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Acoustic Analysis of Voice in Khatibs

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Abstract

Khatib is a professional voice user who is at risk of developing voice problems. Like teachers, Islamic religious officials appear to be at a high risk of acquiring voice disorders. It is critical to increase awareness of the prevalence of voice problems because there is a dearth of research on the incidence of voice abnormalities among Islamic religious authorities. The study was to analysis the acoustic characteristics among male Khatibs. It was carried out among 22 male khatibs in which 11 of them had experience of less than 20 years and 11 of them with experience of more than 20 years. The recording was carried out using PRAAT software and the analysis was done on features including fundamental frequency, jitter, shimmer and HNR. The statistical analyses for the obtained recordings were carried out using ANOVA and t test. The result shows slight variation in fundamental frequency, jitter and shimmer when analyzed between the Khatibs with more than 20 years of experience, and also with less than 20 years of experience. All acoustic parameters did not show any differences whereas on the basis of years of experience, differences were observed in the parameters like fundamental frequency, jitter and HNR. When comparing the acoustic characteristic of khatibs with other professionals, it was found that all these professionals including teachers, singers and even khatibs face problems in vocal variation showing changes in voice characteristics and less vocal strain was observed even though there is more use of voice. Therefore, it's important for all these professionals to be aware of the vocal hygiene tips that help in the voice variation and to accelerate these tips as a management once they are in their working age.

Introduction

Voice is a crucial element of speech which is characteristically a human trait. It is an effective communication tool that not only delivers messages but also provides context (Colton & Casper, 1996). When a person speaks or sing, many muscles, including those in the mouth and throat are active. Similar to other muscles in the body, speech-supporting muscles can become tense, damaged and prone to wear and tear. Furthermore, using the incorrect strategy could give you hoarseness.

A professional voice user is an individual who uses his/her voice for livelihood.

Overuse, abuse or the misuse of voice are features of functional vocal disorders. The cause could be physiological changes brought by environmental exposure (allergies), hormonal changes, or other systemic illnesses that affects the voice, such as acid reflex disease (GERD), acute infectious laryngitis and benign vocal fold masses.

A classification system based on "vocal usage" was proposed by Kaufman & Isaacson in 1991. It consists of 4 levels. Elite vocal performers who fall under Level I include professional singers and actors for whom even a minor voice issue can have major consequences. Level II refers to professional voice users such as theologians, public speakers, lecturers, telephone operators, etc., for whom even mild vocal impairment would prohibit effective job performance. Doctors, attorneys, businesspeople, salespeople, and other professionals who would be unable to conduct their jobs effectively if they had severe dysphonia make up Level III. Even while mild or moderate dysphonia could be uncomfortable, it wouldn't prevent competent job performance. Level IV includes factory employees, labourers and clerks whose employment would not be hindered by vocal impairment.

Teachers were compared to Islamic religious officials in the study by Büyükatalay, Gökmen & Dursun (2020). They found that, like teachers, Islamic religious officials appear to be at a high risk of acquiring voice disorders. It is critical to increase awareness of the prevalence of voice problems because there is a dearth of research on the incidence of voice abnormalities among Islamic religious authorities.

Khatib is a professional voice user who is at risk of developing voice problems. A khatib / khateeb or hatib is an individual who gives the sermon at the Friday and Eid prayers in Islam. Typically, the khatib leads the prayers. The khatibs should be capable of leading the prayer and giving the discourse (khutba). Muslim khatibs perform a congregational prayer, which is offered five times a day at mosque. In three of these five prayers, the khatib must recite aloud verses from the Holy Qur'an. Each *adhan* lasts for 10-15 minutes and is performed through loudspeaker in-order to make aware people around mosque about the time of the prayer.

In addition to these verbal pleas, some khatibs also read the Khutbah during the hour of prayer (lesson taught in the mosques during weekly ceremonies usually on Fridays). Both positions are open to anyone who the mosque deems qualified, but the khatib frequently has a permanent position (part-time or all the time) (Farahat & Mesallam, 2016). A few khatibs also take religious classes in morning and evening nearly an hour for children.

Acoustic analysis is a collection of complex yet fundamental laws that regulate how sound waves are created and behaves. The application of acoustic measurements depends on their link to perceived voice quality and how much they mirror a person's regular speaking patterns. Despite being essential for identifying voice disorders, these measurements are not always reliable. Acoustic measurements provide fundamental factual information that aids in the identification and management of voice disorders.

Measurements of these variations include harmonic to noise ratio (HNR), jitter, shimmer and fundamental frequency (F0). The F0 is the voice parameter that matters the most. It reflects the vocal cords' frequency of vibration cycles per second as well as the glottis' biomechanical properties. Jitter refers to a frequency change detected within a sample of phonation that changes with strain, stiffness, and vocal fold mass. Shimmer is controlled by sub-glottal pressure and glottal resistance (Robieux, Galant, Lagier, Legou & Giovanni, 2015). The relationship between the sounds made by the vocal chords and background noise is reflected in the HNR (Brkic, Liu, Campion & Leonhard, 2022).

There is no set limit for when someone is using their voice excessively because no two voices are the same. Vocal strain can be caused by a variety of internal and environmental causes, including the volume, intensity, and tone at which you speak. Knowing how voice functions will help to comprehend some of the effects of overusing or overstraining it.

Review of Literature

Pitch, loudness, resonance, quality, and flexibility are paralinguistic characteristics of the human voice that reveal information about the speaker. Speakers change these paralinguistic to add emotion to their speech (Williamson, 2014). The air you breathe in and out creates an air stream in your trachea, which gives the voice its strength. The stronger the airstream, the louder the voice will be. When performing, it is crucial to have open passages since the vocal folds are powered by this airflow or intake. Because of this, a lot of people find it challenging to perform when they have any kind of blockage, such a cold or a cough. The primary sound generator during speech is located in the larynx. The architecture of the vocal tract further modifies voice which is a laryngeal alteration of pulmonary airflow. The voice serves as a mirror of the interior in addition to communicating language, creating music and expressing emotions. Consequently, voice is a potent weapon that not only transmits a message but also gives it additional meaning (Colton & Casper, 1996).

The mucous membrane that makes up the vocal folds is folded in two and stretched over the larynx. They can vibrate anywhere from 100 to 1000 times per second while in use to assist in obtaining a required sound. The vocal folds are exerting considerable effort to produce various sounds and tones when performing. Individual differences exist in vocal fold thickness, although generally speaking, men have thicker vocal folds than women. Everybody uses their voice differently and has different needs. A vocal issue often exists when the quality, pitch, loudness or flexibility of the voice differs from the voices of people of a comparable age, sex and cultural group.

Voice experts or professional voice users are those who depend on their voice to perform their job duties. They use their voice more frequently and intensely than non-professional voice users. Professional voice users are unaware of the anatomy and physiology underlying their vocal mechanism and are also unaware of the negative effects of poor vocal hygiene. Vocal overuse or abuse is a common practice among cheerleaders, teachers, rock singers, actors, and other people who use their voice professionally. They comprise the group

with a high risk of vocal issues.

According to pertinent legislation, vocabulary and context, definitions of work-related voice problems or vocal injuries may differ from one geographic place to another. Any speech pathologist, however, is aware of the vast number of occupational voice users including singers, stage performers, sports coaches, sales assistants, teachers, lecturers, lawyers, telephone operators, call-center employees, receptionists, priests, and medical professionals. Voice is a crucial occupational tool in today's workplace. The severe financial costs of voice abnormalities as well as their effect on social and professional identity are observed firsthand by speech pathologists. (Phyland & Miles- 2019)

In the literature and acoustic analytic applications, the fundamental frequency, jitter, shimmer and HNR are now the most utilized and frequently mentioned acoustic parameters. The frequency at which a vocal sound wave repeats within a specific time interval is known as the fundamental frequency (FO), expressed in Hertz. Additionally, it describes how many times the glottis has cycled back and forth. This frequency is within a typical range of values for the various genders and ages. These numbers are not constant, though, as FO is also used to denote prosody. In addition, it differs by sex and age and is believed to be influenced by factors like a person's mindset, the time of day that suits their lifestyle, and how they utilize their voice professionally (Teixeira, Oliveira & Lopes, 2013).

Fundamental frequency also conveys paralinguistic data such as the speaker's emotional state (McRoberts, Kennedy & Shankweiler 1995). In studies where spontaneous emotional utterances have been recorded and analyzed, both the average FO and FO range are usually higher when compared to less affectively characterized speech (e.g., Williams & Stevens, 1981). It is demonstrated that the marking of positive and negative affect by FO variation is distinct from the process of creating stress contrasts (McRoberts, Kennedy & Shankweiler 1998).

Teixeira, Oliveira & Lopes (2013), has been found that jitter and shimmer measurements of the FO have been beneficial in defining the voice qualities. While shimmer refers to changes in the sound wave's amplitude, jitter is defined as the parameter of frequency variation from cycle to cycle. These factors can be examined with a consistent voice that continuously produces a vowel. Individuals with frequent voice disorders will have higher jitter values. The majority of researchers regarded the sustained phonation in young people as having a normal value fluctuation between 0.5 and 1.0 percent. The shimmer is connected with the existence of noise emission and breathiness, and it alters with changes in glottal resistance and mass lesions on the vocal cords. For readings between 0.4 and 1 percent for children and fewer than 3 percent for adults, it is deemed pathological voice.

The HNR measures the proportion of periodic to non-periodic speech components in a segment of spoken speech. The first component results from the vocal cords vibrating, while the second is the glottal noise, measured in decibels (dB). The comparison of the two factors represents the effectiveness of speaking or more specifically, the amount of air that is

converted into vibrational energy by the vocal cords. In such circumstances, the HNR will be higher. Consequently, a voice sound is distinguished by a high HNR, which is connected to sonorant and harmonic voice. A low HNR indicates dysphonia and an asthenic voice. In other words, an HNR value of less than 7 dB is regarded as abnormal (McRoberts, Kennedy & Shankweiler 1995).

Khutba refers to several forms of address that have a ritualistic or religious component. Khatibs can conduct Islamic prayers, lead Islamic worship rituals, function as community leaders, and give religious instructions. A Khatib leads a group of 2 or more people when they pray. An appointed Khatib often delivers the Friday sermon. All mosques have Khatib to conduct the (congregational) prayers. According to Hadith (a collection of traditions containing sayings of the Prophet Muhammad which, with accounts of his daily practice (the Sunna), constitute the major source of guidance for Muslims apart from the Koran. (Definition from *Oxford Languages Dictionary*, Oxford University Press) https://www.google.com/search?q=Hadith+definition&oq=Hadith+definition&aqs=chrome..69i57.8841j0j15&sourceid=chrome&ie=UTF-8**)**, the best candidate is one who is morally upright and has a thorough grasp of the Holy Qur'an and Sunnah (the prophetic tradition). The Khatib develops the outline of his sermon using this context as a guide.

Western Studies

Sorensen & Horii (1982) studied on cigarette smoking and voice fundamental frequency and found that smokers had lower FO levels than nonsmokers.

Soltani, Ashayeri, Modarresi, Salavati & Ghomashchi (2014) analyzed fundamental frequency changes of Persian speakers across the life span and the results shown that from childhood to maturity, the mean F0 declines for both sexes.

Farahat & Mesallam (2016) studied psychosocial assessment of voice problems among Saudi imams and found significant voice-related issues were noted by 65% of imams. Pestana, Freitas & Manso (2017) compared the relevance of voice disorders in singers and discovered a considerably greater prevalence of self-perceived dysphonia among traditional and popular music singers as well as singing instructors.

Gorris, Maccarini, Vanoni & Garzaro (2020) studied on acoustic analysis of normal voice patterns in Italian adults by using PRAAT and discovered that there were statistically significant gender differences across all vocal parameters, especially for the variables associated to the FO and jitter local absolute.

Garcia, Dumitrache, & Lopez (2021) analyzed the acoustic analysis of the voice in patients with parkinson's disease and hypokinetic dysarthria and revealed that the vowel space area, intensity, F0, jitter, and shimmer all showed substantial variations.

Elsherbeny, Baz & Afsah (2022) compared the acoustic characteristics of voice and speech in Arabic-speaking stuttering children and found that children's voices and speech have noticeable variances from typical children's voices and speech.

AlBustan, Marie, Darawsheh, Natour (2022) studied on voice handicap and acoustic measures in Arab Kuwaiti prospective professional singers and discovered that the perception of voice impairment and acoustic measurements are separate characteristics that are unrelated.

Indian Studies

Sebastian, Babu, Oommen & Ballraj (2012) studied on acoustic measurements of geriatric voice and found that males and females did not differ significantly for the parameters of jitter and shimmer, only for the parameters of FO and formant frequencies (F1 and F2). For males, as fundamental frequency increases as the age also increases.

Mahato, Regmi & Bista (2018) compared acoustic analysis of voice in school teachers and found that long-term vocal abuse, overuse, or misuse in teaching practise can lead to vocal nodules or polyps or an insufficient phonatory rhythm due to tissue damage to the vocal folds.

Lathadevi, Goudar & Pundalikappa (2018) analyzed the objective acoustic analysis and comparison of normal and abnormal voices, and they demonstrated how many anomalous voice metrics, such as jitter (ddp), shimmer (dda), median pitch, and HNR measurements, differed from those of normal voices. Jitter (p-value of 0.026) and Shimmer (p-value of 0.035) were the two variables that showed significance, but HNR did not.

Gunjawate, Ravi & Bellur (2018) conducted a systematic review of the literature on the acoustic analysis of voice in singers and found that acoustic metrics including fundamental frequency, pertuburation, cepstral, spectral, dysphonia severity index, and singing power ratio were not standardised, and there was a great deal of diversity in the instruments and activities utilised.

Ambreen, Bashir & Kausar (2019) studied on the acoustic analysis of normal voice patterns in Pakistani adults and found that fundamental frequency, absolute and relative jitter, jitter period perturbation quotient, shimmer five-point amplitude perturbation quotient, and harmonics-to-noise ratio all showed significant gender differences. In all of the jitter measurements, the interaction between age and gender was significant. Women showed an increase in all of these measures during the 31–40-year age range and a decrease during the 41–50 year age range as a result of the interaction, whereas men showed opposite effect throughout both of these age groups.

Balasubramanium, Saldanha & Gunjawate (2020) studied on vocal and non-vocal habits among 37 beat boxers in India and the findings revealed that common vocal complaints during and after boxing were voice fatigue, breathing problems, and muscular stress.

Priyadharshini, Vasupradaa & Yeshoda (2021) studied on acoustic analysis of voice of temple priests and reveled that compared to other groups of professional voice users, it was discovered that the mean frequency range and disruptions were significantly larger.

Munjal, Sharma & Chhabra (2021) studied on perceptual, aerodynamic and acoustic

evaluation of vocal characteristics in subjects with obesity. And discovered the obese group had higher levels of basic frequency tremor and normalized noise energy with considerably shorter maximum phonation time and expiratory reserve volume.

Narasimhan & Gowda (2022) studied on multiparametric analysis of voice following prolonged voice use and voice rest in teachers and discovered that there were substantial differences between the three conditions for fundamental frequency, jitter, shimmer, harmonic to noise ratio, and smoothened cepstral peak prominence. Only three characteristics correctly classified 98.3% of the samples between the three situations, according to the discriminant analysis.

Nussbaum, Schirmer & Schweinberger (2022) studied on contributions of fundamental frequency and timbre to vocal emotion perception and their electrophysiological correlates and found that the relative contributions of timbre and F0 to vocal emotion processing differ depending on the emotional category, with timbre being more significant for pleasure and F0 being more significant for happy, afraid and sad expressions.

Balasubramanium, Jacob, Susan, Krishnamurthy & Rahul (2022) studied on acoustic and perceptual changes in voice during pregnancy and found these value is sensitive to vocal deviations in both pregnant women and professional voice users, who are more susceptible to voice changes or disorders because of their frequent use of the voice.

Elangovan, Paul & Kumaraswamy (2022) studied on aerodynamic and acoustical analysis of adults and geriatrics and they indicated that fundamental frequency increases from adult to geriatrics.

Method

Aim

The aim of the present study was to analyze the acoustic features of male khatibs by comparing the voice parameters (fundamental frequency, jitter, shimmer and harmonic to noise ratio) of /a/, /i/ and /u/ and based on the years of experience between the 2 interval groups: below 20 (including 20) years and above 20 years.

Participants with Inclusion and Exclusion Criteria

Participants were 22 experienced Malayalam speaking khatibs in the age range of 20-70 years. Khatibs who have been preaching for at-least 3years from now and with absent history of speech, language, hearing, and other medical problems were selected.

Equipment

Software PRAAT (Patchogue Rotatory Animal Assisted Therapy, Version 6.2.14) was used to analyze the acoustic characteristics. It is used to measure fundamental frequency, jitter, shimmer and HNR.

Procedure

A standard laptop with a in-built microphone was used. The subjects were comfortably seated, and recordings were made through a microphone in a quiet environment. The microphone of the laptop was placed at about 3inches from the mouth of the subjects for audio recordings and subjects were asked to take a deep breath and phonate /a/, /i/,/u/ as long as possible at a comfortable pitch level. The illustration of the procedure was shown by the clinician before the actual procedure.

The selected voice parameters (fundamental frequency, jitter, shimmer, HNR) are compared with the years of experience and are statistically analyzed.

Analysis

The collected data was subjected to statistical analysis to determine the significant differences across /a/,/i/ and /u/ by ANOVA test and t-test was performed for comparison with 2 groups on the basis of years of experience.

Result

The present study was to obtain acoustic voice data of khatibs who are one among the prominent group with risk of voice abuse. The aim of the study was to compare the acoustic characteristics of khatibs based on:

(i) Evaluating the acoustical features of male khatibs by the different voice parameters (fundamental frequency, jitter, shimmer and HNR) of /a/, /i/ and /u/.

(ii) Comparing the year of experience between 2 interval groups: below 20(including 20) years and above 20 years with the same parameters of /a/, /i/ and /u/.

Comparison among male Khatib

Table 1:*Showing comparison of /a/,/i/ and /u/ of fundamental frequency, jitter, shimmer and HNR of male khatibs.*

Vowel sound			N	Mean	Std. Deviation	95% Confidence Interval for Mean		Repeated measures ANOVA -p value	
						Lower Bound	Upper Bound		
F0	> 20 Y	/a/	12	164.00	15.13	154.39	173.61	0.714	NS
		/i/	12	167.08	13.49	158.51	175.65		
		/u/	13	161.31	22.13	147.93	174.68		
	<= 20 Y	/a/	12	131.00	24.61	115.36	146.64	0.793	NS
		/i/	12	134.08	26.99	116.93	151.23		
		/u/	11	138.27	24.80	121.61	154.93		
	Total	/a/	24	147.50	26.14	136.46	158.54	0.890	NS
		/i/	24	150.58	26.82	139.26	161.91		
		/u/	24	150.75	25.70	139.90	161.60		

Jitter	> 20 Y	/a/	12	0.78	0.41	0.52	1.04	0.835	NS
		/i/	12	0.88	0.46	0.59	1.17		
		/u/	13	0.80	0.45	0.53	1.07		
	<= 20 Y	/a/	12	0.65	0.50	0.33	0.96	0.440	NS
		/i/	12	0.61	0.43	0.34	0.89		
		/u/	11	0.44	0.25	0.27	0.61		
	Total	/a/	24	0.71	0.45	0.52	0.90	0.664	NS
		/i/	24	0.75	0.46	0.55	0.94		
		/u/	24	0.63	0.41	0.46	0.81		
Shimmer	> 20 Y	/a/	12	0.95	0.40	0.69	1.20	0.919	NS
		/i/	12	1.02	0.39	0.77	1.26		
		/u/	13	0.97	0.50	0.67	1.28		
	<=20 Y	/a/	12	1.18	0.36	0.95	1.41	0.253	NS
		/i/	12	1.20	0.46	0.91	1.49		
		/u/	11	0.95	0.31	0.75	1.16		
	Total	/a/	24	1.06	0.39	0.90	1.23	0.466	NS
		/i/	24	1.11	0.43	0.93	1.29		
		/u/	24	0.97	0.42	0.79	1.14		
HNR	>20 Y	/a/	12	14.67	2.10	13.33	16.00	0.664	NS
		/i/	12	15.25	1.14	14.53	15.97		
		/u/	13	15.23	1.96	14.04	16.42		
	<= 20 Y	/a/	12	13.75	1.29	12.93	14.57	0.580	NS
		/i/	12	13.83	1.80	12.69	14.98		
		/u/	11	14.36	1.36	13.45	15.28		
	Total	/a/	24	14.21	1.77	13.46	14.96	0.455	NS
		/i/	24	14.54	1.64	13.85	15.23		
		/u/	24	14.83	1.74	14.10	15.57		

The above table 1 shows no significant differences in all parameters (FO, jitter, shimmer and HNR) of /a/, /i/ and /u/.

Comparison with Experience

Table 2*: Showing comparison of /a/,/i/ and /u/ of fundamental frequency, jitter, shimmer and HNR of male khatibs based on the below and above 20years of experience.*

Vowel sound			N	Mean	Std. Deviation	95% Confidence Interval for Mean		t test p value	
						Lower Bound	Upper Bound		
F0	/a/	> 20 Y	12	164.00	15.13	154.39	173.61	0.001	Sig
		<= 20 Y	12	131.00	24.61	115.36	146.64		

		Total	24	147.50	26.14	136.46	158.54		
	/i/	> 20 Y	12	167.08	13.49	158.51	175.65		
		<= 20 Y	12	134.08	26.99	116.93	151.23	0.001	Sig
		Total	24	150.58	26.82	139.26	161.91		
	/u/	> 20 Y	13	161.31	22.13	147.93	174.68		
		<= 20 Y	11	138.27	24.80	121.61	154.93	0.025	Sig
		Total	24	150.75	25.70	139.90	161.60		
Jitter	/a/	> 20 Y	12	0.78	0.41	0.52	1.04		
		<= 20 Y	12	0.65	0.50	0.33	0.96	0.483	NS
		Total	24	0.71	0.45	0.52	0.90		
	/i/	> 20 Y	12	0.88	0.46	0.59	1.17		
		<=20 Y	12	0.61	0.43	0.34	0.89	0.153	NS
		Total	24	0.75	0.46	0.55	0.94		
	/u/	> 20 Y	13	0.80	0.45	0.53	1.07		
		<=20 Y	11	0.44	0.25	0.27	0.61	0.026	Sig
		Total	24	0.63	0.41	0.46	0.81		
Shimmer	/a/	> 20 Y	12	0.95	0.40	0.69	1.20		
		<= 20 Y	12	1.18	0.36	0.95	1.41	0.139	NS
		Total	24	1.06	0.39	0.90	1.23		
	/i/	> 20 Y	12	1.02	0.39	0.77	1.26		
		<= 20 Y	12	1.20	0.46	0.91	1.49	0.307	NS
		Total	24	1.11	0.43	0.93	1.29		
	/u/	> 20 Y	13	0.97	0.50	0.67	1.28		
		<= 20 Y	11	0.95	0.31	0.75	1.16	0.913	NS
		Total	24	0.97	0.42	0.79	1.14		
HNR	/a/	>20 Y	12	14.67	2.10	13.33	16.00	0.211	NS

		<=20 Y	12	13.75	1.29	12.93	14.57		
		Total	24	14.21	1.77	13.46	14.96		
	/i/	>20 Y	12	15.25	1.14	14.53	15.97		
		<=20 Y	12	13.83	1.80	12.69	14.98	0.031	Sig
		Total	24	14.54	1.64	13.85	15.23		
	/u/	>20 Y	13	15.23	1.96	14.04	16.42		
		<= 20 Y	11	14.36	1.36	13.45	15.28	0.231	NS
		Total	24	14.83	1.74	14.10	15.57		

The above table shows that significant differences were obtained in fundamental frequency (P=0.001). Also, significant differences were observed in jitter of /u/ and HNR of /i/.

Fundamental frequency

Table 3: *Showing fundamental frequency of /a/,/i/ and /u/ of male khatibs based on the year of experience.*

		<20 Y	<=20 Y	Total
F0	/a/	164.00	131.00	147.50
	/i/	167.08	134.08	150.58
	/u/	161.31	138.27	150.75

The above table 3 shows the mean value of fundamental frequency for /a/ is 164 for above 20 years of experience and 131 for below 20 years of experience which means that the total value is 147.The parameter /i/ shows value of 167 for above 20 years of experience whereas 134 for below 20years of experience and the total value is 150.58. At the same time, the fundamental frequency value of /u/ is 161 for participants above 20 years of experience and 138 for below 20years of experience, with the total value of 150.75.

Fig 1: *This figure represents the graphical representation showing fundamental frequency of /a/, /i/ and /u/ of male khatibs based on the year of experience.*

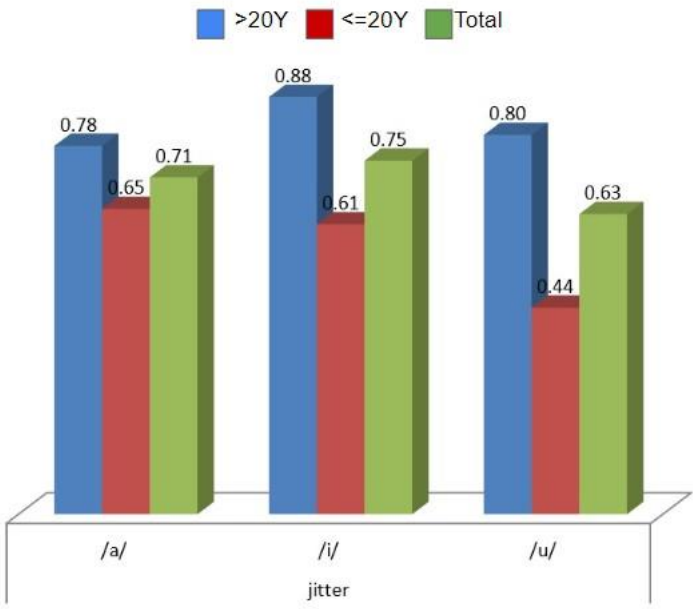
Jitter:

Table 4*: Showing jitter of /a/,/i/ and /u/ of male khatibs based on the year of experience.*

		<20 Y	<=20 Y	Total
Jitter	/a/	0.78	0.65	0.71
	/i/	0.88	0.61	0.75
	/u/	0.80	0.44	0.63

The above table 4 shows the mean value of jitter for /a/ is 0.78 among the participants above 20 years of experience and .65 for below 20years of experience. The table also shows that the value of parameter /i/ is .88 for above 20years of experience and .61 for below 20years of experience. The value of /u/ is 0.80 for participants with above 20years of experience and 0.44 for below 20 years of experience.

Figure 2: S*howing graphical representation of jitter of /a/,/i/ and /u/ of male khatibs based on the year of experience.*



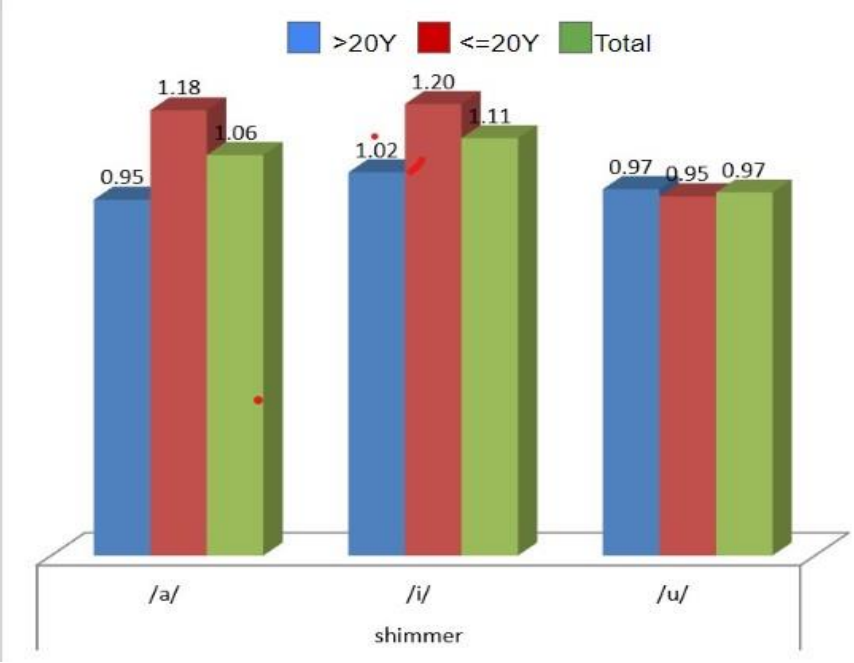
Shimmer:

Table 5: *Showing shimmer of /a/,/i/ and /u/ of male khatibs based on the year of experience.*

		<=20 Y	> 20 Y	Total
shimmer	/a/	0.95	1.18	1.06
	/i/	1.02	1.20	1.11
	/u/	0.97	0.95	0.97

The above table 5 shows the value of shimmer shows 0 .95 for /a/ parameter in participants below 20 years of experience and 1.18 for participants above 20years of experience with the total value of 1.06 The value for /i/ is 1.02 for below 20 years of experience and value is 1.2 for above 20years of experience. With the total mean 1.11. It also shows that /u/ parameter provides value of .97 for below 20years of experience and .95 for above 20years of experience with total value of .97.

Figure 3: *Showing graphical representation of shimmer of /a/,/i/ and /u/ of male khatibs based on the year of experience.*



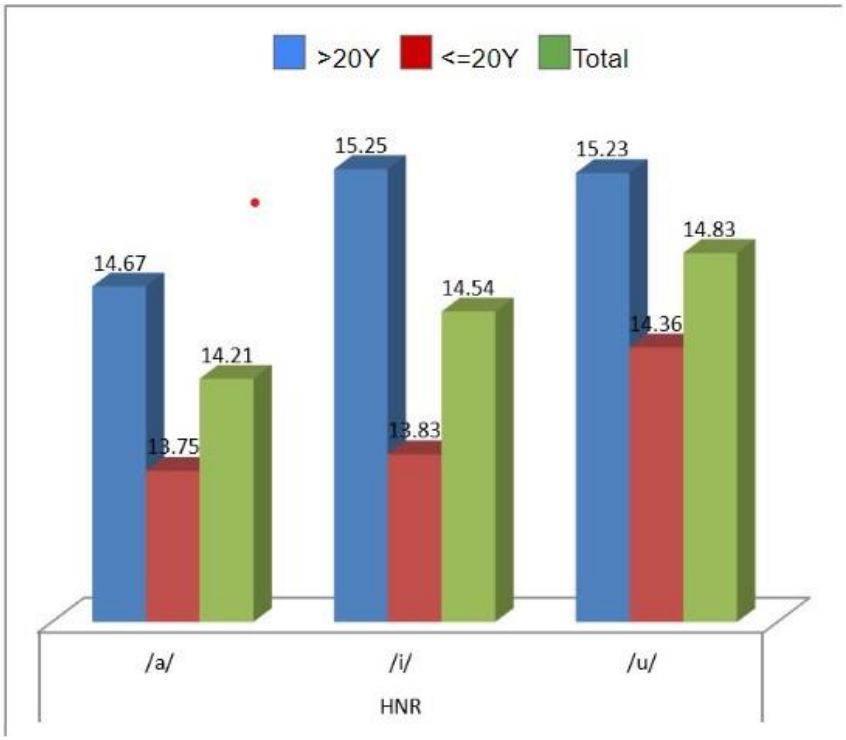
HNR:

Table 6: *Shows the graphical representation of HNR of /a/,/i/ and /u/ of male khatibs based on the year of experience.*

		<=20 Y	> 20 Y	Total
HNR	/a/	14.67	13.75	14.21
	/i/	15.25	13.83	14.54
	/u/	15.23	14.36	14.83

The above table 6 shows that the mean frequency of HNR value for the vowel /a/ in subjects with 20 years of experience or less is 14.67, and in those with more than 20years of experience is 13.75 for the same. For the vowel /i/, the HNR value for subjects with 20 years or less experience is 15.25, and that of subjects with more than 20 years of experience is 13.83. Similarly, the HNR value of vowel /u/ in subjects with 20 years or less experience is 15.23. In the same way, participants having more than 20 years of experience, obtained HNR value of 14.36 for the same vowel /u/.

Fig 4 *Showing graphical representation of HNR of /a/,/i/ and /u/ of male khatibs based on the year of experience.*



DISCUSSION

The result of the present study indicated no differences among the acoustic parameters on phonation of /a/,/i/ and /u/. Philip & Kumaraswamy (2013) reported that there were no differences observed in any of the parameters (fundamental frequency, jitter, shimmer, HNR and SNR) after continuous hours of preaching.

Also, when acoustic parameters were observed on the basis of years of experience, it showed that there were variations only in fundamental frequency, jitter and HNR. The result obtained showed an increase in fundamental frequency, jitter and HNR as the years of experience increased which correlated with the results obtained from the investigations by Elangovan, Paul & Kumaraswamy (2022) and Sebastian, Babu, Oommen & Ballraj (2012). Priyadharshini, Vasupradaa & Yeshoda (2020) found that temple priests had considerably larger mean frequency ranges and perturbations than other groups of professional voice users.

All these changes were significantly greater in older adults than in younger adults. Even though the acoustic measures are typical when compared to the pathological measures might be because of appropriate voice rest and adequate amount of intake of water taken into consideration by all Khatibs. The informal analysis of phonation also showed voice breaks and inadequate breath while phonating. These kinds of estimations were not found in the acoustic characteristics.

The end result provides a brief conclusion that a higher number of variations are observed in fundamental frequency, jitter and HNR on the basis of years of experience whereas no differences were observed on the phonation of /a/, /i/ and /u/. These acoustic measures were maintained with appropriate voice rest as well as hydration among the khatibs.

Summary & Conclusion

Voice is a strong, useful and creative communication instrument. Voice helps in detecting subtle emotional undertones and complex scholarly concepts. However, the voice is the main tool via which a person's personality is portrayed and their fellow countrymen are impacted (Satalofff, 2006). Voice has been of major use by all professionals including the Khatib. Khatibs are the one who frequently use their voice for prayers as well as for religious classes.

The study was to analysis the acoustic characteristics among male Khatibs. The study was carried out among 22 male khatibs in which 11 of them had experience of less than 20 years and 11 of them with experience of more than 20 years. The participants were asked to relax in-order to take a deep breath. They were asked to phonate /a/, /i/, /u/ for about 5 seconds. The recording was carried out using PRAAT software and the analysis was done on features including fundamental frequency, jitter, shimmer and HNR. The statistical analyses for the obtained recordings were carried out using ANOVA and t test. The result shows slight variation in fundamental frequency, jitter and shimmer when analysed between the Khatib with more than 20 years of experience and also with less than 20 years of experience. All acoustic parameters did not show any differences whereas on the basis of year sof experience, differences were observed in the parameters like fundamental frequency, jitter and HNR.

When comparing the acoustic characteristic of khatibs with other professionals, it was found that all these professionals including teachers, singers and even khatibs face problems in vocal variation showing changes in voice characteristics and less vocal strain was observed even though there is more use of voice. Therefore, it's important for all these professionals to be aware of the vocal hygiene tips that help in the voice variation and to accelerate these tips as a management once they are in their working age.

Implication of the Study

1. This gives an idea for the khatibs to seek intervention for their voice using different options including vocal hygiene tips.
2. This study provides an awareness to reduce the vocal strain for the khatibs.

Limitations of the Study

1. Limited sample size.
2. Limited acoustic parameters (only FO, jitter, shimmer and HNR).
3. The effect of smoking and alcohol consumption in the khatibs is not taken into consideration.
4. The study was limited based on age and years of experience.

Further Recommendations

1. More acoustic parameters can be included in the study.
2. Comparison of acoustic characteristics with perceptual characteristics can be analysed. Analysis of MPD and S/Z ratio can be considered for further studies.

3. Further study can be emphasised based on the working hours.

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