Global Scientific JOURNALS

GSJ: Volume 9, Issue 10, October 2021, Online: ISSN 2320-9186

www.globalscientificjournal.com

AERODYNAMIC MEASURES OF MPD AND S/Z RATIO IN MALAYALAM SPEAKING POLITICIANS AND THEYYAM ARTISTS

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INTRODUCTION

Voice is the sound produced by humans and other vertebrates using the lungs and the vocal folds in the larynx, or voice box (NIDCD, [National Institute on Deafness and Other Communication Disorders], 2017). The human voice conveys information about the speaker through paralinguistic features such as: pitch, loudness, resonance, quality and flexibility. Speakers vary this paralinguistics to infuse their talk with emotion (Williamson, 2014).

Voice problems usually include pain or discomfort when you speak, or difficulty controlling the pitch, loudness, or quality of your voice. As you exhale, air gently passes through your throat, across your open vocal cords, and out your mouth and nose. It mainly affects the ability to speak normally. The voice may quiver, be hoarse, or sound strained or choppy. It might also have pain or a lump in the throat when speaking.

Muscle tension dysphonia, vocal fold lesions (e.g., nodules and polyps), cysts, vocal fold scarring, changes in vocal fold mobility, and age-related alterations are all common problems among professional voice users (Franco & Andrus, 2007).

Individuals need to maintain a healthy life style and follow proper diet to take care of their voice. Staying hydrated and using the voice wisely is part of it.

The parameters of voice include aerodynamic assessments, auditory perceptual assessments and acoustic assessments. Auditory-perceptual analysis is the most commonly used clinical voice assessment method, and is often considered a gold standard documentation of voice disorders. Parameters of voice production are pitch, habitual

pitch, MPD, maximum to minimum intensity at various pitches, jitter, noise and resonance. Perceptual analysis of aerodynamic measures is MPD and S/Z ratio.

Different laryngeal and respiratory pathologies affect a person's ability to phonate a sound, which can be quantified using two measures, termed Maximum Phonation Duration (MPD) and S/Z ratio, which allow to assessing the efficiency of the respiratory and phonatory system.

The Maximum phonation duration (MPD) is the longest time that a client can sustain a vowel sound at a comfortable pitch and loudness on a deep breath. Adult females should achieve between 15-25 seconds, whereas adult males exceed this at between 25-35 seconds (Williamson, 2014).

The S/Z ratio is a standard test of vocal function. It is obtained by timing the longest duration that a patient can sustain the individual phonemes S and Z, and then divides the two figures to obtain a numerical ratio. Unlike S, the voiced Z requires phonation (i.e., glottis vibration). Under normal circumstances, the ideal S/Z ratio is 1. 95% of people who have problems with their vocal folds have an s/z ratio of greater than 1(Williamson, 2018).

According to Stemple, Glaze and Gerdman (1995), vocal professionals by the very nature of their occupations are at a greater risk of developing voice problems and laryngeal pathologies than general population. The demand on an individual's vocal system depends on the kind of occupation one is engaged in. Vocal professionals, especially those in the speaking profession require certain qualities in their speech to be successful in their profession such as good pitch range, rhythm, melody, fluency, phrasing, emphasis, modulation & good expiratory air to sustain speech.

A study on aerodynamic measures of maximum phonation duration and s/z ratio was analyzed on a group of (5) professional voice users to investigate their pre and post aerodynamics. This study comprised of 100 subjects without any voice complaints (age range – 25 to 45 years). Each group was divided into 10 males and 10 females, the results showed that on the basis of gender comparison; females showed highest negative impact compared to males in the post-recording compared to pre-recording (Meghana & Roy, 2019).

Maximum Phonation Duration (MPD), a clinical measurement of the longest time one can phonates a vowel, typically /a/, is a frequently used measure of vocal function, but normative data are lacking for MPT in healthy older adults. Sixty-nine healthy older adult volunteers participated (i.e., 15, 26, and 28 in the seventh, eighth, and ninth decades of life, respectively). The effects of age, gender, and repeated measures (three trials in a single session) on MPT were assessed. Results suggest that MPTs were longer in this group of older adults than previously reported and did not vary significantly with age or gender. Additionally, across a single short sampling session, measurements were relatively stable across three trials of MPTs (Maslan et al, 2011).

Sabu, Ashok, Krishnapriya and Sunny (2019) studied to find the acoustic characteristics of individual performing religious rituals like theyyam, and results revealed that there is only considerable variance in theyyam artists compared to that of the normal healthy individuals.

Chung, Eun-Ee, Lee and Sang-Ho (2016) analyzed the voices of politicians, who represent their nation by selecting politicians representing ROK (Republic of Korea; South Korea) and USA (United States of America), choose representative speeches to nation, made a comparative analysis of their voices in the speeches, and draw implications by analyzing the politicians voices on the basis of vocal properties as vocal pitch, accuracy of pronunciation, resonance, and intonation variation and results found that ROK politicians were poorer at utilizing their voice than US ones. They were also poorer at accurate pronunciation, which exerts a significant impact on message passing.

Shrestha and Adhikari (2019) did a study in Nepal to measure the MPD and S/Z ratio in normal healthy adults, tuberculosis and asthma group patient. Results showed that a significant difference in MPD of /a/, /i/, /u/ sound between control and experimental group. MPD were significantly shorter in Asthma and Tuberculosis group compared to Normal group with no significant difference in S/Z ratio. The study also concluded that MPD is more reliable measure to assess respiratory function compared to S/Z ratio.

Researchers are also looking at new ways to assess vocal disorders and testing new methods of voice therapy for people with growths on the vocal folds. New techniques to combat age-related weakness in the laryngeal muscles have the potential to prevent voice disorders in the ageing population. Recent results from NIDCD (National Institute on Deafness and Other Communication Disorders, (2021) funded researchers showed that, in

an animal model of the ageing voice, vocal training exercises helped the muscles of the larynx and stay strong. Professional voice users include singers, actors, entertainers, and media professionals. They also include lawyers, members of the clergy, politicians, professors, and teachers. All of these individuals have very unique, very unique vocal demands. Due to a heavy vocal load, strenuous travel schedules, and often long work hours, these individuals may be more prone to throat and larynx disorders (UCI Health Voice & Swallowing Center, 2020).

Theyyam is the most unique dance form in Kerala. It is a sacred ritual art form which is performed to worship the Hindu Goddess "Kali". Considered as the Dance of the Gods, Theyyam is usually performed by men. It showcases a rare combination of dance, music, and mime which reflects the ancient tribal culture of Kerala. This cultural style combines motor control motions with the use of the voice. These performances lack a voice deficit due to the excessive use of voice at different intensities and pitches.

A politician is another professional voice user who is active in party politics, or a person holding or seeking an elected seat in government. Politicians propose, support, and create laws that govern the land and, by extension, its people. Broadly speaking, a "politician" can be anyone who seeks to achieve political power in the government. There are few or limited studies in Malayalam on politicians and Theyyam artists (Sabu, Ashok, Krishnapriya & Sunny, 2019) on Jitter and Shimmer. Hence, the present study attempts to measure the MPD and S/Z ratio to identify the changes in voice characteristics of Theyyam artists and politicians who are professional voice users. They can further be referred for the intervention or not, depending on their results.

REVIEW OF LITERATURE

The human voice is not only the key to human communication but also serves as the primary musical instrument (Benninger, 2011). "Voice is the sound produced in the larynx by the vibration of the vocal folds (vocal cords). Certain speech sounds are voiced by this vibration. The human voice conveys information about the speaker through paralinguistic features such as: pitch, loudness, resonance, quality and flexibility. All speech sounds are produced on an outgoing air stream from the lungs, i.e., air from the lungs is directed up through the trachea, through the space between the vocal folds in the larynx (i.e., the glottis) and eventually out through either the mouth or nose. This air stream may either be vocalised by the vibration of the vocal folds or non-vocalized. The vocalised air stream is used to produce voiced speech sounds, e.g., all vowels, and voiced consonants such as ‘b’, ‘d’ and ‘g’. A non-vocalized air stream is used to produce many voiceless consonants, e.g., "p", "t" and "s" (Williamson, 2014).

Many professions rely on voices, but the most noticeable and visible are those who continuously use their voices for 6 hours a day. The performing voice requires a thorough understanding of the interaction between the anatomy and physiology of voice production, along with an awareness of the interrelationships between vocalization, acoustic science and non-vocal components of performance.

An occupational or professional voice user is anyone whose voice is essential to their job. We all generally think of singers, actors, and broadcast personalities as professional voice users, but this also applies to teachers, clergy, salespeople, courtroom attorneys, telemarketers, receptionists, politicians, theyyam artists, and countless other professions that rely heavily on the voice. A voice disorder occurs when voice quality,

pitch, and loudness differ or are inappropriate for an individual's age, gender, cultural background, or geographic location. A voice disorder is present when an individual expresses concern about having an abnormal voice that does not perceive it as different or deviant. Occupational and professional voice users are at greater risk for developing voice disorders.

Furthermore, the consequences of even a minor voice disorder can have a significant impact on the user. Vocal problems can be functional, such as overuse, abuse, or misuse of the voice. They can also be caused by physiologic changes brought on by environmental exposure (allergies), alterations in hormones, or other systematic conditions that can adversely affect the voice, such as acid reflux disease (GERD), acute infectious laryngitis, and benign vocal fold masses (Williamson,2014).

Like other professional voice users, theyyam is the traditional and most spectacular and mythical ritual art form of Kerala. Moreover, it is a sacred ritual art form which is performed to worship the Hindu Goddess "Kali". Considered as the Dance of Gods, Theyyam is usually performed by men before the village shrine, groves, and compounds of ancestral houses as ancestor-worship with elaborate rites and rituals. Theyyam artists use their voice two-three hours every day as part of their work. It showcases a rare combination of dance, music and mime which reflects the ancient tribal culture of Kerala.

Aerodynamic forces play a major role in the production of vocalisations. Aerodynamic measures can be used in the objective clinical assessment of how the larynx is functioning to produce voice (i.e., vocal function). Other common objective voice measures are derived from acoustic and electrographic assessments. The general concept of objective measurement of vocal function stems from a long-standing desire in the field to develop measures that would be less subjective and provide more reliable insights into vocal function than judgments that rely heavily on auditory perception. And this includes the maximum phonation duration and s/z ratio; they are supplemental tools that are used as part of a comprehensive, integrated evaluation to enhance the quality of diagnosis and treatment of voice (Mehta & Hillman, 2007).

In order to produce a good quality voice, a person must be able to bring their vocal folds (vocal cords) together easily along their entire length. The gap between them (the glottis) needs to be closed with just the right amount of tension. Of course, during phonation of voiced speech sounds, the vocal folds vibrate extremely rapidly – about 100 times per second for adult males and around 200 times per second for adult females. The ability to close the glottis is also important in protecting the airway, preventing foreign objects falling into the larynx. A firm closure is also necessary to allow the person to cough strongly. The ability to close (adduct) the vocal folds efficiently and easily – and to vibrate them strongly through rapid opening and closing cycles – is referred to as glottic efficiency.

A simple test of glottic efficiency is maximum phonation time/duration (MPD/MPT). MPD is the maximum duration, as the name implies, measures the duration of a maximally sustained vowel, and for reasons similar to the s/z ratio, it ought to be sensitive to impaired phonatory glottal closure. The maximum phonation duration is elicited by asking the individual to take a deep breath and sustain a vowel at comfortable pitch and loudness for as long as possible. The duration is then measured. It requires no sophisticated instrumentation – only a watch with a second hand. Similar to the s/z ratio, maximum phonation duration is used to assess the integrity of phonatory glottal closure. (Ptacek & Sander, 1963). Men produce greater maximum phonation duration than women in general, due to their greater lung volume (Yanagihara, Koike, & Leden, 1966).

The S/Z ratio is a maximum performance task that requires nothing more than a stopwatch for instrumentation. The s/z ratio is used to assess the integrity of phonatory glottal closure. It is a statistic of the relative durations of maximum phonation of the phonemes /s/ and /z/. The s/z ratio has no units of measurements. Both the /s/ and /z/ consonants are produced in the same manner. That is, the tongue is in contact with the hard palate just behind the upper front teeth; with a narrow channel or groove left open between the tongue and the palate to allow the outflow of air. The narrow constriction produces turbulent airflow, which is the sole source of the sound for the /s/. For the production of /z/, the vocal folds vibrate to produce a glottal acoustic wave, the sound of which is added to the turbulent airflow in the mouth. In sum, the only difference between the two sounds is the vibration of the vocal folds. Increased laryngeal resistance should occur with production of /z/ compared to /s/, because the glottis is wide open for the /s/ (minimal resistance), and vibrating open and closed for the /z/ (greater resistance).

For a speaker with normal vibratory dynamics, it is hypothesized that an individual should be able to sustain the /s/ and the /z/ for equal durations, yielding an s/z ratio of one. In cases of incomplete glottal closure during phonation, the glottal resistance would be lowered; allowing greater escape of air, and the /z/ would be sustained for shorter duration, yielding a ratio greater than one (Eckel & Boone, 1981).

The S/Z Ratio and MPD are not, of course, diagnostic of laryngeal pathology (a laryngoscopic examination would be required to determine any actual structural and/or functional lesions). However, it is an indicator of laryngeal pathology which can be used as a 'rough and ready' test to identifying people who may have laryngeal lesions. It is important to remember that an MPD and S/Z Ratio of 1.4 or above do not guarantee that the person has an actual laryngeal pathology – it is just a quick 'rule of thumb' that is useful in early identification of potential difficulties and as a tool to monitor progress.

Western Literature:

Shrestha and Adhikari (2019) did a study in Nepal to measure the MPD and S/Z ratio in normal healthy adults, tuberculosis and asthma group patient. The results revealed a substantial difference in MPD between the control and experimental groups for the /a/, /i/, and /u/ sounds. The Asthma and Tuberculosis groups had much shorter MPD than the Normal group, with no significant change in the S/Z ratio.

Mohseni & Sandoughdar (2016) did a study on acoustic parameters of voice in Iranian female teachers and comparison with non-teachers was analyzed. 90 Iranian female elementary teachers, 30–50 years old, and 90 Iranian female non-teachers in the same age were assessed, the difference measures of F_0, jitter, shimmer, harmonic to noise ratio (HNR), and maximum of phonation time (MPT) between two groups were investigated. Results showed that the values of F_0 were higher in teachers (210.03 Hz) than in non-teachers (194.11 Hz; $P < 0.001$) and the values of perturbation measures were greater in teachers (jitter 0.32% and shimmer 4.63%) than those in the control group (jitter 0.22% and shimmer 3.15%; $P < 0.001$), but in HNR and MPT values, non-teachers showed higher levels ($P < 0.001$). The value of HNR in teachers was (18.84±1.56) but it was (21.3±1.73) in non-teachers and MPT value in teachers was (16.83±3.65) and in non-teachers was (22.5±5.2).

Chung, Eun-Ee, and Lee, Sang-Ho (2016) analysed the voices of politicians who represent their nation by selecting politicians representing ROK (Republic of Korea; South Korean) and USA (United States of America), choosing representative speeches to the nation, comparing their voices in the speeches, and drawing implications by assessing the politicians' voices on the basis of such vocal properties. Also, they are less accurate in pronouncing words correctly, which has a considerable impact on message transmission.

Ling-Lu, Presley and Lammers (2013) examined the efficacy of intensive respiratory phonatory treatment (LSVT) for glottal incompetence associated with presbyphonia. Traditional voice therapy and surgery were found to be ineffective in treating age-related dysphonia, especially in more severe instances with evident fold atrophy or wider glottal gaps.

Yick-yu, Lee, Lao and Tak –sun Yu (2010) studied the prevalence of voice disorders and associated risk factors among primary school teachers in Hong Kong. Results showed that voice issues impacted 70% of the elementary school instructors in the study and, a significant number of the affected teachers also had both functional and psychological consequences.

Kyung-A, Soon-Bok, Sung-Won, Hyung-Shin, Jong-Cheol, Yong-Rok, Bong-Joo, Yung-Jin, Tae-Hyun and Kang-Dae (2007) studied the effect of eating a raw egg by professional or non-professional voice users on their voice quality and the duration of the effect. Results showed that firstly, vocal hygiene was good in 57.5% of the total subjects and was poor in 42.5%. 40% of professional voice users and 75% of non-professional voice users hand good quality. 77.5% of the total subjects had the vocal fatigue while 22.5% of the subjects did not. 95% of the professional voice users and 60% of non-professional voice users complained the vocal fatigue. 60% of the total subjects reported a subjective vocal symptom. 65.0% professional voice users and 70.0% of non-professional voice users reported a voice symptom.

Roy, Merrill, Thibeault, Gray and Smith (2004) discussed the frequency and adverse effects of voice disorders on job performance and attendance in teachers and the general population using a voice disorder questionnaire and found that occupationally related voice dysfunction in teachers can have significant adverse effects on job performance, attendance, and future career choices.

Simberg, Laine, Sala, Ronnemaa (2000) did a study on the prevalence of voice disorders among students studying to be teachers. The results showed that 20% of this population reported two or more vocal symptoms during the previous year and that 19% had an organic voice disorder.

Indian Literature:

Phatak, Shaikh, Jamdhade and Kelkar (2021) vocal capability of voice-over artists to those of untrained voice users. Results revealed that voice-over artists were recognized by listeners as trained vocal users, and there was no statistically significant difference in the number of sentences where the emotion was correctly conveyed through their voice. Among the emotions studied, “excitement” was maximally perceived correctly by listeners.

Karulkar and Gunjawate (2021) developed a 22-item questionnaire was developed in English language and translated to Marathi language, to study the voice problems, vocal and non-vocal habits of Naradiya kirtankars (narrators). Results revealed that kirtankars may be at risk of experiencing vocal difficulties. When compared to kirtankars without voice problems, those with voice problems frequently pursued primary occupations requiring extensive voice use, performed in a noisy environment, engaged in excessive talking, strained neck muscles while voicing, impersonated voice, had reduced sleep duration, and had hearing difficulty.

Karulkar, Ravi and Gunjawate (2020) developed a questionnaire and administered the survey to profile voice-related complaints, as well as vocal and non-vocal habits among 61 Hindustani classical singers. Result found that 41% of singers reported of at least three vocal symptoms. Out of breath during singing, tiredness after singing, and tension or tightness in the neck/shoulder were the most common vocal symptoms. Excessive phone use, loud coughing/sneezing, throat clearing, and excessive speaking were among the most commonly mentioned vocal behaviours. There was also a significant consumption of caffeinated beverages and spicy foods.

Balasubramanium, Dsouza, Rao, Saldanha, Jahan, Thomas and Gunjawate (2020) developed a questionnaire to profile the voice complaints, vocal and non-vocal habits among 37 beatboxers in India. Results showed common vocal complaints included vocal

fatigue after long usage of voice (72.97%) and breathing difficulty after performance (86.49%). Also 76.38% reported of using loud voice during performances. Poor non-vocal habits such as muscle tension during beatboxing (56.76%), breathing difficulty during beatboxing (45.94%). Two most common good non-vocal habits included food intake on time (78.38%) and use of relaxation techniques (72.97%) prior to performance.

Dodderi, Johnson and Aji (2020) did a study on vocal fatigue among 117 beat boxers and compared their rating of vocal tiredness with two control groups. Mean scores suggest non-singers rating lowest scores of vocal tiredness followed by beat boxers, and ratings of untrained singers were highest. Results were observed between and within-group analysis at $P < 0.05$. Self-awareness of experiencing vocal fatigue was 72.5% and 48.6% in untrained singers and beat boxers respectively.

Sabu, Ashok, Krishnapriya, and Sunny (2019) investigated the voice characteristics of theyyam performers in terms of jitter and shimmer, and found significant differences between theyyam artists and the normal healthy person.

Meghana and Roy (2019) studied on a group of professional voice users, to investigate the pre and post aerodynamics across professional voice users in the age range 25-45 years. The subjects were divided into five professional voice users (Group I Teachers, Group II- Singers, Group III-Speech language pathologist, Group IV- Lawyers and Group V Call-centers. Results found that the Group V Call centers showed high negative impact of MPD and s/z ratio in the post recording compared to pre-recording. Across gender comparison, females showed highest negative impact compared to males.

Gunjawate, Ravi, and Bellur (2018) conducted a systematic review of the literature on the acoustic analysis of voice in singers and found that there was a wide variation in the instruments and tasks used, as well as different acoustic measures like fundamental frequency, perturbation, cepstral, spectral, dysphonia severity index, and singing power ratio, and there was a lack of standardization.

Ravi, Shabnam, George and Saraswathi (2018) investigated and compared the acoustic and aerodynamic characteristics of choral singers and non-singers. Results suggested that from acoustic analysis of female groups revealed higher F0 in singers than non-singers: higher jitter, shimmer, and noise-to-harmonics ratio (NHR) values were obtained for non-singers compared to singers. Results from acoustic analysis of male

groups revealed significantly higher F0 in singers than non-singers and significantly higher shimmer and NHR values for non-singers compared to singers. Results from aerodynamic analysis for both male and female groups revealed higher vital capacity, forced vital capacity, and slow vital capacity in singers than non-singers.

Devadas, Kumar and Maruthi (2018) examined the prevalence of and possible risk factors for the self-reported voice problem (VP) in Carnatic singers. The prevalence of VP was found to be high among Carnatic vocalists at both the career (35%) and point (23%) levels. Clenching of teeth, frequent colds, hearing difficulty, work-related stress, and regular use of drugs for various health concerns were among the risk variables identified to have a significant association with a high incidence of self-reported VPs.

Balasubramanium, Karuppali, Bajaj, Shastry and Bhat (2018) studied the voice characteristics of purohits using perceptual and acoustic analyses. Results revealed that purohits did not have vocal aberrations as measured by perceptual and acoustic characteristics, but cepstral measurements were greater in Indian Hindu purohits than in normal controls, indicating that purohits have a higher degree of harmonic structure.

Sathyanarayan, Boominathan and Nallamuthu (2018) developed a VH questionnaire to provide socio-culture-specific information on VH practices and nature of voice problems in teachers. Results showed the 'Flexible voice' (23%), 'enduring voice' (22%), and 'good voice' (22%) were descriptions to indicate good VH by teachers. 'Vocal fatigue' (13%), 'dry throat' (9.4%), 'throat irritation' (4.7%), and 'pain while swallowing/speaking' (3.1%) were frequently reported throat sensations to indicate poor VH. For 30.2% of the teachers, voice mattered for professional need and most of them managed to cope with voice problems through several home remedies and 'intentional/self-imposed neglect' despite their vocal difficulties.

Pathan and Rajani (2017) aimed to measure the acoustic parameters of voice across different levels of vocal professionals. Results were analyzed and compared across two tasks; sustained phonation task and reading task. The sustained phonation sample is clearly insufficient to reflect the multifaceted elements of connected speech. Aspects of the connected speech sample, such as articulatory rate, accuracy, intonation, and intention, may reveal significant changes in voice production. As a result, the connected speech tasks, as well as the sustained phonation task, are discovered to provide important information in acoustic parameters.

Devadas, Hegde and Maruthy (2017) did a study on (a) the prevalence of self-reported VPs, (b) the different risk factors associated with the development of VPs, (c) the self-reported vocal health, and (d) the effect of VP on Yakshagana folk artists. Result suggested that the career prevalence of self-reported VPs in singers and actors were found to be 91.2% and 74%, respectively, with multiple symptoms of vocal attrition. Frequent throat clearing was found to have a significant association with actors reporting VPs.

Alva, Machado, Bhojwani and Sreedharan (2017) studied the various risk factors that influence the onset and progression of voice disorders in school teachers in the Indian context, by assessing the effect of voice problems on the physical, psychosocial and functional aspect of a teacher's life. Results found that 81 percent of the participants in the study had vocal difficulties at some point during their careers. And a total of 26% of them were diagnosed with a vocal issue. The association between upper respiratory infections like DNS and GERD and vocal issues was found to be statistically significant. It was also discovered that a large proportion of teachers with voice disorders had modified their teaching approaches and were considering retiring early. Teachers with voice issues were also shown to have a lower quality of life than those who did not have a voice disorder ($p<0.001$).

Devadas, Bellur and Maruthy (2016) studied the prevalence and risk factors of VPs among primary school teachers in India. Results showed that out of 1082 teachers the most common symptom was fatigued voice after long hours of talking, followed by sore/dry throat, strain in voice, neck muscular tension, and trouble projecting voice. 188 teachers reported VPs, accounting for a prevalence rate of 17.4 percent. Number of years of teaching, high background noise levels in the classroom, psychological stress while teaching classes, improper breath management (holding breath while speaking), poor tone focus (clenching jaw/teeth while speaking), upper respiratory infection, thyroid problems, and acid reflux were all identified as significant risk factors for the development of the disease.

Boominathan, Rajendran, Nagarajan, Seethapathy and Gnanasekar (2013) developed a questionnaire to study the vocal abuse and vocal hygiene practices among 400 voice professionals including singers, teachers, politicians, and vendors. The results revealed that the highest prevalence and frequency of vocal difficulties were found among politicians and vendors. Politicians had the highest rate of abusive nonverbal behaviours.

Abuse (non-vocal) behaviours were thought to have a detrimental impact on voice by 84.3 percent of voice professionals. For long periods of time, all subjects engaged in throat clearing and loud speaking/singing (abusive vocal habits). An equal percentage of people said they would try home treatments or not seek help at all. To prevent voice disorders, these various vocal professionals in India use both ancient traditional techniques (such as drinking milk with pepper or turmeric) and experimentally established procedures. Vendors and politicians had a low awareness of how to manage voice difficulties earlier.

Devdas, Rajashekar and Aithal (2009) analyzed the voice parameters in Yakshagana Singers (Bhagavata). Results revealed that Bhagavatas had a higher fundamental frequency and lower MPD than non-singing counterparts, and laryngeal examination revealed symptoms of vocal abuse in Bhagavatas.

Balasubramanium, Karuppali, Bajaj, Shastry and Bhat (2018) studied the voice characteristics of purohits using perceptual and acoustic analysis and a study on aerodynamics of a group of professional voice users such as singers, speech-language pathologists, lawyers, teachers, and call-centers was also done across gender comparisons in males and females by Meghana and Roy (2019).

A survey of voice related complaints, as well as vocal and non-vocal habits in Hindustani classical singers was reported [Karulkar, Ravi & Gunjawate (2020)]. Also, a study on the prevalence and risk factors of voice problems among primary school teachers in India was carried out [Devadas, Bellur, and Maruthy (2017)].

NEED OF THE STUDY:

The performing voice involves a detailed understanding of the anatomy and physiology of voice production, as well as an understanding of the interrelationships between voice, acoustics, and non-vocal aspects of performance.

Anyone whose voice is required for their work is referred to as an occupational or professional voice user. Many occupations rely on voice, but those that use it for 6 hours a day are the most apparent and visible. Among professional voice users, muscle tension dysphonia, vocal fold lesions (e.g., nodules and polyps), cysts, vocal fold scarring, changes in vocal fold mobility and age-related variations are all prevalent issues.

Aerodynamic measures of MPD and S/Z ratio on Theyyam artists and politicians have only been published in a few research studies in the Indian scenario. To fill the paucity, the current study compares the maximum phonation duration (MPD) and s/z ratio of Theyyam artists and politicians to normal, healthy individuals in order to determine if there is any aberration in vocal characteristics and to develop assessment protocols and therapeutic intervention.

METHOD

Aim: -

The present study aimed to measure the MPD and S/Z ratio to identify the changes in voice of Malayalam speaking Theyyam artists and Politicians, with professional experience of 5-10 years. Hence, the current study attempts to measure the MPD and S/Z ratio to identify the changes in voice characteristics of Theyyam artists and politicians who are professional voice users. They can further be referred for the intervention or not, depending on their results.

Participants Selection: -

A total of 60 males participated in the study. The individuals were divided into three groups, and each group consisted of 20 individuals in the age range of 25 - 45years old.

1. Group I-20 normal healthy males,
2. Group II- 20 male Politicians,
3. Group III -20 male Theyyam artists.
4. A detailed case history was administered to rule out the presence of hoarseness, loss of high or low frequencies, pitch breaks, throat clearing, dryness in the throat, and vocal fatigue.

Each subject is evaluated with the following: -

Manual aerodynamic measurements -

1. MPD as well as
2. S/Z ratio

Inclusion criteria: -

Subjects who have been working in the field for more than 5-10 years were included in the age group of 25–45 years.

Exclusion criteria: -

Subjects who had undergone medical or surgical management for voice disorders, habitual alcohol consumption, or smoking were excluded from the study.

Materials used: -

1.Consent Form
2.Case History
3.Stopwatch

Procedure: -

A detailed case history was administered before the participants were ready to be a part of the present study. Voice samples were recorded in a quiet room with a stopwatch. Participants were asked to perform two tasks, MPD and S/Z ratio. In the first task of maximum phonation duration, the subjects were instructed to take a deep breath and then to prolong the vowel/a/as long as possible with maximum inspiration, with comfortable loudness and pitch in one exhalation (manual aerodynamic measures). A

demonstration was given to the subjects. A total of three trials were given, and the best of the three trials was considered as the Maximum Phonation Duration.

The second task was the S/Z ratio, another measure of phonation time where subjects were instructed to sustain the individual phonemes/s/and/z/as long as they could; three trials were given. The S/Z ratio is calculated by dividing the time of the longest duration (s/) by the time of the longest duration (z/). Variations in voice characteristics in Theyyam artists and politicians were analyzed by comparing them with healthy, normal individuals.

Analysis: -

The data was subjected to statistical analysis to determine the significant differences. ANOVA was used to find a significant difference for the three groups (Group 1, Group 2, Group 3), and the Bonferroni test was performed for multiple comparisons between the three groups (Group 1, Group 2, Group 3).

RESULTS AND DISCUSSION

Aim: -

The present study aimed to measure the MPD and S/Z ratio to identify the changes in voice in Theyyam artists and Politicians, with professional experience of 5-10 years.

A. Significance of MPD

Table 4.1:

Shows the comparison of Maximum Phonation Duration between Normal, Politicians and Theyyam Artists.

Parameter	Groups		Mean difference	Standard error	p value	Significant
Maximum	Normal	Politicians	13.2	0.67	<0.001*	HS
	Normal	Theyyam	19.6	0.67	<0.001*	HS

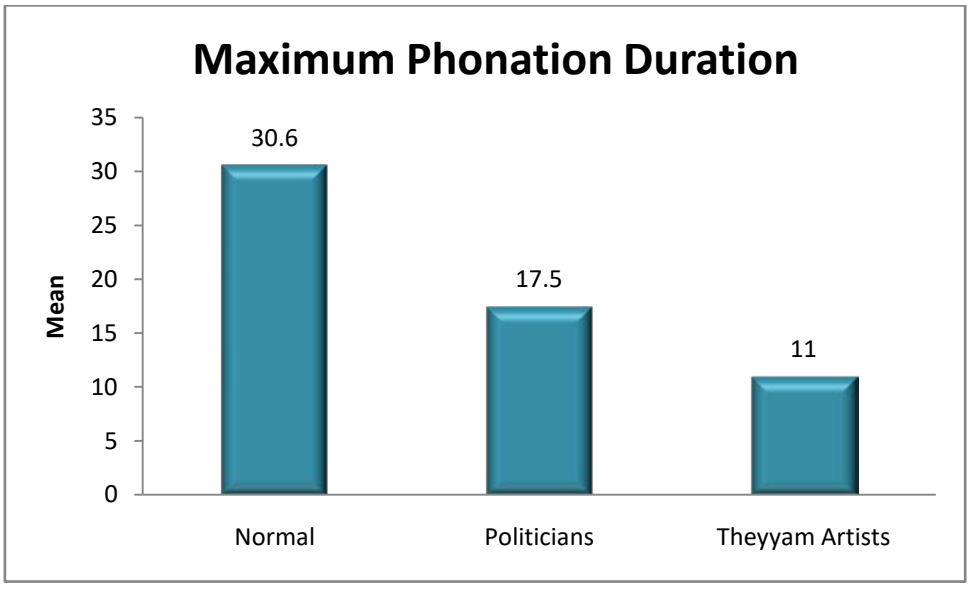
Phonation Duration		Artists				
	Politicians	Theyyam Artists	6.5	0.67	<0.001*	HS

The HS in the table represent; HS = Highly Significant

B. Responses of MPD

Figure 4.1*:*

Shows the comparison of MPD between Normal, Politicians and Theyyam Artists.



On examining Table 4.1 and Figure 4.1, the comparison of MPD between normal, politicians, and theyyam artists shows that healthy normal adults have higher MPD than politicians, followed by theyyam artists. Hence, a high statistically significant difference was noticed between the groups.

C. Significance of S/Z ratio

Table 4.2:

Shows the comparison of S/Z ratio between Normal, Politicians and Theyyam Artists.

Parameters	Groups		Mean difference	Standard error	p value	Significant
S/Z Ratio	Normal	Theyyam artists	-0.03350	0.05093	1.000	NS
	Normal	Politicians	0.22200	0.05093	0.000	HS
	Politicians	Theyyam Artists	0.25550	0.05093	0.000	HS

The NS, HS, in the table represents; NS = Non Significant, HS = Highly Significant

D. Responses of S/Z ratio

Figure 4.2:

Shows the comparison of S/Z ratio between Normal, Politicians and Theyyam Artists.

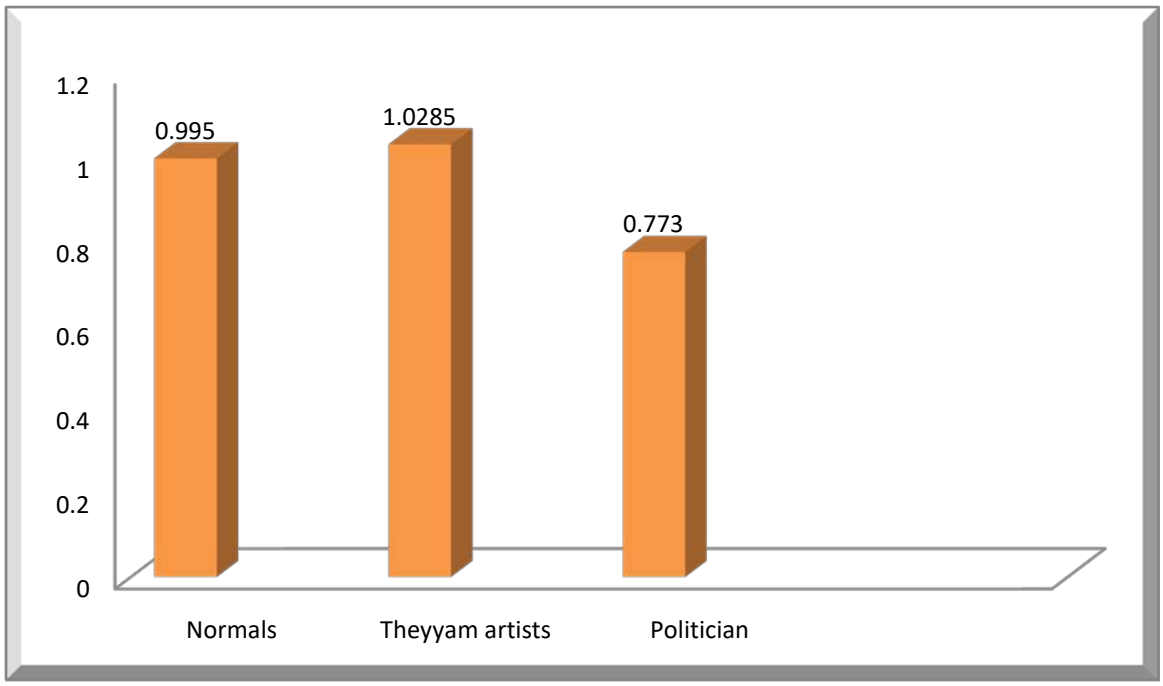


Table 4.2 and Figure 4.2 compare the S/Z ratios of normal, politicians, and theyyam artists. Politicians have a lower s/z ratio compared to healthy, normal adults. Hence, a highly significant difference was noticed. On the S/Z ratio, healthy normal adults and theyyam artists performed similarly. No statistical difference was seen between the theyyam artists and healthy, normal adults.

DISCUSSION

The present study was aimed to assess and compare the aerodynamic measures of MPD and S/Z ratio in Malayalam speaking politicians and theyyam artists with voice characteristics of healthy, normal adults.

Analysis revealed that there is a highly significant difference ($p < 0.001$) between the MPD in healthy, normal adults and in politicians, followed by that in theyyam artists. Also, the present study suggests that there is a highly significant difference in S/Z ratio between politicians and healthy, normal adults, as well as no significant statistical difference between theyyam artists and healthy, normal adults.

The results of the present study on measuring S/Z ratio in theyyam artists are in accordance with the study by Devadas, Rajashekar, and Aithal (2009), where they found

no significant difference in the S/Z ratio between the Yakshagana Singers (traditional dance-drama art) and non-singers. Similar results were reported by Shrestha and Adhikari (2019) who said there was no significant difference in the S/Z ratio when they compared tuberculosis patients and asthma group patients with healthy, normal adults. Hence, the recent study also suggests that MPD is a better assessment tool than S/Z ratio to assess the voice characteristics of professional voice users like politicians and theyyam artists.

To conclude, theyyam artists and politicians should have a systematic follow-up to examine any changes in vocal characteristics utilizing MPD and S/Z ratio, as well as decide if therapeutic intervention is required.

SUMMARY AND CONCLUSION

The current study aimed to investigate the MPD and S/Z ratio to identify the changes in the voices of Malayalam speaking Theyyam artists and politicians, with professional experience of 5-10 years.

The subjects selected were a total of 60 individuals, out of which 20 were healthy, normal adults, 20 were politicians, and 20 were theyyam artists. The age of the participants ranged from 25 to 45 years. Subjects who had undergone medical or surgical management for voice disorders, habitual alcohol consumption, or smoking were excluded from the study.

The participants were informed about the study's aim and were asked to sign a consent form. Following that, a detailed case history was compiled. After that, a voice sample was taken and analysed for aerodynamic evaluation. The data was statistically evaluated to determine the significance of the difference.

The results suggest that there was a highly significant difference in individual voice characteristics – MPD and S/Z ratio – between healthy, normal adults (group 1) and politicians (group 2), followed by theyyam artists (group 3), and no significant difference between theyyam artists (group 3) and politicians (group 2), followed by healthy, normal adults (group 1).

Hence, the recent study suggests that it is necessary to have timely and regular follow-up to assess any change in the voice characteristics of theyyam artists and politicians using aerodynamic measures and to decide whether any therapeutic intervention is needed or not.

REFERENCES

Balasubramanium, R. K., Dsouza, S. B., Rao, A., Saldanha, S. J., Jahan, N., Thomas, E., & Gunjawate, D. R. (2020). Voice Complaints, Vocal and Non-vocal Behaviours Among Beatboxers–A Preliminary Study. *Journal of Voice*.

Balasubramanium, R. K., Karuppali, S., Bajaj, G., Shastry, A., & Bhat, J. (2019). Acoustic- perceptual correlates of voice in Indian Hindu Purohits. *Journal of Voice*, *33*(5), 804-e1.

Behrman, Alison., (2007). Speech and Voice Science. *190-192.*

Benninger M. S. (2011). The professional voice. *The Journal of laryngology and otology*, *125*(2), 111–116.

Boominathan, P., Mahalingam, S., Samuel, J., Babu, M. V. D., & Nallamuthu, A. (2012). Voice characteristics of elderly college teachers: A pilot study. *Journal of Laryngology and Voice*, *2*(1), 21.

Boominathan, P., Rajendran, A., Nagarajan, R., Seethapathy, J., & Gnanasekar, M. (2008). Vocal abuse and vocal hygiene practices among different level professional voice users in India: a survey. *Asia pacific journal of speech, language and Hearing*, *11*(1), 47-53.

Chowdhury, K., & Dawar, H. (2019). Impact of classroom determinants on psychosocial

Aspects of voice among school teachers of Indore, India: a preliminary survey. *Indian Journal of Otolaryngology and Head & Neck Surgery*, *71*(1), 776-783.

Chung, E, -E, & Lee, S. –H. (2016). A Comparative Study on the public Speech Spectrum between ROK and USA politicians. *Journal of Digital Contents Society, 17(3), 143- 155.*

Devadas, U., Bellur, R., & Maruthy, S. (2017). Prevalence and risk factors of voice problems among primary school teachers in India. *Journal of voice*, *31*(1), 117-e1.

Devadas, U., Hegde, M., & Maruthy, S. (2019). Prevalence and risk factors of self-reported voice problems among Yakshagana artists. *Journal of Voice*, *33*(1), 124-e35.

Devadas, U., Kumar, P. C., & Maruthy, S. (2020). Prevalence of and risk factors for self-reported voice problems among Carnatic singers. *Journal of Voice*, *34*(2), 303-e1.

Devdas, U., Rajashekar, B., & Aithal, V. U. (2009). Analysis of voice in Yakshagana singers. *Journal of All India Institute of Speech and Hearing (JAIISH), 28,* 59-64.

Dodderi, T., Johnson, A., & Aji, A. M. (2020). Vocal Fatigue in Beat Boxers. *Journal of Voice*. DOI: 10.19080/GJO.2017.09.555767

Eckel, F. C., & Boone, D. R. (1981). The s/z ratio as an indicator of laryngeal pathology. *Journal of speech and hearing disorders*, *46*(2), 147-149.

Feby, S., Amritha, A., Krishnapriya, k. p., & Geethu, K. S., (2019). A Preliminary Study on Voice Characteristic of Theyyam Artist (A Traditional Art Form of Kerala). *Paripex- Indian Journal of Research (PIJR), 8(4).*

Franco, R. A., & Andrus, J. G. (2007). Common diagnoses and treatments in professional voice users. *Otolaryngologic Clinics of North America*, *40*(5), 1025-1061.

Gelfer, M. P., & Pazera, J. F. (2006). Maximum duration of sustained/s/and/z/and the s/z ratio with controlled intensity. *Journal of Voice*, *20*(3), 369-379.

Graham Williamson, (2014).

Karulkar, R. R., & Gunjawate, D. R. (2021). Voice-Related Problems, Vocal and Non-Vocal Habits in Naradiya Kirtankars: A Preliminary Study. *Journal of Voice*.

Karulkar, R. R., Ravi, R., & Gunjawate, D. R. (2020). Voice-related complaints and vocal and nonvocal habits of Hindustani classical singers: a questionnaire-based study. *Logopedics Phoniatrics Vocology*, 1-6.

Kim, K. A., Kwon, S. B., Kim, S. W., Lee, H. S., Hong, J. C., Kim, Y. R., ... & Lee, K. D (2007). Voice analysis before and after swallowing a raw egg in professional voice users. *Speech Sciences*, *14*(2), 43-53.

Lee, S. Y. Y., Lao, X. Q., & Yu, I. T. S. (2010). A cross-sectional survey of voice disorders among primary school teachers in Hong Kong. *Journal of occupational health*, 1009270144-1009270144.

Lu, F. L., Presley, S., & Lammers, B. (2013). Efficacy of intensive phonatory-respiratory treatment (LSVT) for presbyphonia: two case reports. *Journal of Voice*, *27*(6), 786-e11.

Maslan, J., Leng, X., Rees, C., Blalock, D., & Butler, S. G. (2011). Maximum phonation time in healthy older adults. *Journal of Voice*, *25*(6), 709-713.

Meghana, S., Dr. Reeny, R., (2019). Aerodynamic measures of maximum phonation duration and S/Z ratio in professional voice users. *National Journal of Multidisciplinary Research and Development, 4(3), 16-24.*

Mehta & Hillman., (2007). Use of Aerodynamic Measures in Clinical Voice Assessment. *Perspectives on voice and voice disorders, 17(3), 14-18.*

Mohseni, R., & Sandoughdar, N. (2016). Survey of voice acoustic parameters in Iranian

female teachers. *Journal of voice*, *30*(4), 507-e1.

National Institute on Deafness and Other Communication Disorders (NIDCD, 2017),

National Institute on Deafness and Other Communication Disorders (NIDCD, 2021),

Pathan, S., & Rajani, Y. (2017). Acoustical evaluation of voice across different levels in vocal professionals. *Glob J Otolaryngol*, *9*, 88-97.

Phatak, P., Shaikh, S., Jamdhade, N., & Sovani Kelkar, P. (2021). Do Voice-Over Artists Convey Emotion Better Than Untrained Voice Users?. *Voice and Speech Review*, 1-15.

Ramani, S. A., Balasubramanium, R. K., & Gunjawate, D. R. (2021). Vocal and nonvocal habits among vedic chanters. *Folia Phoniatrica et Logopaedica*, *73*(1), 7-14.

Rasna, M. V. (2019). Discourse Analysis and Ritualistic Traditions-A Study on Theyyam Art Form of Kerala.

Ravi, S. K., Shabnam, S., George, K. S., & Saraswathi, T. (2019). Acoustic and aerodynamic characteristics of choral singers. *Journal of Voice*, *33*(5), 803-e1.

Roy, N., Merrill, R. M., Thibeault, S., Gray, S. D., & Smith, E. M. (2004). Voice disorders in teachers and the general population.

Sanazeb P, Yaashna R., (2017). Acoustical Evaluation of Voice across Different Levels in Vocal Professionals. *Global Journal of Otolaryngology, 9(4).*

Sathyanarayan, M., Boominathan, P., & Nallamuthu, A. (2019). Vocal health practices among school teachers: a study from Chennai, India. *Journal of Voice*, *33*(5), 812-e1.

Shrestha, S., & Adhikari, A. K. (2019). Comparison of Maximum Phonation Duration

and S/Z Ratio in Individuals with Asthma, Tuberculosis and Clinically Normal Voice. *Medical Journal of Shree Birendra Hospital*, *18*(2), 16-21.

Simberg, S., Laine, A., Sala, E., & Rönnemaa, A. M. (2000). Prevalence of voice disorders among future teachers. *Journal of voice*, *14*(2), 231-235.