down and physical exercises. Table 4 shows the various vocal exercises used by the female singers.

Sl.No	Exercises	Exercises
1.	Breath support	Pra:na:ya:ma, meditation, maximum phonation duration (MPD), omka:r, a:ka:rasa:dagam, 'riya:z' *(practice)*, yoga, kapa:labhati and deep breathing.
2.	Frequency range	A:ka:rasa:dagam, practice in lower and higher 'stha:yi', practice in different octave frequencies, 'riya:z', humming in different pitches, practicing 'varna' and practicing u:ka:ra.
3.	Vibrato	A:ka:rasa:dagam, svara practice, 'briga' *(briga/spuritham are repeating svara.s like ss - rr - gg - mm)* practice, imitating, practicing 'varna' , practicing 'alanka:r svara:s' *(literally means that which decorates or embellishes)* , sanca:ra:s *(melodic phrases)* and practicing i:ka:ra and u:ka:ra.
4.	Warm up	Sustaining on /sa pa sa/, a:ka:rasa:dagam, singing *'a:la:p'(a.la.p is exposition of the ra.ga of the song that will be performed)*, singing softly, practicing 'varna', humming and practicing basic phrases.
5.	Warm down	Taking voice rest after singing, speaking less after singing, singing 'bhajans' *(bhajans are a genre of vocal devotional music also presented from the concert-stage)* at the end of singing and sustaining /sa pa sa/.
6.	Physical exercises	Yoga, walking, meditation, jogging, aerobic exercises, physical work and gym workout.

Table 4: Vocal exercises used by female singers.

Eighty eight percent of Hindustani singers and 80% of Carnatic singers practiced exercises to improve their breath support. 84% of Hindustani singers and 88% of Carnatic singers practiced exercises to improve their frequency range. 84% of Hindustani singers and 72% of Carnatic singers practiced exercises to improve vibrato. Warm up exercises were equally practiced by both Hindustani and Carnatic singers (60%). 8% of Hindustani singers and 20% of Camatic singers practiced warm down exercises. 76% of Hindustani singers and 80% of Carnatic singers practiced physical exercises like yoga, walking,

meditation, jogging, aerobic exercises, physical work and gym workout. Figure 2 shows the percentage of female singers who used the exercises.

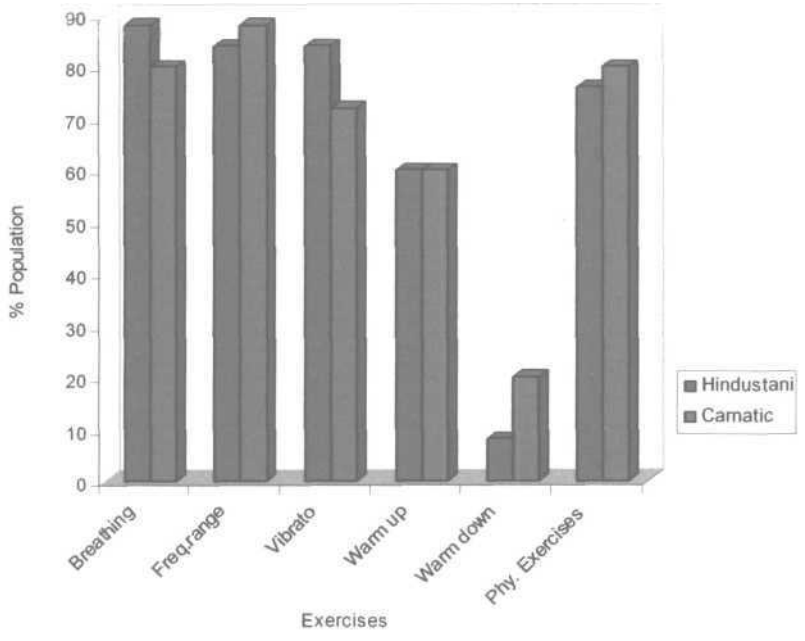


Figure 2: Percentage of vocal exercises used by female singers.

Breathing exercises

Male singers: The breathing exercises performed by the male singers include yoga *(yoga is a combination of breathing exercises, physical postures, and meditation and it has been practiced for over 5,000 years. The different breathing exercises included loud breathing, rhythmical breathing, forced rapid breathing, alternate breathing and 'bhramhari' which is customarily described as involving rapid inhalation producing a high humming sound and slow exhalation producing a low humming sound),* pra:na:ya:ma *(pra:na:ya:ma is a Sanskrit word that means control (yama) of the breath. It is also commonly used to describe various yogic breathing exercises that help give the*

practitioner control of the breath), meditation *(meditation describes a state of concentrated attention on some object of thought or awareness. Many practice meditation in order to achieve peace, while others practice certain physical yoga in order to become healthier),* deep breathing *(diaphragmatic breathing or deep breathing is the act of breathing deep into your lungs by flexing your diaphragm rather than breathing shallowly by flexing your rib cage and it is more healthier),* open mouth singing, maximum phonation duration *(longest time duration for which a note can be sustained),* omka:r *(Aum also called as Om is a mystical or sacred syllable in the Dharmic religions. Chanting this sacred syllable is called as omka.r chanting),* ra:ga practice *(ra.ga means a set of notes arranged in ascending and descending order within the octave),* a:ka:rasa:dagam *(the practice of vowel fa/ in ascending and descending note at different speeds),* practicing 'taans' *(taans are normally understood as the fast-paced musical and melodic elaborations in Indian music, vocal as well as instrumental)* in one breath, kapa:labhati *(Kapa:la means "skull," and bhati means "that which brings lightness. ". Kapa.labhati is a breathing technique used specifically for cleansing. If we have a lot of mucus in the air passages or feel tension and blockages in the chest it is often helpful to breathe quickly. In this practice we deliberately breathe faster, and at the same time use only abdominal (that is, diaphragmatic) breathing, not chest breathing. In kapa.labhati the breath is short, rapid, and strong. We use the lungs as a pump, creating so much pressure as they expel the air that all the rubbish is cleared from the air passages, from the lungs up through the nostrils)* and art of living exercises *(sudarshan kriya as done at art of living workshops is a unique rhythmical breathing process that results in the overall betterment of both body and mind. It involves regulating one's breath to the*

sounds of So-hum ('so'for inhale and 'hum'for exhale). The entire kriya involves multiple rounds with each round having long, medium and short inhalation and exhalations with varying rhythms and intensities). Forty three percent of Hindustani singers and 63.6% of Carnatic singers practiced 'pra:na:ya:ma'. 13% of Hindustani singers and 9% of Camatic singers did 'yoga'. 4.3% of Hindustani singers and 4.5% of Camatic singers did 'meditation'. 8.6% of Hindustani singers and 13.6% of Camatic singers practiced 'deep breathing'. 17.3% of Hindustani singers and 45% of Camatic singers reported that sustaining on svara:s improved their breath support (Maximum Phonation Duration - MPD). 4.3% of Hindustani singers and 4.5% of Camatic singers reported that singing with open mouth improved breathing. Apart from the above mentioned exercises, 4.3% of Hindustani singers reported that inhalation of fresh air was important. 4.3% of Hindustani singers reported that practicing the specific ra:ga itself improved breath support, 4.3% of Hindustani singers practiced 'taans' in one breath, 5.2% of Hindustani singers did 'kaparlabhati' and 30.4% of Hindustani singers practiced 'omka:r'. On the contrary, 4.3% of Camatic male singers reported that 'a:ka:rasa:dagam' improved breath support and also 4.3% of Camatic singers involved themselves in 'art of living' exercises. Figure 3 depicts percentage of male singers performing different exercises to improve their breath support.

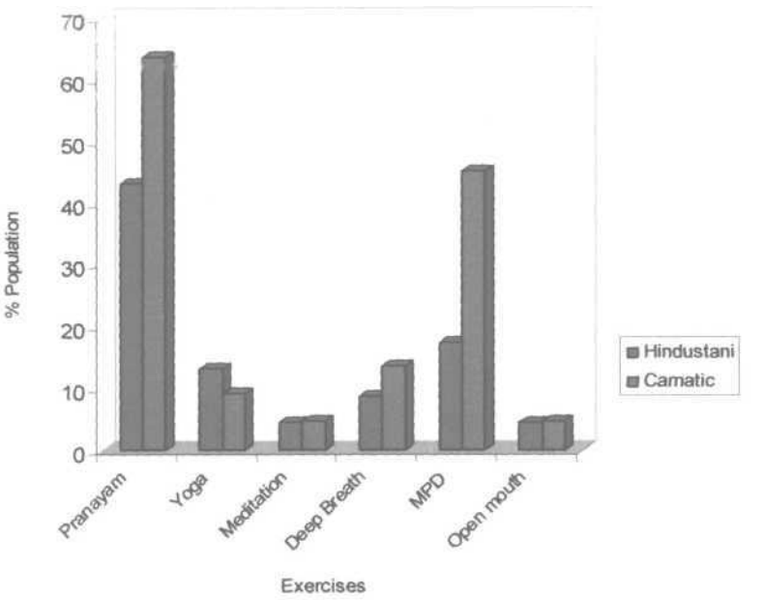


Figure 3: Breathing exercises in male singers.

Female singers: The breathing exercises performed by the female singers include pra:na:ya:ma, meditation, maximum phonation duration (MPD), omkarr, a:ka:rasa:dagam, yoga, kapa:labhati, deep breathing, steam inhalation, appropriate posture, 'riya:z' *(practice).* Forty five percent of Hindustani singers and 70% of Camatic singers practiced 'pra:na:ya:ma'. 13.6% of Hindustani singers and 10% of Camatic singers did 'omkarr'. 9% of Hindustani singers and 5% of Camatic singers did 'meditation'. 27.2% of Hindustani singers and 30% of Camatic singers reported that sustaining on svarars improved their breath support. Apart from the above mentioned exercises 18% of Hindustani singers reported that 'riya:z' itself improved breath support. 5.2% of Hindustani singers did 'kaparlabhati'. On the contrary, 10% of Camatic singers reported that 'a:ka:rasa:dagam' improved breath support and also 5% of Camatic singers reported appropriate posture improved breathing, 5% of Camatic singers reported 'steam

inhalation' was useful. 5% of Carnatic singers practiced 'deep breathing' and around 15% of Carnatic singers did 'yoga'. Figure 4 depicts percentage of female singers performing different exercises to improve their breath support.

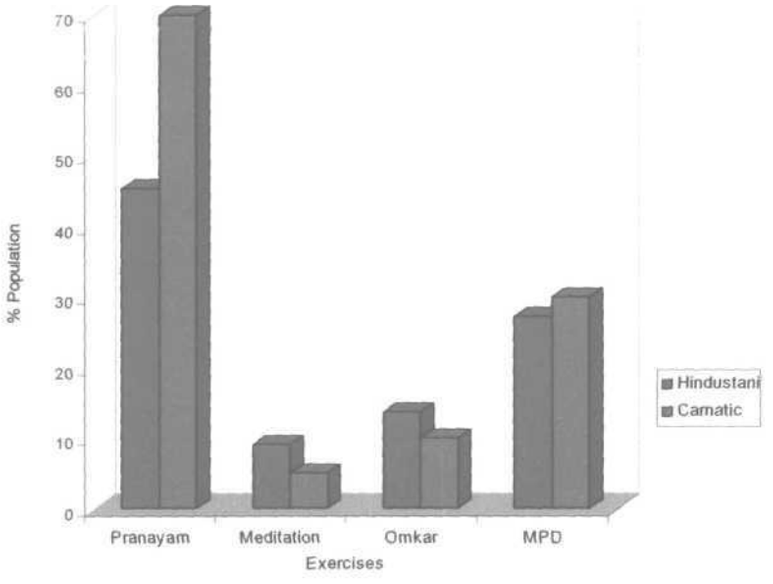


Figure 4: Breathing exercises in female singers.

Frequency range

Male singers: The exercises performed by the male singers to improve their frequency range include a:ka:rasa:dagam, practice in lower and higher 'stharyi'*(pitch),* practice in different octave frequencies, ra:ga practice, svara *(svara refers to a type of musical sound that is a single note, which defines a relative (higher or lower) position of a note, rather than a defined frequency)* practice, humming in different pitchesfa *sound produced with closed lips at different pitches),* practicing 'varna' *(a song)* and practicing basic phrases *[basic phrases include sarale varase* (these fundamental sequences enable the student to get a feel of melody with rhythm), *janti varase* (these are forceful sequences, which facilitate the students to add weight and majesty to their voice), *geethams (they are*

simplest of music compositions in Carnatic music and starting point for a beginner)]. Twenty six percent of Hindustani singers and 45.8% of Carnatic singers practiced 'a:ka:rasa:dagam'. 13% of Hindustani singers and 16.6% of Camatic singers practiced in lower and upper stha:yi to improve their frequency range. 13% of Hindustani singers and 50% of Camatic singers practiced in different octaves (lower and higher octave frequencies). Apart from the above mentioned exercises, 4.3% of Hindustani singers reported that practicing different 'ra:ga:s' itself improved frequency range. 26% of Hindustani singers reported practice was important. 8.6% of Hindustani singers reported that 'svara practice' enhanced frequency range. 4.3% of Hindustani singers hummed different pitches. On the contrary, 4.1% of Camatic singers practiced 'varna' and 8.3% of Camatic singers practiced basic phrases to improve their frequency range. Figure 5 depicts percentage of male singers performing different exercises to improve their frequency range.

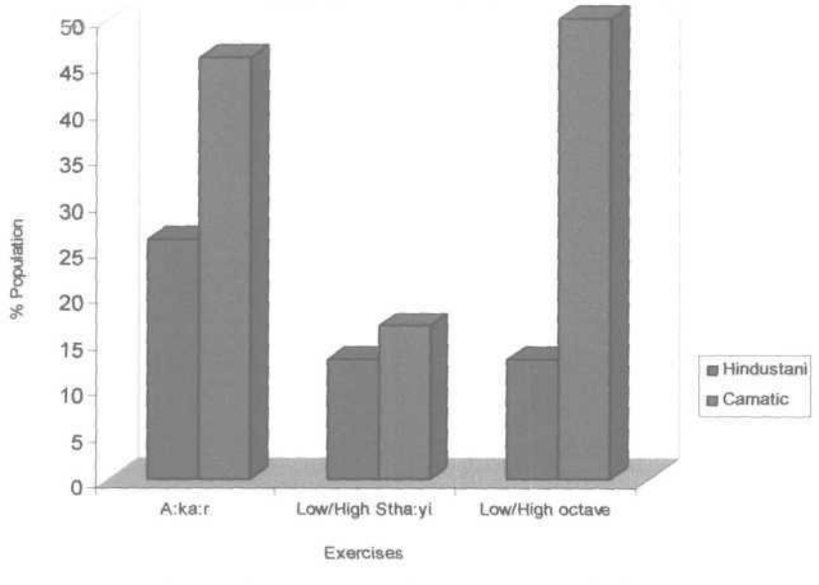


Figure 5: Exercises to improve frequency range in male singers.

Female singers: The exercises performed by the female singers to improve their frequency range include a:ka:rasa:dagam, practice in lower and higher 'stha:yi', practice in different octave frequencies, 'riyarz', humming in different pitches, practicing 'varna' and practicing u:ka:ra *(practice of vowel /u/ in ascending and descending note).* Nine and half percent of Hindustani singers and 5.5% of Camatic singers practiced 'a:ka:rasa:dagam'. 66.6% of Hindustani singers and 27.7% of Camatic singers practiced in lower and upper stha.yi to improve their frequency range. 19% of Hindustani singers and 27.7% of Camatic singers practiced in different octaves (lower and higher octave frequencies). Apart from the above mentioned exercises, 4.7% of Hindustani singers reported that 'riya:z' itself improved frequency range. On the contrary, 11.1% of Camatic singers practiced 'varna'. 5.5% of Camatic singers hummed different pitches. 5.5% of Camatic singers practiced 'u:ka:ra' and 16.6% of Camatic singers reported practice was very important. Figure 6 depicts percentage of female singers performing different exercises to improve their frequency range.

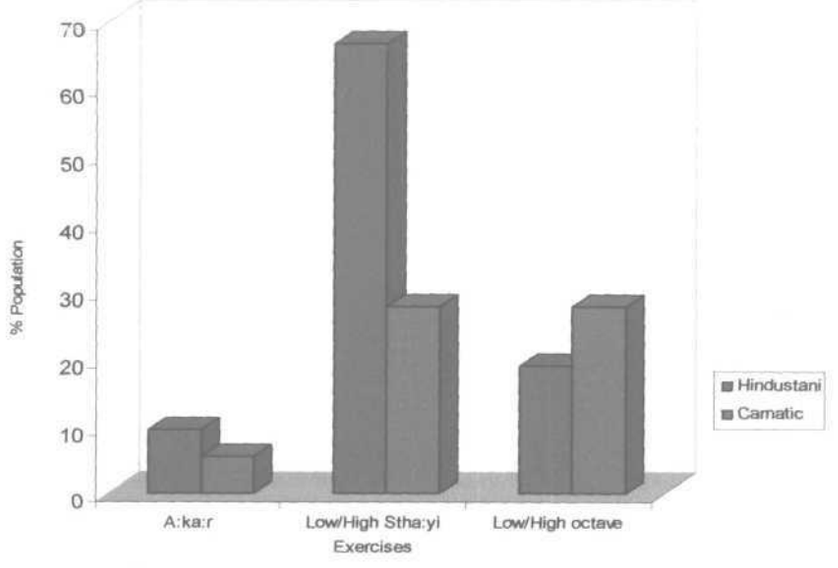


Figure 6: Exercises to improve frequency range in female singers.

Vibrato

Male singers: The exercises performed by the male singers to improve their vibrato include a:ka:rasa:dagam, svara practice, practicing phrases with vibrato, imitating, practicing 'kanars' *(kana:s are differential features of Indian classical music. They are short grace notes above or below the main note, produced by the inflection of voice. It is a type of vibrato)* and practicing i:ka:ra *(practice of vowel /if in ascending and descending note)* and u:ka:ra. Forty eight percent of Hindustani singers and 71.4% of Carnatic singers practiced 'a:ka:rasa:dagam' 14.2% of Hindustani singers and 4.7% of Carnatic singers reported that practicing 'svarars' at different speeds improved vibrato. 14.2% of Hindustani singers and 19% of Carnatic singers reported that they imitated. 23.8% of Hindustani singers and 9.5% of Carnatic singers reported that practicing the phrases with vibrato naturally improved vibrato. Apart from the above mentioned exercises, 4.7% of Hindustani singers reported practicing 'kana:s' improved vibrato. On the contrary, 4.7% of Carnatic singers practiced 'i:ka:ra' and 'u:ka:ra'. Figure 7 depicts percentage of male singers performing different exercises to improve their vibrato.

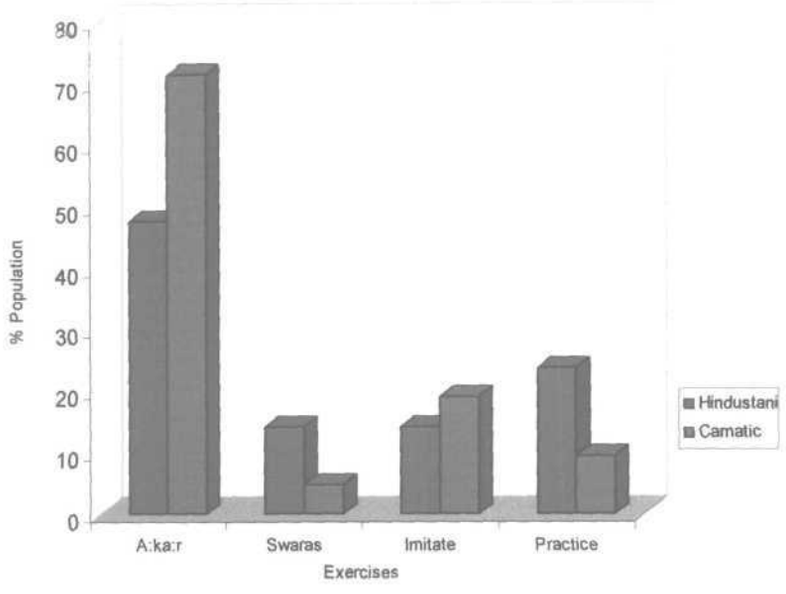


Figure 7: Exercises to improve vibrato in male singers.

Female singers: The exercises performed by the female singers to improve their vibrato include a:ka:rasa:dagam, svara practice, 'briga' *(briga/spuritham are repeating svara:s like ss-rr-gg- mm)* practice, imitating, practicing 'varna', practicing i:ka:ra and u:ka:ra, practicing 'sanca:ras' *(sanca.ras are melodic phrases that serve to establish the identity of the raga. It is the permutation and combination of svara.s that give rise to these melodic phrases)* and practicing 'alankarr *svara.s"(literally means 'that which decorates or embellishes.' In music it refers to features such as a change in the sequence of notes, their repetition, introduction of variety in timbre in one single phrase, etc. Embellishments are employed to bring in more beauty in presentations).* Thirty eight percent of Hindustani singers and 36.3% of Carnatic singers practiced 'a:ka:rasa:dagam'. 71.4% of Hindustani singers and 22.7% of Carnatic singers reported that practicing 'svarars' at different speeds improved vibrato. Apart from the above mentioned exercises,

4.7% of Hindustani singers reported to practice 'i:ka:ra' and 'u:ka:ra', 9% of Hindustani singers reported that practicing the 'alanka:r svara:s' improved vibrato. On the contrary, 4.5% of Carnatic singers practiced 'i:ka:ra', 18.1% imitated, 9% practiced 'varna', 4.5% practiced 'sanca:ras' and 9% did 'briga' practice to improve vibrato in singing. Figure 8 depicts percentage of female singers performing different exercises to improve their vibrato.

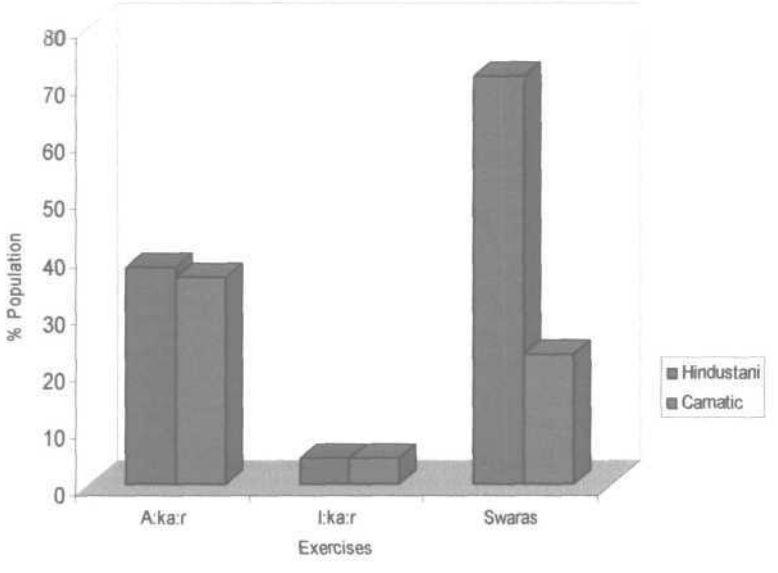


Figure 8: Exercises to improve vibrato in female singers.

Warm up exercises

Male singers: The warm up exercises performed by the male singers include sustaining on /sa pa sa/ *(prolonging the notes mandra /sa/ /pa/ and tara /sa/ in ascending and decending pattern),* a:ka:rasa:dagam, singing ra:ga, singing softly, practicing basic phrases, practicing in different pitches and practicing 'varna'. Seven percent of Hindustani singers and 11.7% of Carnatic singers considered sustaining on /sa pa sa/ as a

warm up exercise. 7.14% of Hindustani singers and 17.6% of Carnatic singers considered 'a:ka:rasa:dagam' as a warm up exercise. 28.5% of Hindustani singers and 11.7% of Camatic singers reported that singing the outline of the ra:ga acted as a warm up exercise. 35.7% of Hindustani singers and 17.6% of Camatic singers reported that singing the song softly before the performance warmed up their voice. Apart from the above mentioned exercises, 7.14% of the Hindustani singers reported that practicing in low to high pitch warmed up their voice. On the contrary, 11.7% of Camatic singers considered singing basic phrases as warm up exercise, 11.7% of Camatic singers said they had warm water which helps to warm up their voice and 11.7% of Camatic singers considered 'varna' as warm up exercise. Figure 9 depicts percentage of male singers performing different warm up exercises.

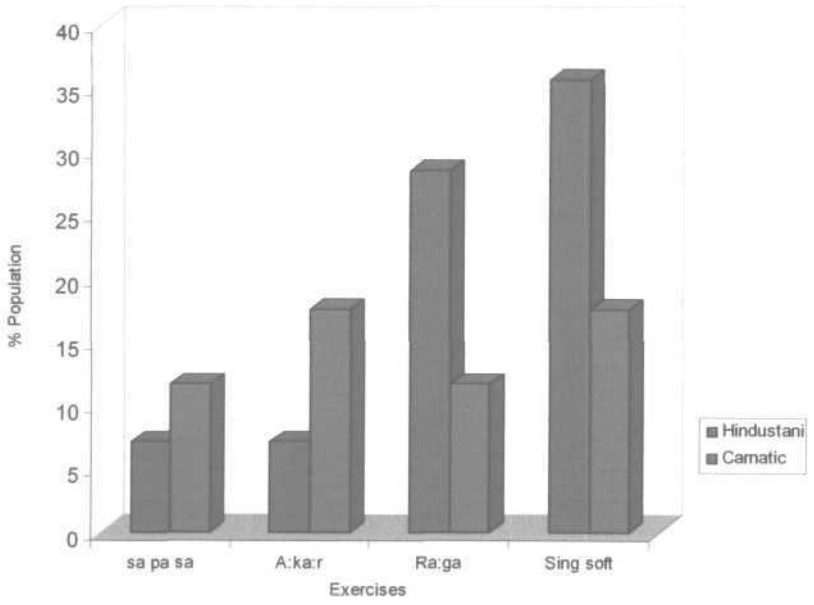


Figure 9: Warm up exercises in male singers.

Female singers: The warm up exercises performed by the female singers include sustaining on /sa pa sa/, a:ka:rasa:dagam, singing 'a:la:p' *(a:la:p is exposition of the ra:ga of the song that will be performed. A performer will explore the ra:ga first by singing the lower octaves and then moving up to higher ones and touching various aspects of the ra.ga. It is a slow improvisation with no rhythm. In Hindustani music there are three kinds of a:la:p namely a:ka:r, nom-tom a:la:p and bol-a:la:p)*, singing softly, practicing 'varna', humming and practicing basic phrases. Thirteen percent of Hindustani singers and 6.6% of Carnatic singers considered sustaining on /sa pa sa/ as a warm up exercise. 26.6% of Hindustani singers and 20% of Carnatic singers considered 'humming' as a warm up exercise. 40% of Hindustani singers and 26.6% of Carnatic singers reported that singing the song softly before the performance warmed up their voice. Apart from the above mentioned exercises, 26.6% of the Hindustani singers reported that 'a:la:p (a:ka:ra)' warmed up their voice. On the contrary, 13% of Carnatic singers considered singing basic phrases as w[r]arm up exercise, 26.6% of Carnatic singers reported that 'a:ka:rasa:dagam' helps to warm up their voice and 33.3% of Carnatic singers considered 'varna' as warm up exercise. Figure 10 depicts percentage of female singers performing different warm up exercises.

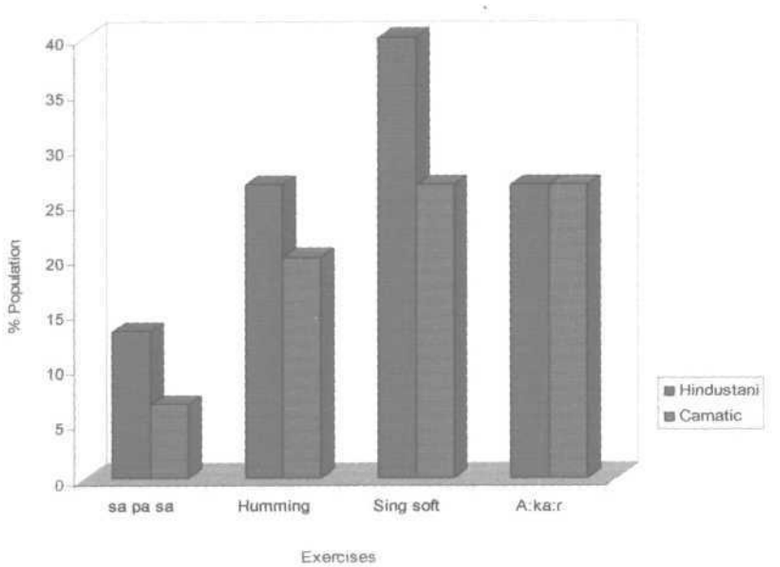


Figure 10: Warm up exercises in female singers.

Warm down exercises

Male singers: The warm down exercises performed by the male singers include taking voice rest after singing *[giving complete rest to voice after singing (no talking)]*, listening to 'sruti' after singing *(listening to pitch after singing)*, taking water after singing and speaking less after singing. Thirty three percent of Hindustani singers and 50% of Carnatic singers reported that they took voice rest after singing. Apart from taking voice rest, 33.3% of Hindustani singers reported listening to 'sruti' as warm down exercise. On the contrary, 25% of Carnatic singers reported to take water after singing and 50% of Carnatic singers reported that they spoke less after singing. Figure 11 depicts percentage of male singers performing different warm down exercises.

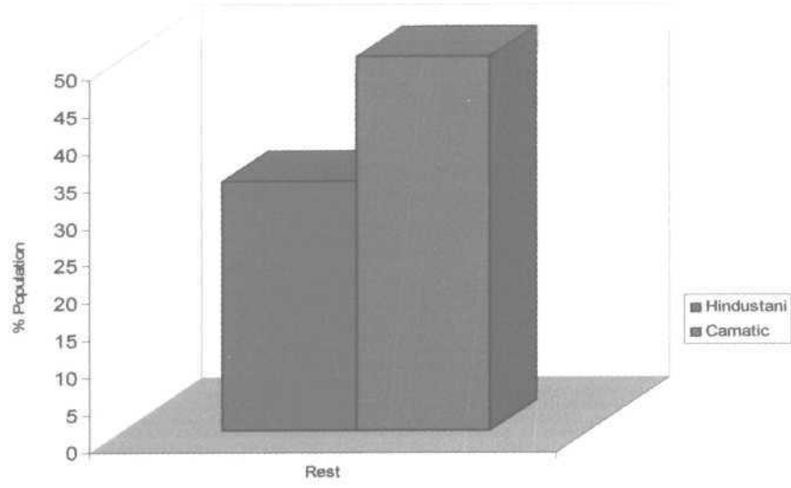


Figure 11: Warm down exercises in male singers.

Female singers: The warm down exercises performed by the female singers include taking voice rest after singing, speaking less after singing, singing 'bhajans' *(bhajans are a genre of vocal devotional music also presented from the concert-stage)* at the end of singing and sustaining /sa pa sa/. Fifty percent of Hindustani singers and 20% of Carnatic singers reported that they sustained /sa pa sa/ at the end of singing. Apart from this, 50% of Hindustani singers reported singing 'bhajans' at the end of singing as warm down exercise. On the contrary, 40% of Carnatic singers reported to take voice rest after singing and 20% of Carnatic singers reported that they spoke less after singing. Figure 12 depicts percentage of female singers performing different warm down exercises.

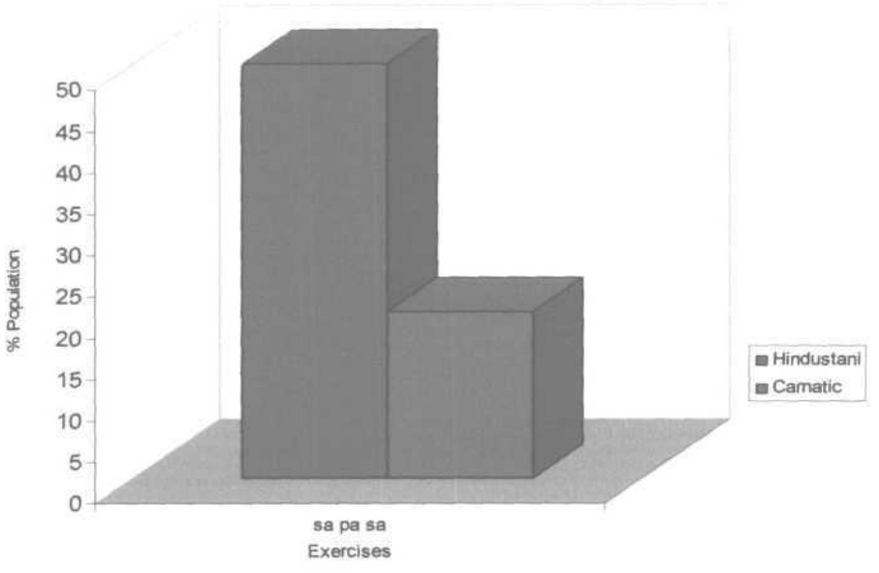


Figure 12: Warm down exercises in female singers.

Physical exercises

Male singers: The physical exercises performed by the male singers include yoga, walking, meditation, art of living exercises, pra:na:ya:ma, suryanamaska:r *(an yogic exercise also called as sun salutation. It is excellent because it stretches and strengthens all the major muscle groups in the body and exercises the respiratory system)* and playing outdoor games. Hundred percent of Hindustani singers and 40% of Carnatic singers did 'yoga'. 31.5% of Hindustani singers and 57.1% of Carnatic singers went for 'walking' everyday. 5.2% of Hindustani singers and 7.1% of Carnatic singers did 'meditation'. 7.1% of Hindustani singers and 10.5% of Carnatic singers did 'art of living' exercises. Specifically, 31.5% of Hindustani singers and 7.1% of Carnatic singers did 'pra:na:ya:ma' and 5.2% of Hindustani singers and 7.1% of Carnatic singers did 'suryanamaskarr'. On the contrary, 7.1% of Carnatic singers indulged in playing outdoor

games like tennis. Figure 13 depicts percentage of male singers performing different physical exercises.

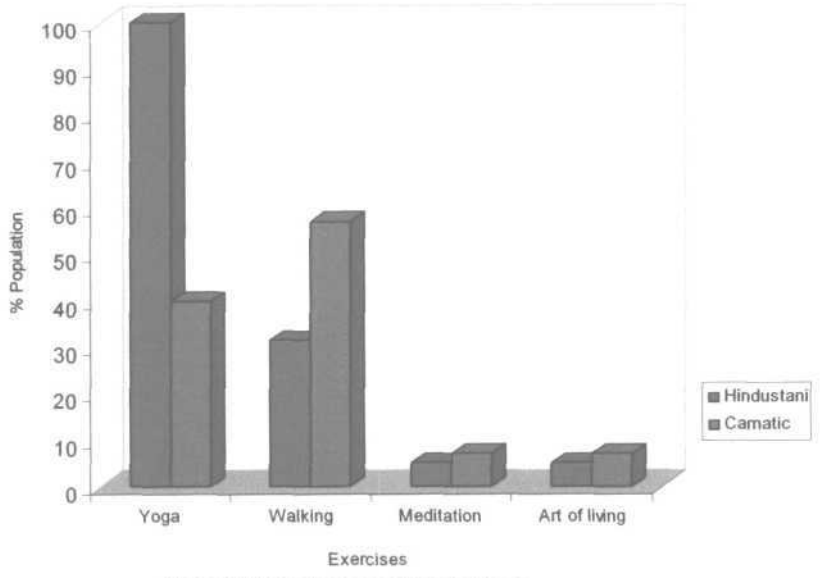


Figure 13: Physical exercises in male singers.

Female singers: The physical exercises performed by the female singers include yoga, walking, meditation, pra:na:yama, sudarshan kriya, jogging *(jogging is a form of trotting or running at a slow or leisurely pace. The main intention is to increase fitness without stress),* aerobics *(aerobics is a particular form of exercise. Aerobic classes generally involve rapid stepping patterns, performed to music with cues provided by an instructor),* physical work (household work which involves sweeping, cleaning and washing) and gym workout *(gym is shortened form of gymnasium which refers to facilities intended for indoor sports or exercise).* Fifty six percent of Hindustani singers and 100% of Carnatic singers did 'yoga'. 42.1% of Hindustani singers and 20% of Carnatic singers went for 'walking' everyday. Specifically, 10.5% of Hindustani singers and 70% of Carnatic

singers did 'pra:na:ya:ma', 5.2% of Hindustani singers and 5% of Carnatic singers did 'sudarshan kriya', 5.2% of Hindustani singers went for 'jogging', 5.2% of Hindustani singers went for 'aerobic classes' and 10.5% of Hindustani singers did 'meditation'. On the contrary, 10% of Carnatic singers indulged in physical work (household work) and 5% of Carnatic singers had a 'gym workout'. Figure 14 depicts percentage of female singers performing different physical exercises.

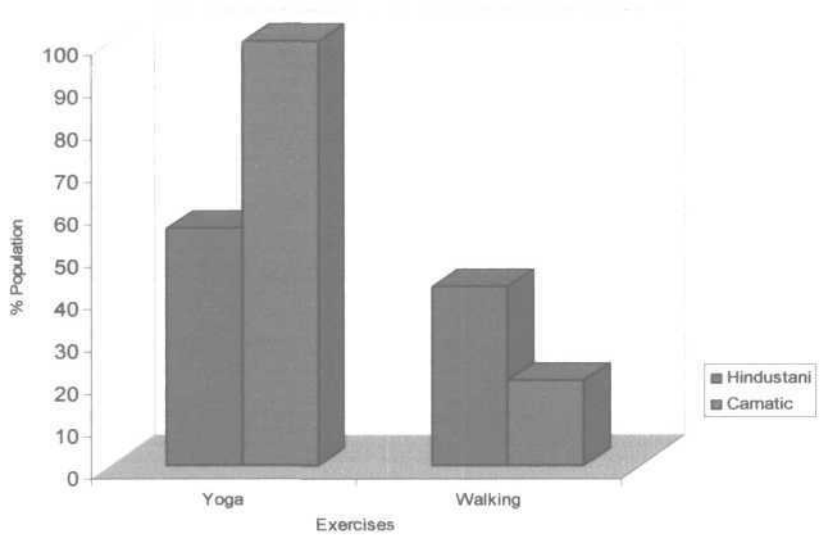
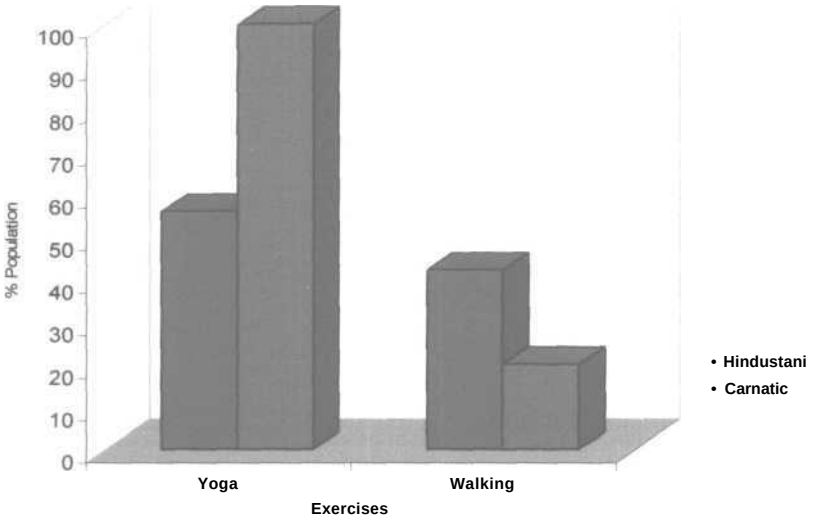


Figure 14: Physical Exercises in female singers.

Out of the 100 subjects, 58 singers taught music/were music teachers. 59% were male teachers and 41% were female teachers. Male Hindustani teachers were more in number (53%) compared to male Carnatic teachers (47%). Female Carnatic teachers were more in number (66.6%) compared to female Hindustani teachers (33.3%). All the music teachers irrespective of gender, years of experience selected 'a:dha:ra sruti' (base pitch) by making the student sing and listen to their voice range. 70.6% of music teachers also changed 'a:dha:ra sruti' (base pitch) during the course of training. Criteria for changing 'a:dha:ra sruti'(base pitch) were age factor, years of training/flexibility of voice and

singers did 'pra:na:ya:ma', 5.2% of Hindustani singers and 5% of Carnatic singers did 'sudarshan kriya', 5.2% of Hindustani singers went for 'jogging', 5.2% of Hindustani singers went for 'aerobic classes' and 10.5% of Hindustani singers did 'meditation'. On the contrary, 10% of Carnatic singers indulged in physical work (household work) and 5% of Carnatic singers had a 'gym workout'. Figure 14 depicts percentage of female singers performing different physical exercises.



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Female singers: Four percent of Hindustani singers and 4% of Carnatic singers had poor knowledge on vocal hygiene. None of the singers had below average knowledge on vocal hygiene. 12% of Hindustani singers and 16% of Carnatic singers had average knowledge on vocal hygiene. 60% of Hindustani singers and 44% of Carnatic singers had more or above average knowledge on vocal hygiene. 24% of Hindustani singers and 36% of Carnatic singers had good knowledge on vocal hygiene. On the whole, among female singers, Carnatic singers and Hindustani singers had equal knowledge. Figure 16 depicts the percentage of female singers' knowledge on vocal hygiene.

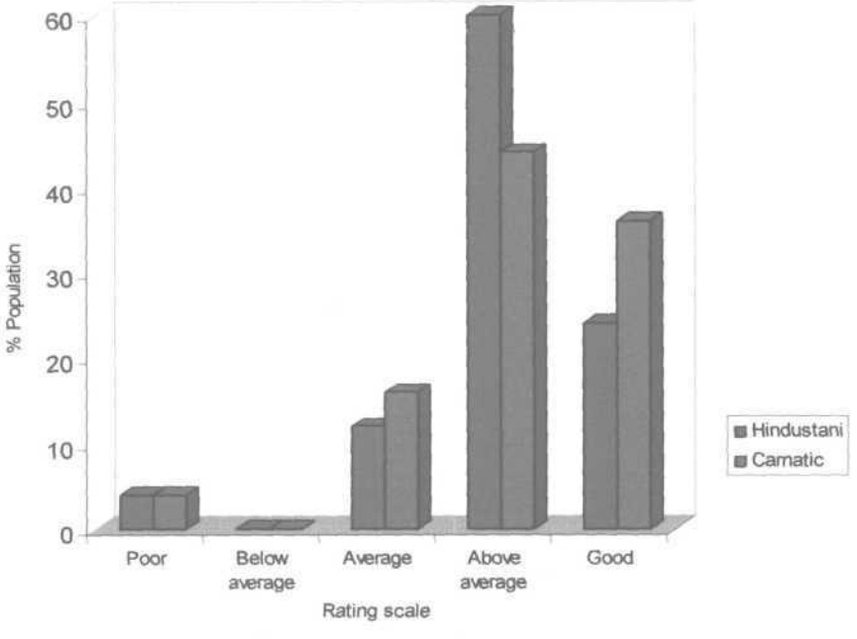

Figure 16: Knowledge of vocal hygiene in female singers.

Awareness of speech/voice therapy: Forty percent of male Hindustani singers and 60% of male Carnatic singers were aware of speech/voice therapy. 56% of female Hindustani singers and 76% of female Carnatic singers were aware of speech/voice therapy. It was very evident that, Carnatic singers, both males and females, were more aware of

speech/voice therapy compared to Hindustani singers. Figure 17 depicts the percentage of singers' awareness of speech/voice therapy.

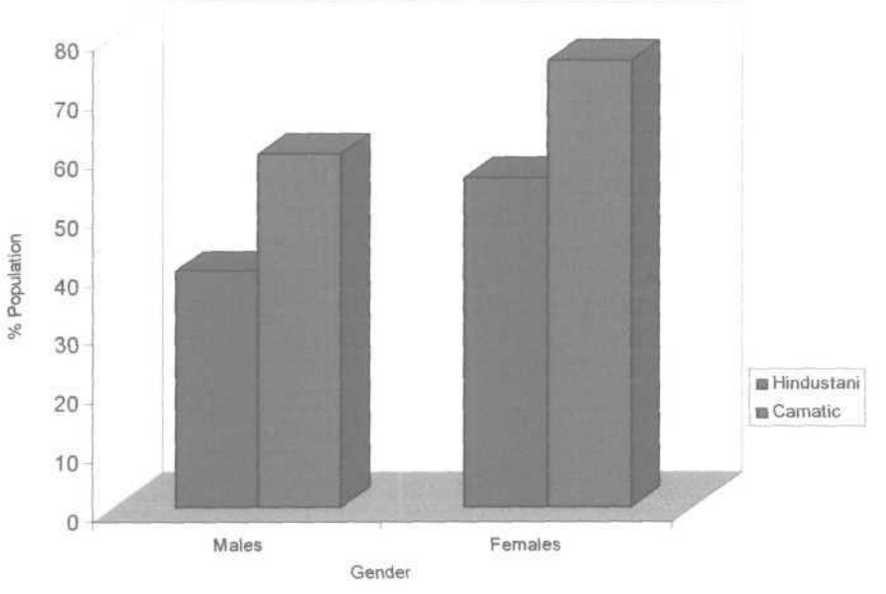

Figure 17: Awareness of speech/voice therapy

Common practices to prevent voice problems

Male singers: Forty percent of Hindustani singers and 64% of Carnatic singers took warm water. 36% of Hindustani singers and 56% of Carnatic singers took voice rest. 12% of Hindustani singers and 48% of Carnatic singers spoke softly. 20% of Carnatic singers took steam inhalation. 64% of Hindustani singers and 60% of Carnatic singers did salt water gargling. 16% of Hindustani singers and 32% of Carnatic singers took herbal or ayurvedic medicines. Apart from the above mentioned practices, 4% of Hindustani singers took turmeric powder in hot water, 4% of Carnatic singers reported singing in appropriate pitch, 4% of Carnatic singers had fibre rich food, 4% of Carnatic singers took mint/pepper/ginger, 8% of Carnatic singers took allopathic or homeopathic medication

and finally 4% of Carnatic singers avoided oily food. Figure 18 depicts percentage of male singers who had these habits prevent voice problems.

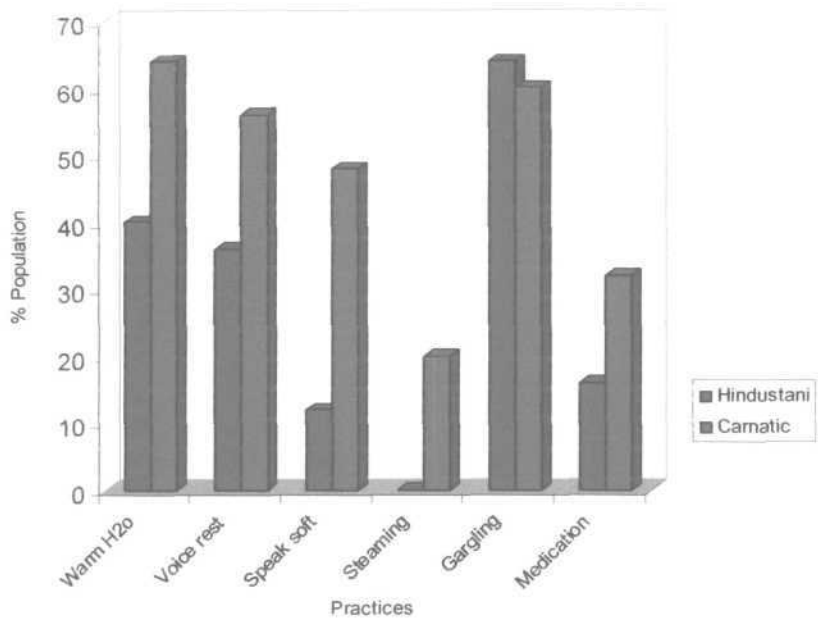

Figure 18: Common practices to prevent voice problems in male singers.

Female singers: Sixty percent of Hindustani singers and 76% of Carnatic singers took warm water. 52% of Hindustani singers and 76% of Carnatic singers took voice rest. 16% of Hindustani singers and 60% of Carnatic singers spoke softly. 16% of Hindustani singers and 36% of Carnatic singers took steam inhalation. 64% of Hindustani singers and 72% of Carnatic singers did salt water gargling. 16% of Hindustani singers and 44% of Carnatic singers took herbal or ayurvedic medicines. Apart from the above mentioned practices 4% of Hindustani singers took turmeric milk, 8% of Hindustani singers took allopathic medication, 4% of Hindustani singers took cloves and 16% of Hindustani singers had honey/lime in hot water. 4% of Carnatic singers reported singing in appropriate pitch, 4% of Carnatic singers had turmericmilk 8% of Carnatic singers took

cloves/ginger, 4% of Carnatic singers took allopathic medication, 16% of Carnatic singers took homeopathic medication and finally 4% of Carnatic singers took ayurvedic medicines (adimathuram, srikaramodini, kadiragutika etc.). Figure 19 depicts percentage of female singers who had these habits prevent voice problems.

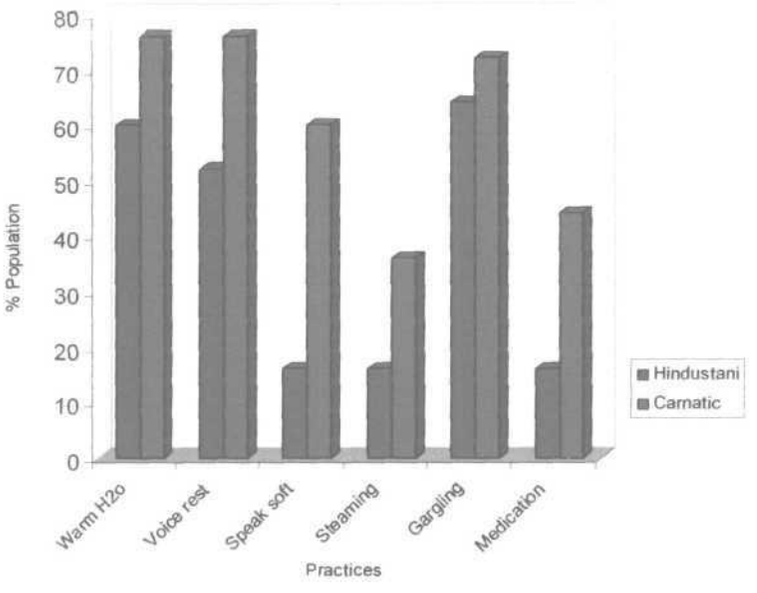

Figure 19: Common practices to prevent voice problems in female singers.

Part 4: Vocal and Non-Vocal Habits of Hindustani and Carnatic singers

Vocal Habits of Carnatic and Hindustani singers: The vocal habits included amount of training, number of times of practice in a day, total hours of practice in a day, number of hours of singing in a performance, gaps given during practice, time of practice, speaking loud and throat clearing. Percentage of singers (both Carnatic and Hindustani) who practiced once a day was more compared to twice a day/> twice a day (59%). Also, greater percentage (73%) of singers (both Carnatic and Hindustani) practiced 1 - 3 hours in a day. The same result is consistent with the hours of singing in a performance. Greater

percentage (58%) of singers (Carnatic and Hindustani) sang 1-3 hours in a performance. Greater percentage of male Carnatic singers gave gaps/breaks in between practice (56%). On the contrary, among female singers, Hindustani singers gave more gaps/breaks during practice (80%). All the singers practiced at early morning (EM), morning (M), evening (E), night (N) but greater percentage of singing is done during morning (M) and evening (E). Most of the singers did not have the habit of speaking loudly. Similarly, most of the singers also did not report to clear their throat frequently. Table 5 depicts the percentage of Carnatic and Hindustani singers with different vocal habits.

Sl.No	Habits		Males		Females	
			Carnatic	Hindustani	Carnatic	Hindustani
1.	Amount of training (in yrs)		15	17	18	12
2.	No. of times u practice in a day	1	64%	64%	52%	56%
		2	16%	28%	36%	40%
		>2	20%	8%	12%	4%
3.	Total hours of practice in a day	1	12%	32%	16%	24%
		1-3	80%	56%	76%	60%
		>3	8%	12%	8%	16%
4.	Performance	1	Nil	Nil	4%	4%
		1-3	48%	72%	56%	56%
		>3	8%	12%	8%	16%
5.	Gaps given during practice	Yes	56%	40%	44%	80%
		No	44%	60%	56%	20%
6.	Time of practice	EM	36%	36%	24%	24%
		M	48%	60%	68%	68%
		E	64%	48%	64%	56%
		N	20%	4%	28%	4%
7.	Speaking loud	Yes	20%	20%	36%	32%
		No	80%	80%	64%	68%
8.	Throat clearing	Yes	16%	16%	12%	12%
		No	84%	84%	88%	88%

Table 5: Vocal Habits of Carnatic and Hindustani singers.

Non-Vocal Habits of Hindustani and Carnatic singers: The non-vocal habits included eating/drinking habits, intake of number of glasses of water and coffee/tea and number of hours of sleep. Greater percentage (72%) of Carnatic singers had specific eating/drinking habits compared to Hindustani singers (42%). Water was consumed more by Hindustani singers (8 glasses) on average. Hours of sleep were equal among all the singers (7 hours on an average). Greater percentage (54%) of singers (Carnatic and Hindustani singers) consumed 2-4 cups coffee/tea per day. Table 6 depicts the percentage of Carnatic and Hindustani singers with different non-vocal habits.

Sl.No	Habits		Males		Females	
			Carnatic	Hindustani	Carnatic	Hindustani
1.	Specific eating/ drinking habits		72%	56%	72%	40%
2.	Water (in glasses)		6	8	6	8
3.	Coffee/tea (in cups)	Nil	16%	24%	28%	40%
		<2	4%	8%	40%	4%
		2-4	76%	56%	32%	52%
		>4	4%	12%	-	4%
4.	Sleep (in hours)		7	7	7	7

Table 6: Non-vocal habits of Carnatic and Hindustani singers.

Specific eating/drinking habits

Male singers: Four percent of Hindustani singers and 24% of Carnatic singers took warm water before performance. 16% of Hindustani singers and 28% of Carnatic singers had milk before performance. Coffee was consumed equally by both Hindustani and Carnatic singers (20%). 16% of Hindustani singers and 8% of Carnatic singers preferred light tiffin in morning prior to performance. Mint/pepper/ginger was consumed equally by Hindustani and Carnatic singers (8%). Apart from the above mentioned eating/drinking habits, 8% of Hindustani singers had tea, 4% of Hindustani singers liked to have nuts, 8% of Hindustani singers had water and 8% of Hindustani singers had

spiced foods before performance. 4% of Hindustani singers had the habit of tobacco chewing, 8% of Hindustani singers had the habit of smoking and 4% of Hindustani singers had alcohol. 4% of Carnatic singers had ayurvedic/herbal medicines prior to performance.Figure 20 depicts percentage of male singers having specific eating/drinking habits.

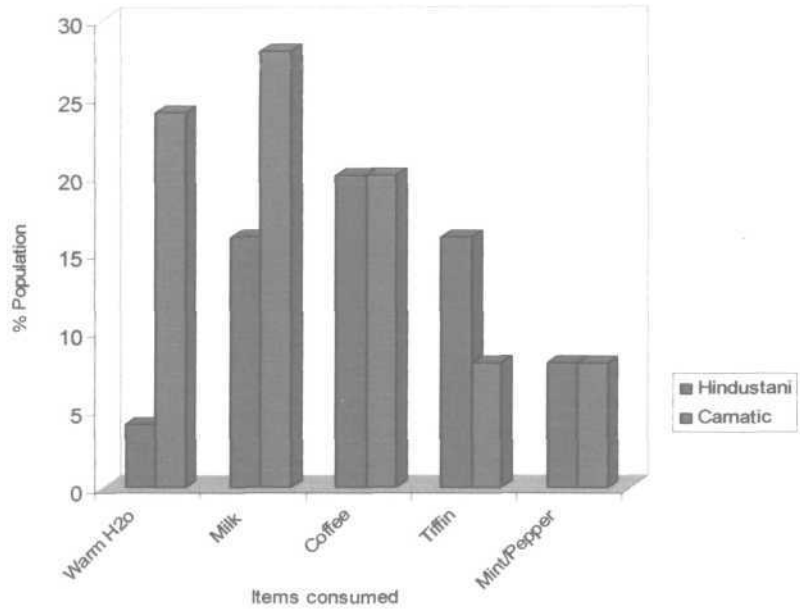

Figure 20: Eating/Drinking habits in male singers.

Female singers: Twenty percent of Hindustani singers and 24% of Carnatic singers took warm water before performance. 8% of Hindustani singers and 36% of Carnatic singers had milk before performance. 4% of Hindustani singers and 12% of Carnatic singers consumed coffee. 4% of Hindustani singers and 12% of Carnatic singers preferred light tiffin in morning prior to performance. 4% of Hindustani singers and 12% of Carnatic singers consumed mint/pepper/ginger. Apart from the above mentioned eating/drinking habits, 8% of Hindustani singers had tea, 4% of Hindustani singers liked to have nuts.

20% of Carnatic singers had ayurvedic/ herbal medicines prior to performance. Figure 21 depicts percentage of female singers having specific eating/drinking habits.

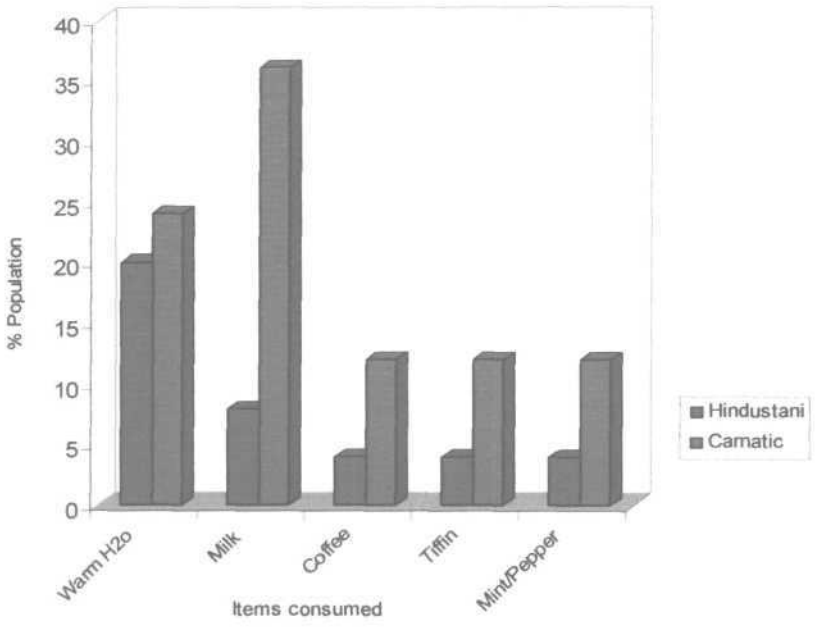

Figure 21: Eating/Drinking habits in female singers.

CHAPTER 5

Discussion

The results of the study revealed several points of interest. If we look at the hierarchy of exercises from most performed to least performed, among the six exercises namely exercises to improve breath support, exercises that improved the frequency range, exercises to improve vibrato, warm up exercises, warm down exercises and physical exercises, the most practiced exercises were exercises that improved the frequency range followed by exercises to improve breath support, exercises to improve vibrato, physical exercises, warm up exercises and the least practiced were warm down exercises.

On the whole, exercises to improve breath support, exercises to improve vibrato and physical exercises were performed more by Hindustani singers and in contrast, warm up exercises, warm down exercises and exercises that helped to improve frequency range were practiced more by Carnatic singers. 90% of the Hindustani singers practiced exercises that improved breath support, 84% of the Hindustani singers practiced exercises that improved vibrato and 76% of the Hindustani singers did physical exercises. On the contrary, 92% of the Carnatic singers practiced exercises that improved the frequency range, 64% of the Carnatic singers did warm up exercises and 18% of the Carnatic singers did warm down exercises.

Among Carnatic singers, vocal exercises performed by the singers can be compared to Sharanya's (2006) study. The results of the present study indicated higher

percentage population practicing exercises that improved breath support and exercises that improved vocal efficiency and endurance compared to Sharanya (2006). However, exercises that improved vibrato were practiced by more number of singers in Sharanya (2006) study compared to the present study.

Breathing exercises

Proctor (1980) reported that by doing the simple exercise of sustaining a tone for as long as possible, one could gradually learn to increase the duration of the tone from 20 to 25 to 30 to 35 or longer, maintaining good tone quality. He also reported that 'deep breathing' was an essential aspect of singing. Titze (1994) reported two prevalent approaches to the establishment of breath support during singing. They are pear shape up and pear shape down approach. In pear shape up approach, primary emphasis is on keeping the ribcage high and stable. The theory is that with minimum contraction and expansion of the ribcage, the softer tissues underneath the ribcage do the pumping of air. This presumably saves energy by preventing a 'heaving' effect of the ribcage during expansion and contraction. In the pear shape down approach, less emphasis is placed on ribcage movement/position; but more emphasis is placed on maintaining stable abdominal pressure. It prevents ribcage and trachea from crowding the larynx and producing shallow sound. Miller (1996) reported that appoggio maintains for a remarkable period of time a posture near that which pertained at the beginning of the inspiratory phase of the breath cycle. This initial posture ensures cooperative muscle activity in the pectoral, epigastric and umbilical regions and diaphragmatic control. The

total torso is involved. The powerful abdominal musculature undergrids the breath mechanism.

The breathing exercises performed by the singers in the present study include yoga *[(yoga is a combination of breathing exercises, physical postures, and meditation and it has been practiced for over 5,000 years. The different breathing exercises included loud breathing, rhythmical breathing, forced rapid breathing, alternate breathing and 'bhramhari' which is customarily described as involving rapid inhalation producing a high humming sound and slow exhalation producing a low humming sound),* pra:na:ya:ma *(pra:na:ya:ma is a Sanskrit word that means control (yama) of the breath. It is also commonly used to describe various yogic breathing exercises that help give the practitioner control of the breath),* meditation *(meditation describes a state of concentrated attention on some object of thought or awareness. Many practice meditation in order to achieve peace, while others practice certain physical yoga in order to become healthier),* deep breathing *(diaphragmatic breathing or deep breathing is the act of breathing deep into your lungs by flexing your diaphragm rather than breathing shallowly by flexing your rib cage and it is more healthier),* kapa:labhati *(Kapa:la means "skull," and bhati means "that which brings lightness.". Kapa.labhati is a breathing technique used specifically for cleansing. If we have a lot of mucus in the air passages or feel tension and blockages in the chest it is often helpful to breathe quickly. In this practice we deliberately breathe faster, and at the same time use only abdominal (that is, diaphragmatic) breathing, not chest breathing. In kapa.labhati the breath is short, rapid, and strong. We use the lungs as a pump, creating so much pressure as they expel the air*

that all the rubbish is cleared from the air passages, from the lungs up through the nostrils), open mouth singing, maximum phonation duration *(longest time duration for which a note can be sustained),* omka:r *(Aum also called as Om is a mystical or sacred syllable in the Dharmic religions. Chanting this sacred syllable is called as omka.r chanting),* ra:ga practice *(ra.ga means a set of notes arranged in ascending and descending order within the octave),* a:ka:rasa:dagam *(the practice of vowel /a/ in ascending and descending note at different speeds),* practicing 'taans' *(taans are normally understood as the fast-paced musical and melodic elaborations in Indian music, vocal as well as instrumental)* in one breath, art of living exercises *(sudarshan kriya as done at art of living workshops is a unique rhythmical breathing process that results in the overall betterment of both body and mind. It involves regulating one's breath to the sounds of So-hum ('so'for inhale and ' hum' for exhale). The entire kriya involves multiple rounds with each round having long, medium and short inhalation and exhalations with varying rhythms and intensities),* steam inhalation, appropriate posture and 'riya:z' *(practice)].*

Meditation helps one to concentrate. During the process of meditation, a singer is taught to concentrate on natural relaxed breathing. Thus it helps the singer to improve breath support. Open mouth singing helps to increase loudness and resonance thereby a singer is able to better project his/her voice. Increased loudness may be the result of increased subglottic air pressure. This increased subglottic air pressure indicates that singers are able to use expiratory air more efficiently which is a pre requisite for singing. Omka:r chanting consists of sustaining the word 'Om' for a long time as in maximum phonation duration. Thus it helps to improve breath support. Singing ra:ga and 'riya:z'

indirectly help in improving breath support as the phrases of the ra:ga will be expanded on a single breath with everyday practice. 'A:ka:rasa:dagam' helps to improve breath support especially when practiced at fast tempo. Initially simple phrases are sung in one breath gradually at fast tempo lengthy phrases are sung in one breath. In an inappropriate posture, there is interference with the proper positioning of larynx and pharynx for singing. Appropriate posture helps in breathing efficiently because in an erect posture the natural curves of the vertebral column and shoulder are well preserved and there is minimal muscular activity. Proper posture releases tension often associated in the breathing mechanism that can interfere with effective voice production. Ordinarily, if there is tension when breathing, that tension radiates to the voice box muscles. Thus appropriate posture is an essential aspect of breathing for singing.

Boominathan et al. (2004) reported that Carnatic singers practiced the exercise of sustaining a note for a long duration to improve their breath support. Durga et al. (2007) reported that 'deep breathing' or diaphragmatic breathing was an essential aspect of singing. They also reported that appropriate posture was important for singing. In India, singing is performed while sitting on the floor cross legged. In order to enhance proper breathing in this posture, the back should be completely erect not stiff. The results of the present study support the earlier studies.

Exercises to improve frequency range

The exercises performed by the singers in the present study to improve their frequency range include a:ka:rasa:dagam, practice in lower and higher 'stha:yi' *(pitch),* practice in different octave frequencies, ra:ga practice, svara *(svara refers to a type of musical sound that is a single note, which defines a relative (higher or lower) position of a note, rather than a defined frequency)* practice, humming in different pitches(a *sound produced with closed lips at different pitches),* practicing 'varna' *(a song),* practicing basic phrases *[basic phrases include sarale varase (these fundamental sequences - sa ri ga ma pa da ni sa, enable the student to get a feel of melody with rhythm), janti varase (these are forceful sequences - sasa riri gaga mama papa dada nini sasa, which facilitate the students to add weight and majesty to their voice), geethams (they are simplest of music compositions in Carnatic music and starting point for a beginner)],* 'riya:z' and practicing u:ka:ra *(practice of vowel /u/ in ascending and descending note).* 'A:ka:rasa:dagam' is usually sung from 'mandra' (lower) /pa/ to 'tara' (higher) /pa/. Everyday the entire range is not covered. Practicing everyday in this frequency range gradually improves the frequency range. 'U:kara' also helps to improve the frequency range in the same manner except that instead of vowel /a/ the vowel /*u/* is practiced. Practicing 'svara:s' at different pitches (lower and higher) everyday improves frequency range. Practicing 'ra:ga' and 'riya:z' help to improve frequency range as the compostion of ra:ga would include phrases at different pitches. Each ra:ga will be unique with its own frequency range. Hence, practicing on different ra:gas which consist of low and high notes will improve frequency range. 'Varna' is the most complicated composition

(Appendix I). It brings out all the essential features of the ra:ga. It also includes phrases with different pitches which help to improve frequency range. Singing basic phrases improves frequency range as they contain compositions of different pitches. The basic phrases are taught initially during the singing training to help the singer get control over the frequency range and other aspects of singing.

Exercises to improve vibrato

The exercises performed by the singers in the present study to improve their vibrato include a:ka:rasa:dagam, svara practice, practicing phrases with vibrato, imitating, practicing 'kana:s' *(kana:s are differential features of Indian classical music. They are short grace notes above or below the main note, produced by the inflection of voice. It is a type of vibrato),* practicing i:ka:ra *(practice of vowel /// in ascending* ***and*** *descending note)* and u:ka:ra, 'briga' *(briga/spuritham are repeating svara.s like ss - rr - gg - mm)* practice, practicing 'varna', practicing 'alanka:r svara:s' *(literally means 'that which decorates or embellishes.' In music, it refers to features such as a change in the sequence of notes, their repetition, introduction of variety in timbre in one single phrase, etc. Embellishments are employed to bring in more beauty in presentations)* and practicing 'sanca:ras' *(sanca.ras are melodic phrases that serve to establish the identity of the raga. It is the permutation and combination of svara.s that give rise to these melodic phrases).* 'A:ka:rasa:dagam' is singing the vowel /a/ in ascending and descending note at different tempos. The vowel /a/ sung at different tempos helps in faster shift in transition between the notes thereby helping to improve vibrate. 'I:ka:ra'

and 'u:ka:ra' also help to improve vibrato as 'a:ka:rasa:dagam' except that vowel *I'll* and vowel *lul* are used for improvisation. 'Svara' improves vibrato in same manner like 'a:ka:ra' but in 'svara' practice many different notes are used. 'Varna' is the most complex composition and it comprises of all essential features of ra:ga encompassing lots of phrases with vibrato. Hence, by practicing 'varna' vibrato can be improved. 'Alanka:r svara:s' are phrases which are similar to 'dhatu svara:s'. They have lots of jumping between notes like ga sa or ni pa etc., They improve vibrato when sung at fast speeds. 'Briga', 'kana:s' and 'sanca:ras' are phrases produced by inflection of voice and with regular practice they enhance vibrato.

Boominathan et al. (2004) reported that a:ka:rasa:dagam was used to improve ornamentation aspects of singing. Sharanya (2006) reported that most singers used 'a:ka:rasa:dagam' *(the practice of vowel /a/ in ascending and descending note at different speeds)* exercises to enhance ornamentation aspects of their singing. The results of the present study support the earlier studies. Durga et al. (2007) reported that aka:ra passages played a predominant role in improvisation. In Carnatic music more solfa exercises (svara:s also refer to the solfege of Carnatic music, which consist of seven notes, "sa-ri-ga-ma-pa-da-ni") were prescribed for voice training, whereas aka:ra and other vocalizes were preferred in Hindustani music. Indian singers used glutteral articulation for the execution of ornamentation. The results of the present study contradict Durga et al.'s study. The results of the present study showed the reverse trend, with Carnatic singers practicing more 'a:ka:rasa:dagam' and Hindustani singers practicing more svara:s.

Warm up exercises

Warm-ups, as in weight training, are used to stretch the muscles to prepare them for work without injury and are hypothesized to improve performance. Titze (1992, 1994, and 1996) reported that a vocalist can engage in laryngeal and respiratory stretching exercises by gliding over a large range of pitches and intensities. Accuracy of targeting is practiced by attacking notes at precise pitches, stability of posturing is practiced by long, sustained notes, often with crescendos and decrescendos; speed of transition is practiced by rapid scales or arpeggios and dynamic range (pitch range a singer can use) is extended by jumping quickly between high and low notes. Lip and tongue trills are common as vocal warm ups. In practicing tongue trill, tongue can be alternatively moved from one side of the mouth to another (laterally). It can also be moved alternatively from inside to outside of the mouth (tongue protrusion and retraction). Trill should be produced in both ascending and descending pitch. Messa Di Voce is also one of the common vocal warm ups. While practicing this exercise, pitch should be constant and loudness should be increased initially and then decreased. Amir, Amir & Michaeli (2005) investigated effect of vocal warm up on voice quality of trained singers using acoustic measurements of voice quality (frequency and amplitude perturbation and noise indices). They included 21 young female singers who had mean years of training as 5.4 years. The warm up exercises done by these singers included body posture alignment and relaxation exercises, breathing exercises and voice productions and placement at different pitches, registers and amplitude levels using **a** variety of syllables sung in different pitches.

The warm up exercises performed by the singers in the present study include sustaining on /sa pa sa/ *(prolonging the notes mandra /sa/, /pa/ and tara /sa/ in ascending and decending pattern.),* a:ka:rasa:dagam, singing ra:ga, singing softly, practicing basic phrases, practicing in different pitches, practicing 'varna', singing 'a:la:p' *(a:la:p is exposition of the ra.ga of the song that will be performed. A performer will explore the ra.ga first by singing the lower octaves and then moving up to higher ones and touching various aspects of the ra.ga. It is a slow improvisation with no rhythm. In Hindustani music there are three kinds of a:la:p namely a.ka.r, nom-tom a:la:p and bol-a:la:p)* and humming. Sustaining on /sa pa sa/ helps to set an appropriate pitch for singing and singers have felt it warms up the voice. 'A:ka:rasa:dagam', practicing basic phrases in a relaxed manner help to warm up the voice before singing as it prepares the vocal system for a long stretch of activity and it would help in improving articulatory flexibilty and vowel balancing. Practicing different pitches is essential before singing as the song would comprise of notes of different frequencies. Each song will have its own frequency range. Hence practicing at different pitches prior to singing will help the singer take those notes with ease/ less effort during singing or helps in balancing the registers. It provides maximum stretch on the vocal folds. Singers usually start at low pitch and slowly move on to high pitches and glide in a relaxed manner from high to low pitch. During concerts, 'varna:s' are sung at the beginning as a warm up because it has simple lyrics, consists of long syllables and phrases of varying lengths which bring out the essential features of ra:ga. It would help in improving articulatory flexibility and vowel balancing. Thus, it would help the singer prepare for a long concert. 'A:la:p' is the exposition of the ra:ga and it is more imaginative manner of singing. It is a slow improvisation. Thus, it helps in

warming up the voice. Humming highlights anterior frontal vibrations in lips, teeth and facial bones. It is an excellent form of warm up as it focuses on the sound of lips.

Sharanya (2006) reported that the Carnatic singers also used vowel /a/ in ascending and descending note as a warm up exercise. The results of the present study support the Sharanya's study. Samashitha et al. (2007) reported that practice of 'Dhatu varase' can also be used as a warm up exercise.

Warm down exercises

During speaking and singing, blood flow to the larynx is increased. Stopping immediately after prolonged speaking or singing may contribute to a pooling of blood in the larynx, weighing the vocal cords down. Damage may result as one attempts to speak on these potentially swollen folds. Hence, warm down exercises are important. The warm down exercises performed by the singers in the present study include taking voice rest after singing *[giving complete rest to voice after singing (no talking)],* listening to 'sruti' after singing *(listening to pitch after singing),* taking water after singing, speaking less after singing, singing 'bhajans' *(bhajans are a genre of vocal devotional music also presented from the concert-stage)* at the end of singing and sustaining /sa pa sa/. Giving complete voice rest after singing helps to warm down the voice because inadequate rest causes inadequate healing of tissue. Hence, if a singer stops singing and then continues talking immediately, there will be more pressure on vocal folds; voice rest for a small duration will help the vocal folds come back to normalcy and thus it preserves vocal

function and quality. Listening to 'sruti' may help in warming down the voice as there is voice rest and it involves relaxation. Hydration is very important to vocal folds. Singers should have lots of water all day long to keep the vocal folds moist. Singing in dry vocal folds causes irritation and singers lose their voice quality. Also, taking warm water relaxes muscles. Thus, it helps to warm down the voice. Singing 'bhajans' help in warming down the voice because they are usually sung in a slow speed with less effort and are light in terms of composition (does not have a wide frequency range).

Physical exercises

Miller (1996) reported that physical exercises especially jogging are thought to develop the body for the physical events of singing.

The physical exercises performed by the singers in the present study include yoga, walking, meditation, art of living exercises, pra:na:ya:ma, suryanamaska:r *(an yogic exercise also called as sun salutation. It is excellent because it stretches and strengthens all the major muscle groups in the body and exercises the respiratory system),* playing outdoor games, jogging *(jogging is a form of trotting or running at a slow or leisurely pace. The main intention is to increase fitness without stress),* aerobics *(aerobics is a particular form of exercise. Aerobic classes generally involve rapid stepping patterns, performed to music with cues provided by an instructor),* physical work (household work which involves sweeping, cleaning and washing) and gym workout *(gym is shortened form of gymnasium which refers to facilities intended for indoor sports or exercise).*

Boominathan et al. (2004) reported that males indulged more in outdoor games whereas females practiced yoga and pra:na:ya:ma. There was no such gender differences in the present study.

Setting the base pitch

In the present study, all the music teachers irrespective of gender, years of experience selected 'a:dha:ra sruti' (base pitch) by making the student sing and listen to their voice range. Most of the music teachers also changed 'a:dha:ra sruti' (base pitch) during the course of training. Criteria for changing 'a:dha:ra sruti'(base pitch) were age factor, years of training/flexibility of voice and strain. For boys, music teachers changed the pitch during pubertal age.

Boominathan et al. (2004) reported that a significant change in pitch of singing over years of musical training was observed in males due to pubertal changes whereas there was no significant change observed in females. Durga et al. (2007) commented that in India, a singer chooses his/her a:dha:ra sruti (base pitch), which is the pitch he/she is most comfortable with while singing. Recently, research has been made to fix the optimal pitch which would be the basic *sa* note. The experiment was done taking the entire vocal range from the lowest note to the highest note the voice can produce. The *sa* is then fixed for the singer to have audibility up to reaching two notes in the *mandra sthayi* (lower octave) and two notes in the *tara sthayi* (higher octave) after *tara* (high) *sa*, totaling to 12 notes. (Durga et al., 2007)The results of the present study support the earlier studies.

The knowledge of vocal hygiene in Carnatic and Hindustani singers revealed that singers do have fairly good knowledge on vocal hygiene. Greater percentage of singers had 'above average' and 'good' knowledge than 'average' knowledge which is a good sign. Carnatic singers had better knowledge than Hindustani singers. Singers showed greater percentage of awareness of speech/voice therapy (68%). Higher percentage of Carnatic singers were aware of speech/voice therapy compared to Hindustani singers. Boominathan et al. (2007) reported that only 38% of the singers were aware of speech/voice therapy. The results of the present study show a positive sign as singers have increased awareness about voice therapy. The most common practices to prevent voice problems were intake of warm water, voice rest, speaking softly, steam inhalation, gargling and intake of ayurvedic/homeopathic/herbal medication. The results indicated that higher percentage of Carnatic singers did these practices to prevent voice problems compared to Hindustani singers. The results of the present study show higher percentage of population doing these common practices compared to Boominathan et al. (2007) indicating that singers of the present study have more focus on their voice care. These positive results of having good knowledge of vocal hygiene, increased awareness of voice therapy and higher percentage of singers doing certain practices to prevent voice problems could be because of the education level of the singers. All the singers included in the present study were well educated and were inquisitive about voice care.

Eighty percent of the Carnatic singers reported that they did not clear their throat frequently. Boominathan et al. also reported that over 55% of the singers were habituated to throat clearing. The results of the present study contradict Boominathan et al.'s study.

The non-vocal habits included in the present study were eating/drinking habits, intake of number of glasses of water and coffee/tea and number of hours of sleep. It was interesting to note that none of the Carnatic singers in the present study involved in habits like smoking, tobacco chewing, and consumption of alcohol or having spiced foods. These results contradict Boominathan et al.'s studies (2004 and 2007), where higher percentage of singers had these habits. Thus, singers of the present study have good non-vocal habits which indicate that singers are more concerned about preserving their voice. However, the results of the present study showed that consumption of coffee/tea was higher in present study compared to Boominthan et al. (2007).

Thus, the results of the present study show that the vocal exercises performed by the Indian classical singers to improve their breathing and frequency range are similar to Western singers. This study has revealed different vocal warm up and warm down exercises compared to Western singers. The warm up exercises performed by the Western singers included glissandos, Messa Di Voce, lip and tongue trills (Titze, 1992 &1996) and Amir et al. (2005) reported singers performed relaxation exercises, body posture alignment, voice placement at different pitches, registers and amplitude levels using a variety of syllables as warm ups. The warm up and warm down exercises revealed by the present study include the following:

Warm up exercises

- ***Sustaining on /sa pa sa/:*** Prolonging the notes mandra (lower) /sa/, /pa/ and tara (high) /sa/ in ascending and decending pattern.
- *A:ka:rasa:dagam:* The practice of vowel /a/ in ascending and descending note at different speeds.
- ***Singing*** *'a:la:p':* A:la:p is exposition of the ra:ga of the song that will be performed. A performer will explore the ra:ga first by singing the lower octaves and then moving up to higher ones and touching various aspects of the ra:ga. It is a slow improvisation with no rhythm. In Hindustani music there are three kinds of a:la:p namely a:ka:r, nom-tom a:la:p and bol-a:la:p.
- ***Singing ra:ga:*** Singing the outline of the ra:ga.
- ***Singing*** *softly:* Practicing the songs to be performed softly before the concert.
- ***Practicing basic phrases:*** Singing basic phrases which include sarale varase, janti varase and geethams.
- ***Practicing in different pitches:*** Practicing in different pitches by starting to sing notes from low pitch and gradually moving on to high pitch.
- ***Practicing 'varna':*** Practicing a song. It is a special item which highlights everything important about the ra:ga, not just the scale but also how to approach a note, which notes to stress etc. they are sung in multiple speeds and are good for practice.
- ***Humming:*** A song is sung with closed lips.
- ***Warm water:*** Consuming warm water before singing.

Warm down exercises

- ***Taking voice rest:*** Giving complete rest to voice after singing (no talking).
- ***Speaking less after singing:*** Limiting talks to only essential things after singing.
- ***Listening to 'sruti' after singing:*** Listening to pitch after singing.
- ***Warm water:*** Taking warm water after singing.
- ***Sustaining on /sa pa sa/:*** Prolonging the notes mandra (lower) /sa/, /pa/ and tara (high) /sa/ in ascending and decending pattern.
- ***Singing 'bhajans' at the end of singing:*** Singing bhajans which are a genre of vocal devotional music also presented from the concert-stage. They are usually slow in pace.

The results of the present study indicated that the Carnatic singers and Hindustani classical singers use different types of warm-up and warm-down exercises than those found in the literature. Future studies can focus on the efficacy of such exercises.

CHAPTER 6

Summary and Conclusions

In order to acquire musical skills, singers work to enhance their vocal ability by spending considerable time practicing their music. Every professional singer has to develop series of vocal exercises that is best suited for their voice, which will result in a good voice. Singers also need to modify their habits and lifestyles in a manner that would help preserve their singing voice. Limited research has been carried out in the areas of practices, methods of training and general lifestyles of classical singers. Therefore, there is a need to profile these aspects of classical singers that would aid in voice care and management.

Thus, the aims of the present study were to investigate vocal exercises performed by Hindustani and Carnatic singers, knowledge about vocal mechanism and vocal hygiene in these singers and vocal and non vocal habits that were used by these singers.

A total of 50 Carnatic singers (25 males and 25 females) and 50 Hindustani singers (25 males and 25 females) in the age range of 20 - 60 years participated in the study. All the singers had passed their junior exam and were under regular practice. 90% of the singers were professionals. They did not have any speech/voice problem as evaluated by the investigator. A 4-part questionnaire containing 43 questions was prepared to investigate the vocal exercises performed by Carnatic and Hindustani singers and their vocal health. There were open ended questions as well as few forced- choice

questions. Part 1 of the questionnaire included 4 questions on demographic data; part 2 included 9 questions on vocal exercises performed by the singers to improve their breath support, frequency range, vibrato, warm up exercises, warm down exercises, other physical exercises and selection of 'a:dha:ra sruti' (base pitch). Part 3 of the questionnaire addressed 15 questions related to singers' knowledge about vocal anatomy and also their knowledge on vocal hygiene practices, part 4 of the questionnaire (15 questions) aimed at collecting information on vocal and non-vocal habits of the Carnatic and Hindustani singers. The questionnaire was administered to the singers personally through interview. The investigator recorded the responses. The questionnaire was also sent through post and e-mail to singers who were distant. Questions from part 2 (questions on vocal exercises) and part 4 (questions addressing vocal and non-vocal habits) were taken up for descriptive analysis. Questions on part 3 (knowledge of vocal anatomy and vocal hygiene practices) were rated on a 5 point rating scale with 0 - poor, 1 - below average, 2 - average/ fair, 3 - above average and 4 - good.

The results of the study revealed several points of interest. If we look at the hierarchy of exercises from most performed to least performed, among the six exercises namely exercises to improve breath support, exercises that improved the frequency range, exercises to improve vibrato, warm up exercises, warm down exercises and physical exercises, the most practiced exercises were exercises that improved the frequency range followed by exercises to improve breath support, exercises to improve vibrato, physical exercises, warm up exercises and the least practiced were warm down exercises.

On the whole, exercises to improve breath support, exercises to improve vibrato and physical exercises were performed more by Hindustani singers and in contrast, warm up exercises, warm down exercises and exercises that helped to improve frequency range were practiced more by Carnatic singers. 90% of the Hindustani singers practiced exercises that improved breath support, 84% of the Hindustani singers practiced exercises that improved vibrato and 76% of the Hindustani singers did physical exercises. On the contrary, 92% of the Carnatic singers practiced exercises that improved the frequency range, 64% of the Carnatic singers did warm up exercises and 18% of the Carnatic singers did warm down exercises.

Sl.No	Exercises	Exercises
1.	Breath support	Pra:na:ya:ma, yoga, meditation, deep breathing, open mouth singing, maximum phonation duration (MPD), omka:r, a:ka:rasa:dagam, steam inhalation, posture alignment and art of living exercises.
2.	Frequency range	A:ka:rasa:dagam, u:ka:ra practice, practice in lower and higher 'stha:yi', practice in different octave frequencies, humming in different pitches, practicing 'varna' and practicing basic phrases.
3.	Vibrato	A:ka:rasa:dagam, svara practice, practicing phrases with vibrato, imitating, practicing 'varna', practicing 'sanca:ras', 'briga' practice and practicing i:ka:ra and u:ka:ra.
4.	Warm up	Sustaining on /sa pa sa/, a:ka:rasa:dagam, singing ra:ga, singing softly, practicing basic phrases, humming , consuming warm water and practicing 'varna'.
5.	Warm down	Taking voice rest after singing, sustaining on /sa pa sa/, taking water after singing and speaking less after singing.
6.	Physical exercises	Yoga, walking, meditation, art of living exercises, pra:na:ya:ma, suryanamaska:r, physical work, gym workout and outdoor games.

Table 7: Vocal exercises performed by Carnatic singers (males and females).

Sl.No	Exercises	Exercises
1.	Breath support	Pra:na:ya:ma, meditation, maximum phonation duration (MPD), omka:r, ra:ga practice, 'riya:z', practicing 'taans' in one breath, kapa:labhati, open mouth singing, yoga and deep breathing.
2.	Frequency range	A:ka:rasa:dagam, practice in lower and higher 'stha:yi', practice in different octave frequencies, ra:ga practice, svara practice, 'riya.z' and humming in different pitches.
3.	Vibrato	A:ka:rasa:dagam, svara practice, imitating, practicing phrases with vibrato, practicing 'kana:s', ' alanka:r svara:s' and practicing i:ka:ra and u:ka:ra.
4.	Warm up	Sustaining on /sa pa sa/, a:ka:rasa:dagam, singing 'a:la:p', singing softly, practicing in different pitches, humming and singing 'ra:ga'.
5.	Warm down	Taking voice rest after singing, singing 'bhajans' at the end of singing, sustaining on /sa pa sa/ and listening to 'sruti' after singing.
6.	Physical exercises	Yoga, walking, meditation, jogging, aerobic exercises, pra:na:ya:ma, suryanamaskax and art of living exercises.

Table 8: Vocal exercises performed by Hindustani singers (males and females).

In the present study, all the music teachers irrespective of gender, years of experience selected 'a:dha:ra sruti' (base pitch) by making the student sing and listen to their voice range. Most of the music teachers also changed 'a:dha:ra sruti' (base pitch) during the course of training. Criteria for changing 'a:dha:ra sruti'(base pitch) were age factor, years of training/flexibility of voice and strain. For boys, music teachers changed the pitch during pubertal age.

The knowledge of vocal hygiene in Carnatic and Hindustani singers revealed that singers do have fairly good knowledge on vocal hygiene. Greater percentage of singers had 'above average' and 'good' knowledge than 'average' knowledge which is a good

sign. Carnatic singers had better knowledge than Hindustani singers. Singers showed greater percentage of awareness of speech/voice therapy (68%). Higher percentage of Carnatic singers were aware of speech/voice therapy compared to Hindustani singers. The most common practices to prevent voice problems were intake of warm water, voice rest, speaking softly, steam inhalation, gargling and intake of ayurvedic/homeopathic/herbal medication. The results indicated that higher percentage of Carnatic singers did these practices to prevent voice problems compared to Hindustani singers.

The vocal habits included amount of training, number of times of practice in a day, total hours of practice in a day, number of hours of singing in a performance, gaps given during practice, time of practice, speaking loud and throat clearing. Percentage of singers (both Carnatic and Hindustani) who practiced once a day was more compared to twice a day/> twice a day. Also, greater percentage of singers (both Carnatic and Hindustani) practiced 1 - 3 hours in a day. Greater percentage of singers (Carnatic and Hindustani) sang 1- 3 hours in a performance. Greater percentage of male Carnatic singers gave gaps/breaks in between practice. On the contrary, among female singers, Hindustani singers gave more gaps/breaks during practice. All the singers practiced at early morning (EM), morning (M), evening (E), night (N) but greater percentage of singing is done during morning (M) and evening (E). Most of the singers did not have the habit of speaking loudly. Similarly, most of the singers also did not report to clear their throat frequently.

The non-vocal habits included in the present study were eating/drinking habits, intake of number of glasses of water and coffee/tea and number of hours of sleep. Greater percentage of Carnatic singers had specific eating/drinking habits compared to Hindustani singers. It was interesting to note that none of the Carnatic singers in the present study involved in habits like smoking, tobacco chewing, and consumption of alcohol or having spiced foods. Water was consumed more by Hindustani singers (8 glasses) on average. Hours of sleep were equal among all the singers (7 hours on an average). Greater percentage of singers (Carnatic and Hindustani singers) consumed 2-4 cups coffee/tea per day.

Thus, the results of the study show promising horizons. The singers are improving in terms of their preventive measures, practicing a good vocal hygiene routine, being more aware to speech/voice therapy and also maintaining good vocal and non-vocal habits. The positive results of the present study may be because of the education level of the Carnatic and Hindustani singers. Almost all the singers were well educated and were very inquisitive about voice care.

Thus, the results of the present study show that the vocal exercises performed by the Indian classical singers to improve their breathing and frequency range are similar to Western singers. This study has revealed different vocal warm up and warm down exercises compared to Western singers. The warm up exercises performed by the Western singers included glissandos, Messa Di Voce, lip and tongue trills (Titze, 1992 &1996) and Amir et al. (2005) reported that singers performed relaxation exercises body

posture alignment, voice placement at different pitches, registers and amplitude levels using a variety of syllables as warm ups. The warm up and warm down exercises revealed by the present study include the following:

Warm up exercises

- ***Sustaining on /sa pa so/:*** Prolonging the notes mandra (lower) /sa/, /pa/ and tara (high) /sa/ in ascending and decending pattern.
- ***A:ka:rasa:dagam:*** The practice of vowel /a/ in ascending and descending note at different speeds.
- ***Singing*** *'a:la:p':* A:la:p is exposition of the ra:ga of the song that will be performed. A performer will explore the ra:ga first by singing the lower octaves and then moving up to higher ones and touching various aspects of the ra:ga. It is a slow improvisation with no rhythm. In Hindustani music there are three kinds of a:la:p namely a:ka:r, nom-tom a:la:p and bol-a:la:p.
- ***Singing ra:ga:*** Singing the outline of the ra:ga.
- ***Singing softly:*** Practicing the songs to be performed softly before the concert.
- ***Practicing basic phrases:*** Singing basic phrases which include sarale varase, janti varase and geethams.
- ***Practicing in different pitches:*** Practicing in different pitches by starting to sing notes from low pitch and gradually moving on to high pitch.
- ***Practicing 'varna':*** Practicing a song. It is a special item which highlights everything important about the ra:ga, not just the scale but also how to approach a

note, which notes to stress etc. they are sung in multiple speeds and are good for practice.

- ***Humming:*** A song is sung with closed lips.

- ***Warm water:*** Consuming warm water before singing.

Warm down exercises

- ***Taking voice rest:*** Giving complete rest to voice after singing (no talking).
- ***Speaking less after singing:*** Limiting talks to only essential things after singing.
- ***Listening to 'sruti' after singing:*** Listening to pitch after singing.
- ***Warm water:*** Taking warm water after singing.
- ***Sustaining on /sa pa sa/:*** Prolonging the notes mandra (lower) /sa/, /pa/ and tara (high) /sa/ in ascending and decending pattern.
- ***Singing 'bhajans' at the end of singing:*** Singing bhajans which are a genre of vocal devotional music also presented from the concert-stage. They are usually slow in pace.

The results of the present study are interesting. Different types of warm up and warm down exercises are used by Carnatic and Hindustani classical singers. These are passed from teacher to student and have not been tested for their efficacy. Future studies may focus on investigating the efficacy of these exercises. Also, based on the results of the study, a manual of exercises can be prepared.

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Appendix I

Varna

Ra:ga - Bhairavi

Ta:la -Khandajathi ata

Ascending scale: /sa ga ri ga ma pa da ni sa/

Descending scale: /sa ni da pa ma ga ri sa/

Pallavi

Sa, ri ni: da: ni: sa: ri, ga sa: ri/ ga ri ga ga ri; ga ga ri ga ma pa da ma pa ga ri sa/

Ni sa ma ga ri sa ni sa/ ri ga sa ri ni ni da ni//

Sa ga ri ni sa ni da pa pa da pa da ni ni da pa da ni sa ri/ pa da ni sa ri ga ma pa ma ga ri ga ma ni da pa ma ga ri ni/ sa ri ga ma ga ri ga ga/ ri; s'a ni da pa//

Anupallavi

Ma ga ri sa, ri ni da sa ni da pa ma ga ri ga ma ni da pa/ ma ga ri pa ma ga ri sa pa da ni sa ri ga ni sa ri ga ma pa/ ni ni da pa, da ma pa/ ga ri ga ma pa da ni sa//

Pa da ni sa ri ga ma ga ri ga sa ri ni ga ri sa ni da ni sa/ ga ri ri sa sa ni ni da da pa ma ni da pa ma ga ri ga ri sa/ ni sa ri ga ma pa da ni/ sa ni da da pa ma pa://

Muktha:yi svara

, ma ga ri sa ri ni da ga ga ri sa ri sa ni ni da ni sa ri/ ma ma pa pa da da ni ni pa pa pa da da da ni ni ni sa sa ri /pa da ni sa ri ga ma pa/ da pa ma da pa: ni ni //

Da da da pa pa ma ni da ni pa da ni ma pa da ni sa ri ni da/ ma ga ri sa ri ni sa ri ri ga: ma pa da ma pa, da ni sa/ ni ri: sa ni da sa:/, ni da pa pa, ma//

Charanam

;; ;; ma: ma: da pa da ma pa ga ma:/ pa; pa; ma pa ni ni da pa ma ga ma ni da pa/ ma ga ri ga ma pa da ma/ pa ma da: pa: ma pa//

Sa ni da pa ma ga ri ga ma: ma: da pa da ma pa ga ma:/ pa; pa; ma pa ni ni da pa ma ga ma ni da pa/ ma ga ri ga ma pa da ma/ pa ma da: pa: ma pa//

Chitta svarars

1. Ga, ri, sa ni, da: pa, ma: pa da: ni sa/ ni ri: ni sa ri ga ma ga ma: ni ni da da ni ni da da ma/ ma pa ma ma, ga ri ga/ ni ni da da: ma ma: //ga ri sa ni sa:ri ga
2. Ni ni da da, ni da da ma, ni da pa ma, da pa ma/ ga ri: ga, ma pa da ma pa: da pa da ni da ni sa ri sa/ ni ga ri ni, da pa da/ ma pa: ma ga ri sa ri // ni da: ni sa ga ri ga
3. Sa: ri ga sa ri ga: ri; ni: sa ri ni sa ri:/ sa: pa ma ri ni: ni da ga, ri, sa ni, da: ni/ pa, da, ni sa ri/ pa da ni sa ri;//

   Da pa ga ri, ri ni da ri sa: sa ma ga: ri pa ma: ga/ ri ga: ma pa da pa ma ni ni da da, ni da da pa pa: ma/ ga ri: ga, ma pa da/ ma pa ga ma pa://

   Ni sa ni ga ri ma ga pa ma da pa ni da ni pa da ma pa ga ri/ ga ma pa ma pa da ni sa ni sa ni ga ri ga ni sa ni ri sa ri/ ni ri sa ni da pa da ma/ pa da ni ni sa: ni ni //

   Sa sa ri ri ga ga ma ga ga ri ma ga ri sa ni ga ri sa ni ri/ sa ni da pa da ni sa ri ma ma pa pa da da ni ni da ga ri ni/ , da ri sa ni: da ni/ da da ni da da ma ma:// ga ri sa ni sa: ri ga

Appendix II

Vocal exercises in Carnatic and Hindustani singers - Manual

I Breathing exercises

SI. No	Exercises
1.	Yogic breathing
2.	Meditation
3.	Deep breathing
4.	Maximum phonation duration
5.	Open mouth singing
6.	Omka:r
7.	Ra:ga practice / riya:z
8.	A:ka:rasa:dagam
9.	Practice 'taans' in one breath
10.	Sudarshan kriya
11.	Posture
12.	Steam inhalation

1) **Yoga:** For all the breathing exercises sit comfortably in any meditative posture and sit erect. Be calm and close your eyes.

a. Loud breathing

Step 1: Take in a deep breath loudly.

Step 2: Breath out loud for as long as possible until you exhale all the air slowly.

b. Rhythmical breathing

Step 1: Take a deep breath.

Step 2: Breath in and out in a particular rhythm. Use ordinary counting. Eg: consider the rhythm 4-2-2. Count to 4 while inhaling, hold your breath while counting 1 and 2, and exhale on 3 and 4. Be careful not to hold your breath for too long.

c. Forced rapid breathing

Stepl: Breath in forcefully and in a rapid manner (short inhalation).

Step 2: Breath out forcefully and in a rapid manner (short exhalation).

d. Alternate breathing

Step 1: Close the right nostril with the right thumb. Now inhale slowly through the left nostril and fill your lungs.

Step 2: After complete inhalation, press the left nostril with the ring finger of the right hand and close the left nostril.

Step 3: Open the right nostril, exhale slowly.

Step 4: After complete exhalation, again inhale through the right nostril and fill your lungs.

Step 5: Close the right nostril by pressing it with the right thumb.

Step 6: After opening the left nostril, breathe out slowly.

e. Bhramhari (Nasal snoring)

Step 1: Practice mouth snoring first.

Step 2: The soft palate must be lifted toward the top of the pharynx sufficiently to produced flutter.

Step 3: Inhale rapidly through nostrils producing a high humming sound like a male bee.

Step 4: Exhale slowly through nostrils producing a low humming sound like a female bee.

f. Pra:na:ya:ma

Step 1: The purpose of the first step is to learn to distinguish between belly breathing and chest breathing. Lie on your back on a comfortable flat surface. Relax and start following your breath. Put one hand on your belly and the other on your chest. Relax. Belly breathing: When you inhale, the hand on your belly rises, while the hand on your chest remains still. As you exhale, the hand on your belly goes down again, whereas the hand on your chest remains still. Repeat this for 5-10 breaths. Chest breathing: When you inhale, the hand on your chest rises, while the hand on your belly remains still. As you exhale, the hand on your chest goes down again, whereas the hand on your belly remains still. Repeat this for 5-10 breaths. Alternate between belly and chest breathing for 5-10 minutes.

Step 2: Purpose of step two is to combine belly and chest breathing in one breath. This is called yoga breathing. Lie on a comfortable flat surface. Relax and follow your breath. Put one hand on your belly and the other on your chest. Relax. Yoga breathing: Start inhaling with belly breathing. When you feel that you cannot inhale any more this way, go over to chest breathing until the chest part of your lungs are full. Then you exhale using chest breathing first and then belly breathing until you have emptied your lungs completely. Breathe very slowly. If you feel dizzy, you are breathing too fast. If you feel out of breath, you are breathing too slowly. Follow your body's signals. If you have problems distinguishing between belly and chest breathing, go back to step one again.

Step 3: Sit or stand with your spine upright. Use yoga breathing and follow a set pattern. To do this you need to somehow count the rhythm. Use ordinary counting or words. Eg: consider the rhythm 4-2-2. Count to 4 while inhaling, hold your breath while counting 1 and 2, and exhale on 3 and 4. Be careful not to hold your breath for too long. Yoga breathing should be an effortless process, so your breath should not be louder than usual. If your diaphragm is going rigid, relax through softly patting on the diaphragm. Pra:na:ya:ma works better if you practice it regularly. Do not do it all the time, but a few times a day will not hurt, quite on the contrary.

g. **Kapa:labhati**

Step 1: Sit straight in any comfortable position either with legs crossed or in a lotus position.

Step 2: Exhale whatever breath in lungs.

Step 3: Inhale slowly, relaxing the abdomen allowing the air to return gently to the lungs.

Step 4: Exhale with a quick, strong blast of air. Contract the abdominal muscles quickly causing the diaphragm to rise and force the air out of the lungs.

Step 5: Retain for a split second and repeat for four to eight blasts.

Step 6: This complete one cycle of Kapalabhati. Relax and take few slow and deep breaths in between the cycles.

2) Meditation

Step 1: Prepare yourself for meditation. Wash and put on clean comfortable clothing. Sit with back and head erect, legs folded in, hands clasped and resting in lap, eyes closed.

Step 2: Relax and stretch all the muscles of your body.

Step 3: Calming the mind with relaxed breathing. Breathe in and breathe out as naturally as possible in a relaxed manner. Concentrate on inhalation and exhalation. Sit for 5 minutes first and then increase your meditation time gradually. You can also chant during meditation process.

Step 4: Conclude your meditation with a prayer for family, friends and world peace.

Step 5: Take a final deep breath. Stand and stretch.

3) Deep breathing

Step 1: Inhale gently and effortlessly.

Step 2: Hold the breath for few seconds.

Step 3: Exhale slowly as long as possible.

4) Maximum Phonation Duration (MPD)

Step 1: Take a deep breath.

Step 2: Phonate /a/ as long as you can.

Step 3: Increase this phonation time gradually everyday by one sec.

5) Open mouth singing

Step 1: Open your mouth adequately and sing.

6) Omka:r

Step 1: Prepare yourself for meditation. Wash and put on clean comfortable clothing. Sit with back and head erect, legs folded in, hands clasped and resting in lap, eyes closed.

Step 2: Relax and stretch all the muscles of your body.

Step 3: Calming the mind with relaxed breathing. Breathe in and breathe out as naturally as possible in a relaxed manner. Concentrate on inhalation and exhalation. Sit for 5 minutes first and then increase your meditation time gradually. Chant 'Om' during meditation process.

Step 4: Take a deep breath and chant 'Om' when you exhale effortlessly and for as long as possible in a slow manner.

Step 5: Conclude your meditation with a prayer for family, friends and world peace.

Step 6: Take a final deep breath. Stand and stretch.

7) Ra:ga practice or Riya:z

Step 1: Take a deep breath.

Step 2: Sing the outline of the ra:ga.

Eg: Mohana ra:ga

Ascending scale: sa ri ga pa da sa, Descending scale: sa da pa ga ri sa

Ga ri ga **da** ri g̃a ri/ ga pa g̃a ri ga ri sa …. da **sa** ri g̃a ri/ Ga **pa** ga pa da pa ga ri ga ri sa da/ ga ri ga pa…. ga pa **da:**pa/Ga da pa ga ri sa ri ga pa d̃a pa da **sa** d̃a pa/ sa d̃a pa/ **ri** sa d̃a pa / ga pa da ri **sa**…Sa da pa ga ri sa ri ga pa da ri sa/ da sa **ri ga** ga ri sa da sa ri ga…. Ga ri ga sa ri ga/ ga ri ga ri sa da ri sa da pa da pa ga ri sa ri

9) Practice 'taans' in one breath

Step 1: This is similar to a:ka:rasa:dagam.

Step 2: These are fast paced or sung at fast speed. Practice different taans (Gamak taan, Sapaat taan, Alankarik taan, and bol taan) in one breath.

10) Sudarshan Kriya

Step 1: Sudarshan Kriya includes two simple yoga techniques - pra:na:ya:ma and pu:rnayoga. Pra:na:ya:ma is a technique to govern the breathing process and Pu:rnayoga includes practice of simple yoga postures.

Step 2: Eyes have to be shut to cut off external stimuli so that one concentrates on him/herself.

Step 3: Then shift to *Vajrasana* position which straightens the spinal cord and makes the movement of attention between the brain and spinal cord hindrance free. It also helps in breath freely.

Step 4: The three positions of pra:na:ya:ma, which incrementally takes arms from down to up, physically engages muscles in the neck and shoulders, thereby relieving pressure built-up in them due to stress.

Step 5: The loud breathing technique concentrates attention in the spinal cord, which controls breathing in normal circumstances also.

Step 6: In forced rapid breathing technique, breathing out forcefully, the respiratory tract gets purified and expands.

Step 7: The final stage of kriya is *Sukasana* position which involves rhythmic inhalations and exhalations of long, medium and short duration.

ga pa da sa n ga/ ga pa ga ri sa…. ri da/ da ri sa da pa/ **ga** da pa ga ri/ pa ga;ri/ ga ri sa…. ri **da/** da ga: ri sa da: pa/ pa da sa ri/ pa ga ri da sa/.

notes in mandra stha:yi (.)

- notes in tara stha:yi (')
- fast tempo (-)
- pause(/)
- stressed (~)
- prolongation of the note (. . . .)
- a long note (:)

Some notes have been made bold to show how the notes in the ra:ga traverse. From /ga/ to mandra or lower /da/ to a:dha:ra shadja /sa/ to /pa/ to /da/ to tara or higher /sa/ to tara /ri/ and back to tara /sa/ and to tara /ri/ to tara /ga/ to tara /pa/ and again back to tara /sa/ to /pa/ to /ga/ to /ri/ to a:dha:ra shadja /sa/ to mandra /da/ to mandra /pa/ to a:dha:ra shadja /sa/.

8) A:ka:rasa:dagam

Step 1: Take a deep breath.

Step 2: Practice 'a:ka:ra' in ascending scale with a set of notes in one breath.

Eg: sa ri sa

Step 3: Increase the number of notes in one breath slowly.

Eg: sa ri ga ri sa

Sa ri ga ma ga ri sa

Sa ri ga ma pa ma ga ri sa

Step 4: Practice 'a:ka:ra' in the same way for a descending scale.

Step 8: It takes only about 30 to 45 minutes to do the short Sudarshan Kriya. It can be practiced at any time during the day, except when stomach is full.

Step 9: Spending some time doing the kriya is a great stress reliever. Coupled with light physical exercises, its benefits are manifold.

Step 10: Enroll in an Art of Living course. This exercise has to be done under guidance.

11) Posture

Step 1: Sit in an erect posture with legs crossed. Spine should be erect but not stiff. Head should be straight.

12) Steam inhalation

Step 1: Carefully pour about 4-6 cups of boiling water into the large bowl.

Step 2: Hold your head over the bowl so that you are looking down at it. Cover your head and the bowl with the sheet, ensuring that you do not bring your face too close to the hot water.

Step 3: Close your eyes and breathe slowly and deeply, continuing the treatment for about 15 minutes. If you start to feel overheated or uncomfortable, remove the sheet.

Step 4: You can also add three drops of eucalyptus oil and inhale.

II Exercises to improve frequency range

Sl.No	Exercises
1.	A:ka:rasa:dagam
2.	I:ka:ra and u:ka:ra
3.	Practice in different octave frequencies
4.	Ra:ga practice or riya:z
5.	Humming in different pitches
6.	Varna
7.	Practice basic phrases

1) A:ka:rasa:dagam

Step 1: Take a deep breath.

Step 2: Practice 'a:ka:ra' in ascending scale with different combination of notes.

Eg: sa ri ga ma pa da ni sa

Sa ri ga - ri ga ma -ga ma pa- ma pa da - pa da ni - da ni sa

Step 3: Practice 'a:ka:ra' in descending scale with different combination of notes.

Eg: sa ni da pa ma ga ri sa

Sa ni da - ni da pa - da pa ma - pa ma ga - ma ga ri - ga ri sa

2) I:ka:ra and U:ka:ra

Step 1: Take a deep breath.

Step 2: Practice singing the vowel /i/ and /u/ in ascending scale with different combination of notes.

Eg: sa ri ga ma pa da ni sa

Sa ri ga - ri ga ma -ga ma pa- ma pa da - pa da ni - da ni sa

Sa ri ga ma - ri ga ma pa -ga ma pa da - ma pa da ni - pa da ni sa

Step 3: Practice singing the vowel /i/ and /u/ in descending scale with different combination of notes.

Eg: sa ni **da** pa **ma** ga ri sa

Sa ni **da -** ni **da** pa **- da** pa **ma -** pa **ma** ga **- ma** ga ri **-** ga ri sa

Sa ni **da** pa **-** ni **da** pa **ma - da** pa **ma** ga **- ma** ga ri sa

3) Practice in different octave frequencies

Step 1: Consider pa da ni sa ri ga ma pa da ni sa ri ga ma pa

Step 2: Consider the base pitch is taken at the level of mandra (lower) /da/ and then sing.

Step 3: Consider the base pitch is taken at the level of mandra /ni/ and then sing.

Step 4: Consider the base pitch /sa/ and sing from that note.

4) Ra:ga practice or Riyarz

Step 1: Take a deep breath.

Step 2: Sing the outline of the ra:ga.

Eg: Mohana ra:ga

Ascending scale: sa ri ga pa da sa, Descending scale: sa da pa ga ri sa

Ga ri ga da ri ga ri/ ga pa ga ri ga ri sa …. da **sa** ri ga ri/ Ga pa ga pa da pa ga ri ga ri sa da/ ga ri ga pa…. ga pa da:pa/Ga da pa ga ri sa n ga pa da pa da sa da pa/ sa da pa/ **ri** sa da pa / ga pa da ri sa**…**Sa da pa ga ri sa ri ga pa da n sa/ da sa **ri** ga g'a ri sa da sa ri ga…. Ga ri ga sa ri ga/ ga ri ga ri sa da ri sa da pa da pa ga ri sa ri ga pa da sa ri ga/ ga p'a ga ri sa…. ri da/ da ri sa da **pa/** ga da pa ga **ri/** pa gkjri/ ga ri **sa.**… ri da/ da ga: ri sa da: **pa/** pa da sa ri/ pa ga ri da sa/.

notes in mandra stha:yi (,)

notes in tara stha:yi (')

- fast tempo (-)

- pause (/)

  stressed (~)

- prolongation of the note (. . . .)

- a long note (:)

Some notes have been made bold to show how the notes in the ra:ga traverse. From /ga/ to mandra or lower /da/ to a:dha:ra shadja /sa/ to /pa/ to /da/ to tara or higher /sa/ to tara /ri/ and back to tara /sa/ and to tara /ri/ to tara /ga/ to tara /pa/ and again back to tara /sa/ to /pa/ to /ga/ to /ri/ to a:dha:ra shadja /sa/ to mandra /da/ to mandra /pa/ to a:dha:ra shadja /sa/.

5) Humming in different pitches

Step 1: Practice humming the notes in the lower octave frequencies for few minutes.

Step 2: Make a transition from lower octave frequencies gradually into higher notes.

Step 3: Stay humming higher notes for few minutes.

6) Varna

Step 1: Practice different 'varnars'.

7) Basic phrases

Step 1: Take a deep breath.

Step 2: Practice few basic phrases like 'sarale varase' or 'janti varase' or 'geethams'.

Eg: *'Sarale varase'*

a. Sa ri ga ma pa da ni sa

sa ni da pa ma ga ri sa

b. Sa ri ga ma - sa ri ga ma - sa ri ga ma pa da ni sa

Sa ni da pa - sa ni da pa - sa ni da pa ma ga ri sa

Eg: *"Janti varase'*

a. Sasa riri gaga mama papa dada nini sasa

Sasa nini dada papa mama gaga riri sasa

b. Sasa riri gaga mama riri gaga mama papa

Gaga mama papa dada mama papa dada nini

Papa dada nini sasa sasa nini dada papa

Nini dada papa mama dada papa mama gaga

Papa mama gaga riri mama gaga riri sasa

Eg: *'Geethams'*

Ra:ga - 'Malahari', ta:la - 'Ru:paga'

Ascending scale: sa ri ma pa da sa

Descending scale: sa da pa ma ga ri sa

Mapa dasa sari// risa dapa mapa//

Rima pada mapa// dapa maga risa//

Sari ma: gari// sari gari sa://

Rima pada mapa// dapa maga risa//

Sari ma: gari// sari gari sa://

Ill Exercises to improve vibrato

Sl.No	Exercises
1.	A:ka:rasa:dagam
2.	I:ka:ra and u:ka:ra
3.	Svara practice
4.	Practice phrases with vibrato
5.	Imitate
6.	Briga practice
7.	Sanca:ras
8.	Alanka:r svara:s
9.	Varna

1) A:ka:rasa:dagam

Step 1: Take a deep breath.

Step 2: Practice 'a:ka:ra' in ascending scale with different combination of notes at fast speed.

Eg: sa ri ga ma pa da ni sa

Sa ri ga - ri ga ma -ga ma pa- ma pa da - pa da ni - da ni sa

Step 3: Practice 'a:ka:ra' in descending scale with different combination of notes at fast speed.

Eg: sa ni da pa ma ga ri sa

Sa ni da - ni da pa - da pa ma - pa ma ga - ma ga ri - ga ri sa

2) Irkara and U:ka:ra

Step 1: Take a deep breath.

Step 2: Practice singing the vowel *l'\l* and ***IvJ*** in ascending scale with different combination of notes.

Eg: sa ri ga ma pa da ni sa

Sa ri ga - ri ga ma -ga ma pa- ma pa da - pa da ni - da ni sa

Sa ri ga ma - ri ga ma pa -ga ma pa da - ma pa da ni - pa da ni sa

Step 3: Practice singing the vowel *HI* and /u/ in descending scale with different combination of notes.

Eg: sa ni da pa ma ga ri sa

Sa ni da - ni da pa - da pa ma - pa ma ga - ma ga ri - ga ri sa

Sa ni da pa - ni da pa ma - da pa ma ga - ma ga ri sa

3) Svara practice

Step 1: Practice svara:s of each ra:ga at slow, medium and fast speeds.

Eg: 'Kalyani ra:ga' - / sa ri ga ma ga ri/

/ ri ga ma pa ma ga/

'Mohana ra:ga' - /sa ri ga pa ga ri/

/ ri ga pa da pa ga/

/ ga pa da sa da pa/

4) Practice phrases with vibrato

Step 1: Take a particular ra:ga and practice the notes with vibrato in that ra:ga.

5) Imitate

Step 1: Imitate the vibrato in a song after listening to a song.

6) Briga practice

Step 1: Practice janti varase phrases at fast speed. Eg: 'Janti varase'

a. Sasa riri gaga mama papa dada nini sasa

Sasa nini dada papa mama gaga riri sasa

b. Sasa riri gaga mama riri gaga mama papa

Gaga mama papa dada mama papa dada nini

Papa dada nini sasa sasa nini dada papa

Nini dada papa mama dada papa mama gaga

Papa mama gaga riri mama gaga riri sasa

7) Sanca:ras

Step 1: Take a ra:ga. Select its unique phrases.

Step 2: Practice in 'a:kara' these unique phrases at fast speed.

Eg: 'Kharaharapriya ra:ga' - / ni da pa ga ma ga ri/

/ sa... ri ni da/.

8) Alanka:r svara:s

Step 1: Practice 'alanka:r svara:s' at fast speed.

Eg: 'dhuruva ta:la' - sarigama gari sari gari sarigama.

'matya ta:la' - sarigari sari sarigama

'rupaga ta:la' - sari sarigama

'thrupudai ta:la' - sariga sari gama

'eka ta:la' - sarigama rigamapa..

9) Varna

Step 1: Practice different 'varna:s'.

IV Warm up exercises

Sl.No	Exercises
1.	Sustain on /sa pa sa/
2.	A:ka:rasa:dagam
3.	Ra:ga practice or a:la:p
4.	Sing soft
5.	Practice basic phrases
6.	Practice in different pitches
7.	Varna
8.	Humming
9.	Warm water

1) Sustain on /sa pa sa/

Step 1: Take a deep breath.

Step 2: Say 'a:dha:ra shadja' /sa/ and sustain it for 5 sec approximately.

Step 3: Say /pa/ and sustain it for 5 sec approximately.

Step 4: Say tara (higher) /sa/ and sustain it for 5 sec approximately.

Step 5: Say /pa/ and sustain it for 5 sec approximately.

Step 6: Say 'a:dha:ra shadja' /sa/ and sustain it for 5 sec approximately.

Step 7: Say mandra (lower) /pa/ and sustain it for 5 sec approximately.

Step 8: Say 'a:dha:ra shadja' /sa/ and sustain it for 5 sec approximately.

2) A:ka:rasa:dagam

Step 1: Take a deep breath.

Step 2: Practice 'a:ka:ra' in ascending scale with different combination of notes at different speeds (slow, medium and fast).

Eg: sa ri ga ma pa da ni sa

Sa ri ga - ri ga ma -ga ma pa- ma pa da - pa da ni - da ni sa

Sa ri ga ma - ri ga ma pa -ga ma pa da - ma pa da ni - pa da ni sa

Step 3: Practice ' a:ka:ra' in descending scale with different combination of notes at different speeds (slow, medium and fast).

Eg: sa ni da pa ma ga ri sa

Sa **ni** da - ni da pa - da pa ma - pa ma ga - ma ga ri - ga ri sa

Sa **ni** da pa - ni da pa ma - da pa ma ga - ma ga ri sa

3) Ra:ga practice or A:la:p

Step 1: Take a deep breath.

Step 2: Sing the outline of the ra:ga.

Eg: Mohana ra:ga

Ascending scale: sa ri ga pa da sa, Descending scale: sa da pa ga ri sa

Ga ri ga da ri ga ri/ ga pa ga ri ga ri sa .... da sa ri ga ri/ Ga **pa** ga pa da pa ga n ga ri sa da/ ga ri ga pa.... ga pa daipa/Ga da pa ga ri sa ri ga pa da pa da sa da pa/ sa da pa/ **ri** sa da pa / ga pa da ri sa...Sa da pa ga ri sa ri ga pa da n sa/ da $\dot{s}$a n^{t} **ga** ga ri sa da sa ri ga.... Ga ri ga sa ri ga/ ga ri ga ri sa da ri sa da pa da pa ga ri sa ri ga pa da sa n ga/ ga **pa** ga ri sa.... ri da/ da ri sa da **pa/ ga** da pa ga **ri/** pa ga;ri/ ga ri sa.... ri da/ da ga: ri sa da: **pa/** pa da sa ri/ pa ga ri da sa/.

- notes in mandra stha:yi (,)

  notes in tara stha:yi (')

  fast tempo (-)

  pause (/)

  stressed (~)

- prolongation of the note (. . . . .)

  a long note (:)

Some notes have been made bold to show how the notes in the ra:ga traverse. From /ga/ to mandra or lower /da/ to a:dha:ra shadja /sa/ to /pa/ to /da/ to tara or higher /sa/ to tara /ri/ and back to tara /sa/ and to tara /ri/ to tara /ga/ to tara /pa/ and again back to tara /sa/ to /pa/ to /ga/ to /ri/ to a:dha:ra shadja /sa/ to mandra /da/ to mandra /pa/ to a:dha:ra shadja /sa/.

4) Singing softly

Step 1: Practice the songs whichever has to be sung in the concert softly just before the performance.

5) Basic phrases

Step 1: Take a deep breath.

Step 2: Practice few basic phrases like 'sarale varase' or 'janti varase' or one of the 'geethams'.

Eg: 'Sarale varase'

a. Sa ri ga ma pa da ni sa

sa ni da pa ma ga ri sa

b. Sa ri ga ma - sa ri ga ma - sa ri ga ma pa da ni sa

Sa ni da pa - sa ni da pa - sa ni da pa ma ga ri sa

Eg: 'Janti varase'

a. Sasa riri gaga mama papa dada nini sasa

Sasa nini dada papa mama gaga riri sasa

b. Sasa riri gaga mama riri gaga mama papa

Gaga mama papa dada mama papa dada nini

Papa dada nini sasa sasa nini dada papa

Nini dada papa mama dada papa mama gaga

Papa mama gaga riri mama gaga riri sasa

Eg: 'Geethams'

Ra:ga - 'Malahari', ta:la - 'Ru:paga'

Ascending scale: sa ri ma pa da sa

Descending scale: sa da pa ma ga ri sa

Mapa dasa sari// risa dapa mapa//

Rima pada mapa// dapa maga risa//

Sari ma: gari// sari gari sa://

Rima pada mapa// dapa maga risa//

Sari ma: gari// sari gari sa://

6) Practice in different pitches

Step 1: Practice singing the notes in the lower octave frequencies for few minutes.

Step 2: Make a transition of notes from lower octave frequencies to higher octave frequencies gradually.

Step 3: Stay singing higher notes for few minutes.

7) **Varna**

Step 1: Practice one of the 'varna' or the 'varna' to be sung in the concert few hours before the performance.

8) **Humming**

Step 1: Take a deep breath.

Step 2: Gently hum the song whichever is going to be sung in a slow, relaxed manner.

9) **Warm water**

Step 1: Take a sip/glass of warm water just before performance.

V Warm down exercises

Sl.No	Exercises
1.	Voice rest
2.	Warm water
3.	Speak less
4.	Sustain on /sa pa sa/
5.	Listen to 'sruti'
6.	Sing 'bhajans'

1) Voice rest

Step 1: Do not speak anything after singing. Observe complete silence for few minutes (10 - 15 minutes approximately).

2) Warm water

Step 1: Take a glass of warm water or few glasses of warm water just after performance.

3) Speak less

Step 1: Speak less after your singing. Speak only if it was really essential and speak softly.

4) Sustain on /sa pa sa/

Step 1: Take a deep breath.

Step 2: Say 'a:dha:ra shadja' /sa/ and sustain it for 5 sec approximately.

Step 3: Say /pa/ and sustain it for 5 sec approximately.

Step 4: Say tara (higher) /sa/ and sustain it for 5 sec approximately.

Step 5: Say /pa/ and sustain it for 5 sec approximately.

Step 6: Say 'a:dha:ra shadja' /sa/ and sustain it for 5 sec approximately.

Step 7: Say mandra (lower) /pa/ and sustain it for 5 sec approximately.

Step 8: Say 'a:dha:ra shadja' /sa/ and sustain it for 5 sec approximately.

5) Listen to 'sruti'

Step 1: Listen to 'sruti' which is played from 'tambura/ tanpura' or from an electronic pitch box after your singing for few minutes (2-3 minutes approximately).

6) Bhajans

Step 1: Sing a 'bhajan' as the last song of your performance.

VI Physical exercises

Sl.No	Exercises
1.	Yoga
2.	Meditation
3.	Art of living exercises
4.	Jogging
5.	Aerobics
6.	Gym
7.	Physical work

1) **Yoga:** Practice different yogasanas.

a. Pra:na:ya:ma

Step 1: The purpose of the first step is to learn to distinguish between belly breathing and chest breathing. Lie on your back on a comfortable flat surface. Relax and start following your breath. Put one hand on your belly and the other on your chest. Relax. Belly breathing: When you inhale, the hand on your belly rises, while the hand on your chest remains still. As you exhale, the hand on your belly goes down again, whereas the hand on your chest remains still. Repeat this for 5-10 breaths. Chest breathing: When you inhale, the hand on your chest rises, while the hand on your belly remains still. As you exhale, the hand on your chest goes down again, whereas the hand on your belly remains still. Repeat this for 5-10 breaths. Alternate between belly and chest breathing for 5-10 minutes.

Step 2: Purpose of step two is to combine belly and chest breathing in one breath. This is called yoga breathing. Lie on a comfortable flat surface. Relax and follow your breath. Put one hand on your belly and the other on your chest. Relax. Yoga breathing: Start inhaling with belly breathing. When you feel that you cannot inhale any more this way, go over to chest breathing until the chest part of your

lungs are full. Then you exhale using chest breathing first and then belly breathing until you have emptied your lungs completely. Breathe very slowly. If you feel dizzy, you are breathing too fast. If you feel out of breath, you are breathing too slowly. Follow your body's signals. If you have problems distinguishing between belly and chest breathing, go back to step one again.

Step 3: Sit or stand with your spine upright. Use yoga breathing and follow a set pattern. To do this you need to somehow count the rhythm. Use ordinary counting or words. Eg: consider the rhythm 4-2-2. Count to 4 while inhaling, hold your breath while counting 1 and 2, and exhale on 3 and 4. Be careful not to hold your breath for too long. Yoga breathing should be an effortless process, so your breath should not be louder than usual. If your diaphragm is going rigid, relax through softly patting on the diaphragm. Pra:na:ya:ma works better if you practice it regularly. Do not do it all the time, but a few times a day will not hurt, quite on the contrary.

b. Suryanamaska:r

Step 1: Stand facing the direction of the sun with both feet touching. Bring hands together palm to palm at the heart.

Step 2: Inhale and raise the arms upward. Slowly bend backward, stretching arms above the head.

Step 3: Exhale slowly bending forward, touching the earth with respect until the hands are in line with the feet, head touching knees.

Step 4: Inhale and move the right leg back away from the body in a wide backward step. Keep the hands and feet firmly on the ground, with the left foot between the hands. Raise the head.

Step 5: While exhaling, bring the left foot together with the right. Keep arms straight, raise the hips and align the head with the arms, forming an upward arch.

Step 6: Exhale and lower the body to the floor until the the feet, knees, hands, chest, and forehead are touching the ground.

Step 7: Inhale and slowly raise the head and bend backward as much as possible, bending the spine to the maximum.

Step 8: While exhaling, bring the left foot together with the right. Keep arms straight, raise the hips and align the head with the arms, forming an upward arch.

Step 9: Inhale and move the right leg back away from the body in a wide backward step. Keep the hands and feet firmly on the ground, with the left foot between the hands. Raise the head.

Step 10: Exhale slowly bending forward, touching the earth with respect until the hands are in line with the feet, head touching knees.

Step 11: Inhale and raise the arms upward. Slowly bend backward, stretching arms above the head.

Step 12: Stand facing the direction of the sun with both feet touching. Bring the hands together, palm-to-palm, at the heart.

5) Aerobics

Step 1: Enroll yourself in some aerobic classes where trainers help you to learn aerobic exercises. Popular forms of aerobics include cycling, swimming, brisk walking, roller skating, dancing etc., Common stationary aerobic exercise equipments include treadmills, cycles, rowing machines etc.,

Step 2: Dress comfortably for aerobics.

6) **Gym**

Step 1: Enroll yourself in a gym.

Step 2: Choose your workouts according to your needs (chest/arm/shoulder/leg).

7) Physical work

Step 1: Doing the household chores everyday like sweeping the floor, washing clothes etc., add to good physical exercise.

2) Meditation

Step I: Prepare yourself for meditation. Wash and put on clean comfortable clothing. Sit with back and head erect, legs folded in, hands clasped and resting in lap, eyes closed.

Step 2: Relax and stretch all the muscles of your body.

Step 3: Calming the mind with relaxed breathing. Breathe in and breathe out as naturally as possible in a relaxed manner. Concentrate on inhalation and exhalation. Sit for 5 minutes first and then increase your meditation time gradually. You can also chant during meditation process.

Step 4: Conclude your meditation with a prayer for family, friends and world peace.

Step 5: Take a final deep breath. Stand and stretch.

3) Art of living

Step 1: Enroll in art of living course to practice simple exercises that helps to relieve stress.

4) Jogging

Step 1: Get good shoes and appropriate clothing.

Step 2: Pick good locations for jogging.

Step 3: Start running at a slow pace for few kilometers. Gradually increase it everyday. You can jog for about half hour everyday.