

VOICE CHANGES IN BUS CONDUCTORS

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A Dissertation Submitted in Part Fulfilment for the Degree of
Master of Science (Speech -Language Pathology)

University of Mysore, Mysore



ALL INDIA INSTITUTE OF SPEECH AND HEARING

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MAY, 2014

CERTIFICATE

This is to certify that this dissertation entitled “**Voice Changes in Bus Conductors**” is a bonafide work submitted in part fulfilment for the Degree of Master of Science (Speech-Language Pathology) of the student (Registration No: 12SLP008). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier for the award of any other Diploma or Degree to any other University.

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CERTIFICATE

This is to certify that this dissertation entitled “**Voice Changes in Bus Conductors**” has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier for the award of any Diploma or Degree to any other University.

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DECLARATION

This is to certify that this dissertation entitled “**Voice Changes in Bus Conductors**” is the result of my own study under the guidance of Dr. Jayakumar T., Lecturer, Department of Speech Language Sciences, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier for the award of any Diploma or Degree to any other University.

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DEDICATED TO



TO MY BEST FRIEND SUPIN DAS



TO MY



TO ALL BUS CONDUCTORS

INTRODUCTION

Voice is the sound produced by the vibration of true vocal folds, which are situated in the larynx. Voice of an individual tells the listeners about their personality, educational background, social status, health and mental alertness. Any deterioration in the phenomenon of voice production at the anatomical or physiological level leads to voice changes, which can be due injury and vocal abusive behaviours. Commonly occurring voice changes are associated with voice abuse, which are more prominent in adult population. There are certain professions which demands prominent use of voice they includes teaching, singing, acting, nursing, telemarketing, customer servicing etc. Vocal fatigue is reported to be the most common voice problem in professional voice users such as singers, actors and radio/television personalities (koufman and Blalock, 1988).

Voice problems or disorders are multidimensional phenomena that are usually understood to include a self-perceived reduction in physical, social, emotional, or professional well-being due to voice. The problems of voice can be labeled as occupational voice disorders, if the symptoms are caused by work exposure. Main risk factors of professional voice users include background noise, unsatisfactory acoustics, large speaking distance, poor quality of air (like dryness, dust etc.), unfavorable working posture, and vocal loading from speaking or singing. The prolonged use of voice led to the introduction of vocal loading. It can be measured in terms of intensity and time; the louder and longer a person is talking, the greater will be the strain on the voice and vocal capacity more needed.

Human voice is produced by a combined functioning of anatomical structures, physiological mechanisms, and acoustic output, which are unique to each individual. Person's voice habits are influenced by the factors of psychological and personality like stress and anxiety. Whenever the laryngeal mechanism fails to meet the vocal functioning needs of a speaker, it starts lead to abnormality of larynx which causes the voice disorder. Measures like structural, psychological, audio-perceptual and acoustic analyses helps to measure the voice disorders. In addition speakers can be ask to score their voice symptoms subjectively to examine the voice symptoms. Because of voice is the main tool of trade in many professions ,occupational voice research become an important area of interest of speech science and in recent years they mainly studied effects of vocal loading. There are studies already been done in the voice parameters of teachers, singers, nurses, customer care advisors, telemarketers, and actors. But, Very few studies found in the voice of bus conductors.

Bus conductors especially in India have prone to have voice disorder due their nature of work. Bus conductors have a range of responsibilities, which include collecting fares, issuing tickets, helping passengers with baggage, advising on destinations and ensuring the safety of passengers. In western countries issuing tickets will be done by the machines and the bus driver will manage the passengers. In India buses will be crowded with more people compare to the Western countries and the bus conductors have to manage issuing tickets, collecting money, signaling driver etc. Also the Conductors used to get commissions for the collection of money

from passengers; hence they will put more effort to collect the passengers from bus stands by shouting and calling the destination name.

Bus conductors have to shout or loudly name the destination and speak to illiterate or older passengers who were only competent in regional language. Poor maintenance of vehicle can cause the generation of high level noise from the engine. This will again make the bus conductors to speak in loud voice in noise back ground because of Lombard effect. There general the rate of abuse of voice in privet bus conductors seems to be increased because of the of their work demands. So a study done in this particular population will help this group to be aware about the voice care and better use of voice in future.

Objective of this study of study lies on three domains. 1) To find out the voice changes in bus conductors before and after their work load.2) To find the awareness level in bus conductor about the voice and its care. 3) To find the importance of voice in their occupation by self report.

REVIEW OF LITERATURE

Communication is the way of life for present world. Speech is the chief medium of communication and social adaptation. What we are, what we do and what we decide to do are accomplished majorly through speech. Human beings able to speak because of having a set of organs that are capable of being modified and adapted for the function of speech and accompanied by highly developed nervous system. Voice is the basic source for the speech production. Vibration of the vocal cords in the human larynx results in the production of voice. The organ called larynx is important structure for the voice production. For the voice production Power produced from the lungs, tightening of the crico-arytenoids & inter-arytenoid muscle, tension and thickness of the vocal folds are the important physiological factors for the production of voice. The pitch of the voice is determined by the frequency with which the vocal folds. Hence the vocal system has to work with full force for the production of voice or speech. Many people have to use their voice or speech for the purpose of livelihood. The income of those people is depends on the hours of voice usage e.g venders, bus conductors etc.

An occupational or professional voice user is anyone whose voice is essential to their job. Singers, actors, actresses, and broadcast personalities are require special or unique qualities of the voice are often the essential feature of their careers. But teachers, salespeople, bus conductors, courtroom attorneys, telemarketers, and receptionists are also people for whom spoken communication is an essential part of what they do, and there are countless other professions that rely heavily on the voice.

These people demand on their vocal system or the larynx is much more compared to general public. Professional voice user have higher incidence and increased risk of voice disorders (Epstein, Remacle & Morsomme, 2011)

Vocal load is the amount of work done by the laryngeal mechanism over a time. (Morrow & Connor 2011). It is one of the major causes for development of voice disorders. It can be measured by change in the voice quality by perceptually by the experts or objective voice parameters like fundamental related measures, amplitude related measures, perturbation related measure and noise related measure can be used. Many studies have been done on various professional voice users. However, very few studies were done on bus conductors or the public transporters.

Newman, Kersner (1998) surveyed a group of 110 instructors and a self completion questionnaire was used to gather information voice use, voice problems and symptoms, voice care and training, and the professional implications of voice problems of aerobics instructors regarding. The completion of the questionnaire reveals the results that 48 participants showed voice symptoms of dryness, hoarseness, pitch changes, discomfort, vocal fatigue and throat-clearing. Described other symptoms were sore throat, increased mucus production and irritation in the throat. More alarming finding of the survey was the frequent reporting of permanent voice changes. 60% of the instructors reported the permanent changes like increased hoarseness, lower pitch, weaker voice and more vocal discomfort. Other includes changes were reduced range of singing voice, lack of power, frequent laryngitis and bad voice in the morning.

Instructors worked more than six years were more likely to report a history of voice problems than those who had worked for shorter periods. Voice problems were also associated with reported levels of tension or stress; those with higher tension levels were more likely to have experienced voice problems than those with lower than average levels of tension. No significant relations were found between voice problems and age, other occupations, number of consecutive classes, medication, and frequency of coughs: colds, or use of amplification. Implication of Smoking, allergies and lack of water intake during classes also have had reported.

Manoj (1998) studied the similarities and differences of voice parameters in normal and stage actors. In the study, compared the acoustic parameters like average fundamental frequency, standard deviation of fundamental frequency, fundamental frequency tremor, pitch perturbation quotient, smoothed pitched perturbation quotient, fundamental frequency variation, shimmer percentage, jitter percentage, noise to harmonic ratio. A total of 30 normal at the age of 25-30 years taken as control group and a total of actors at the age of 25-30 years including both females and males were considered for the study. Acoustic analysis was carried out by using the MDVP-software. Results showed that there is a difference in the fundamental frequency, standard fundamental frequency, Amplitude perturbation quotient, smoothed pitch perturbation quotient between the two groups. Sala, Laine, Simberg, Pentti, & Suopaa (2001) studied 145 day care teachers. Results shows that voice disorders more frequently occurring among day care teachers than control group subjects, and the main cause for this was identified as the higher vocal loading among these group than among the control group subjects.

Jones et. al., (2002) research showed an increased rate of occurrence of voice problems in telemarketers compared to general population ,this also revealed the problem have negative effects in productivity. Another study was done on call center customer service advisers by Lehto, Rantala, Vilkinen & Alku (2005) showed an increase in the voice symptoms of call center operators during the working day prior to the short term vocal training. Most symptoms in both male and female subjects were hoarseness, a feeling of strain and mucus in the throat and dryness in the throat. This study investigated that both the short- term and the long – term effects of the short training course will have appositive effect on the symptoms of persons who are working in vocally demanding situations.

Neill & Mcmenamin (2013) studied voice changes in soccer management, and their study describes the professional soccer manager's daily experiences of voice use through the qualitative methods. The data of the study gathered through semi –structured interviews with each participant and identified voice uses, factors affecting the voice change, impact of voice use, importance of voice use in soccer management. Results mainly suggested that the risk factors of voice disorders includes prolonged and intense voice use in environment like poor phonation method and adverse acoustic properties of speaker. Example: Environmental factors such as background noise distance between speaker and listener during training and matches pose adverse weather conditions vocally abusive behaviors like shouting. Kalaiselvi & Jayaram (2006) done a study regarding the analysis of voice in yakshagana folks artists. A group of 60 yakshagana artists in the age of 21-37 years were compare with a normative group of 30 subjects (mean age 31.4years).

Samples were collected by recording the phonation of /a/ sound and spontaneous speech using digital voice recorder. Acoustic analysis of speech samples was done using Vaghmi – software. They estimated the frequency related measures like F0 (fundamental frequency), SF0 (speaking fundamental frequency), FR (frequency range), Jitter, EFF (Extent of frequency fluctuation), SFF (Speed of frequency fluctuation) and intensity related measures like IR (intensity range in phonation) shimmer, Extent and speed of intensity fluctuation. Results of the study indicated that yakshgana artists complaints the symptoms like vocal fatigue, change in voice quality, voice breaks, irritation/dryness in the throat, pain /burning sensation in the throat and loss of pitch range. Results of the comparative study shows that the yakshgana artists were showed differences in all measures compare to the normal, except fundamental frequency and speed and extent of intensity fluctuation.

Assuncao, Jardim & Medeiros (2013) conducted study regarding the prevalence of voice complaints among bus transport workers in a metropolitan area in Brazil. This study tried to examine whether the occupational and socio-demographic factors were related with the results. This was actually a part of one large study which investigating the health of drivers and conductors of urban transportation and the working conditions. Total 1,607 participants were investigated by conducting a face to face interview, using digital questionnaire, applied by the interviewer using a note book. The questions include as follows 1) over the last two weeks? Have you felt tired when speaking?, (no/sometimes/every day. 2) over the last two weeks, have you noticed any worsening of your voice quality? (no/sometimes/everyday). Socio-demographic, lifestyle, occupational characteristics and health situation data were gathered.

The results showed that the prevalence rate of 24% drivers, 34% for conductors and overall prevalence found was 29%. Results showed that the exposure to vibration and thermal discomfort have a positive association with the function of conductors. The usage of voice in a quiet and the noise condition has the significant on the vocal lode of the individuals. Rantala, Lindholm & Vilkman (1998) the study aims to compare the F0 values recorded in a laboratory with recordings made in a working environment. The subjects included in this study were three female teachers with mean age of 34 years with a healthy larynx. The recording of subject's speech samples were carried out in a laboratory which focused on loading task of 45-min, using SPL/75 dB microphone 1m from mouth. Recording of samples at school included only the first and last sessions of one working day. Results showed that F0 rose in both the conditions and F0 was higher under field conditions than the laboratory. But changes during the Loading tasks were observed as not linear.

Smith et al. (1997) studied the impact of voice problems on quality of life. A self report questionnaire based survey was carried out in 174 treatment seeking adults. Another group of 173 non –treatment seeking adults were taken as control group. The designed questionnaire elicited demographic information as well as about voice symptoms and impacts of voice problems on various functioning. As per result 53-49% of patients felt that the voice problem negatively effect their past and present work abilities. 76% of patients felt that voice problem would negatively affect future work function. 75% of patients reported that voice problem negatively affected social interactions which led to social isolation.

Majority of the patients described moderate or worse depression and worse negative professional self-esteem because of voice problems. They also felt that the voice disorders not only affected the voice quality but it also compromised intelligibility. 65% of patients felt that moderate or worse communication difficulties present in background noise, and another 58% reported moderate or worse problems with telephone conversations. The overall findings indicated greater functioning problems due to voice in treatment –seeking group compared with control group.

The above mentioned studies were done in the professional who are more prone to get voice disorders due to their occupation, similarly the bus conductors are one such group who need to be investigated on voice problems especially in Indian condition. In western countries issuing tickets will be done by the machines and the bus driver will manage the passengers. In India buses will be crowded with more people compare to the Western countries and the bus conductors have to manage issuing tickets, collecting money, signaling driver etc. Conductors also get commissions for the collection of money from passengers; hence they will put more effort to collect the passengers from bus stands by shouting and calling the destination name. Bus conductors have to shout or loudly name the destination and speak to illiterate or older passengers who were only competent in regional language. Poor maintenance of vehicle can cause the generation of high level noise from the engine. This will again make the bus conductors to speak in loud voice in noise back ground because of Lombard effect.

There general the rate of abuse of voice in privet bus conductors seems to be increased because of the of their work demands. So a study done in this particular population will help this group to be aware about the voice care and better use of voice in future.

Objective of this study of study lies on three domains. 1) To measure the voice changes in bus conductors before and after their work load. 2) To find the awareness level in bus conductor about the voice and its care. 3) To find the importance of voice in their occupation by self report.

METHOD

Participants:

A total of 25 male participants who had minimum of 5 year experience as bus conductor were enrolled in this study. All participants are working as privet bus conductors in the Ernakulum districts of Kerala state. All of them were in the age range 23-37 years and also native speaker of Malayalam. Participants who are suffering from upper respiratory tract infection during recording, chronic smoking, alcohol drinking and using tobacco user were excluded from the study.

Procedure:

A written consent was taken from all participants before gathering any kind of information. The study was carried out in three different 3 phases. In the first phase the questionnaire was administered to participants. The second phase involves the self-rating of the Voice Handicap Index (VHI) and followed by last phase which was of the recording of the phonation and the speech sample.

Phase I - Questionnaire

During the first phase questionnaire was administered to participants before starting of their work on that particular day. The major information or questions were taken from the questionnaire developed by Koul & Yeshoda (2005). The modified questionnaire suites the needs of conductors to know their awareness and knowledge regarding the voice and voice care (Appendix). This questionnaire had 32 questions which gathering of information regarding Socio-demographic data, life style, vocal habits and symptoms exhibited.

The questionnaire had three sections: section A had questions related life style and the answers were collected in the descriptive manner, section B had questions regarding vocal habits which was rated in 4 point scale and section C had vocal symptoms exhibited which was rated in 4 point scale. The participants were seated comfortably before the data collection. The questions were presented in Malayalam and in English. The questionnaire was filled by the participants themselves. Few of participants taken help from researcher. Only section B & C was subjected for the statistical analysis.

Phase II - Voice Handicap Index (VHI)

In the second phase, all participants were asked to fill the Voice Handicap Index questioner (VHI-30). The VHI-30 was translated and published in Malayalam by Menon, sheejamol and Cherian, 2012 (Appendix). As it was self-rating questionnaire the researcher did not offer much help for the participants

Phase III – Phonation and Speech recording

In the third phase phonation and speech recording was carry out. This also was done before the bus conductors begin the work for that particular day. The instrument used for recording was Olympus (PM-100 linear PCM recorder), a digital audio recorder. It had high quality stereo microphone which had frequency response of 40Hz to 18KHz. The recording was done on stereo mode, 44KHZ sampling rate at 16 bit rate. Recording was carried out in a relatively less noise environment. Before starting of the recording each participant was seated in a relaxed position and kept the recorder about 10cm centimeters apart from the participants' mouth.

All of them were asked to phonate vowel /a/, /i/ & /u/ as longest as possible without discontinuing. Before the actual recording demonstration trail was given for all the people. After the phonation task participants were asked to read a standard Malayalam passage which consist of approximately 100 words. After reading task, they were indulged in a general conversation or conversation about an area of their interest which was last for 2 minutes. Once the initial recording was done the conductors started their work and the working period was ensured as 7-8 hours. After their working period, immediately the post recording was done in the similar way of prerecording. Later the recorded samples were transferred to computer for the further analysis.

Data Analysis

The data collected from phase I and II was entered in the SPSS software for further analysis. The recorded sample was subjected for perceptual and instrumental analyses for all the 25 participants.

Perceptual Analysis: Perceptual analysis was carried out using Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V). The phonation, reading and speech sample was used as stimuli for CAPE-V analysis. The pre recording and the post recordings were randomized. Total of three speech, language pathologists were rate each samples of Pre and post recordings using score sheets. CAPE-V rate the overall severity of voice as well as the severity of roughness, breathiness, strain, pitch and loudness abnormalities using Severity scale of mild, moderate and severity and percentage scores.

Objective analyses: Instrumental analyses were carried out using CSL (computerized speech lab), Model 6500, KAYPENTAX, NY) Multi-dimensional voice profile (MDVP) sub module software.

In order to exclude irregularities associated with the onset and off set of phonation, the most stable 5 s of the mid-vowel /a/ segment was chosen by the clinician and subjected for MDVP analysis. This procedure was repeated for all the phonation samples. The parameters estimated from the MDVP are as follows: Average fundamental frequency (F0), Standard deviation of F0 (STD), Fundamental frequency tremor (Fftr), Jitter percentage (jitt), Pitch perturbation quotient (PPQ), Smoothed pitch perturbation quotient (sPPQ), Fundamental frequency variation (vFo), Shimmer percentage (Shim), Amplitude perturbation quotient (APQ), Smoothed amplitude perturbation quotient (sAPQ), Noise to harmonic ratio (NHR), Voice turbulence index (VTI) and Soft phonation index (SPI). Initially all the prerecording samples was analyzed using MDVP software. Later using the same procedure the post sample were analyzed.

Statistical Analysis: The statistical analyses for comparison of pre recording and the post recording were done with SPSS (version 17) - software. Paired sample t-test was used to compare. For the reliability, Cronbach's Alpha test was used.

RESULTS

The purpose of the study was to investigate the difference in the parameters voice before and after the working periods of the Indian bus conductors. Also, to understand their awareness level about the voice problem and the amount of impact of the voice problem in their daily life. The present study had a three phases. Hence, the results were presented in the similar way.

Results of Phase I

The questionnaire had 32 questions which were divided in to three sections: section A had questions related to life style, section B had questions regarding vocal habits and section C was related to vocal symptoms. Section A had descriptive answers and Section B & C had 4 point rating scale. Mean and SD of the questionnaire was presented in the appendix –I.

Section A result showed are as follows: (a) three individual felt the change in the voice quality after they had taken up the job (b) the group mean average year of experiences was 11.6 years (c) The average period of the working hours was 9-10 hours a day (d) 11 individual felt the presence of voice symptoms at the end the their working periods. The voice symptom includes strain, dryness and fatigue (e) only 14 individual felt that they are working in the noisy environment.

Section B results calculated as percentage for the each question separately, the table 1 shows percentage for each score for the different questions in the section B.

Table 1: Percentage of scores for the different questions in the section B

Questions	Percentage of score		
	Score '0'	Score '1'	Score '2'
Do you indulge in long continuous chat	20.8	66.7	12.5
Do you eat spicy or hot food	16.7	75	8.3
Do you live in noisy environment	87.5	12.5	-
Do you live in dusty environment	100	-	-
Do you smoke	33.3	54.2	12.5
Do you consume alcohol	29.2	62.5	8.3
How many glasses of water you take per day	4.2	25	70.8
Do you indulge in loud talking	37.5	54.2	8.3
Do you indulge in screaming or shouting at work	50	50	-
Do you indulge in screaming or shouting at home	16.7	75	8.3
Do you clear your throat frequently	12.5	75	12.5

The result of table 1 shows that more than seventy five percent of the people indulge in shouting, throat clearing and consume spicy food and more than fifty percent of people frequently involve in long hours of chatting, loud talking, smoking and consumption of alcohol.

Section C results calculated as percentage for the each question separately, the table 2 shows percentage for each scores for the different questions in the section C.

Questions	Percentage of score		
	Score '0'	Score '1'	Score '2'
Does your voice tire very soon	62.5	33.3	4.2
Do you have any kind of changes in your voice before	70.8	29.2	-
Do you perceive roughness in your voice	58.3	33.3	8.3
Do you experience sensations like pain, soreness/irritation or lump in throat	66.7	29.2	4.2
Do you use any solutions/ ayurvedic solutions, salt water, mint etc to relieve your throat? Specify.	83.3	16.7	-
Do you feel that you have better voice in the mornings or evenings? Specify	54.2	45.8	--
Do you experience episodes of loss of voice/ voice breaks while speaking	75	25	-
Do you feel difficulty in raising your voice (increase the loudness	75	25	-
Do you have sensation of dryness in your throat	37.5	54.2	8.3
Do you experience acid reflux, chest pain/ heart burn	62.5	33.3	4.2
Are you allergic to AC, dust, medicine? Specify	75	20.8	4.2
Do you suffer from anxiety, mental tension or stress	20.8	37.5	37.5
Do you feel you are unnecessarily using your voice	79.2	20.8	-

The result of table 2 shows that more than fifty percent of people felt frequent dryness in the throat and more than thirty percent of the people felt vocal fatigue, and slight changes in voice quality. Also more than thirty percent of them felt that they suffer from anxiety and mental stress.

Results of Phase II

In the phase two Voice Handicap index (VHI) was administered to the all the participants to investigate the changes in the life quality due to voice problems. However out of 25 individual's four (16%) of them felt the impact of voice problem. The individual VHI-30 scores have been given in the table 3.

VHI -30	Participant 1	Participant 10	Participant 23	Participant 24
Physical (Max 50)	4	8	2	2
Functional (Max 50)	5	9	1	1
Emotional (Max 50)	1	5	1	1
Total VHI (Max 50)	10	22	4	4

Results of table 3 shows that only two individual (8%) had mild (greater than 10) handicapped due to voice problem and two others scores were not significant to considered has handicapped.

Results of Phase III

In the third phase, phonation and speech were recorded before and after the working periods. The recorded samples were subjected for perceptual (CAPE-V) and objective (MDVP) analysis.

(a) Perceptual analysis:

Inter-rater reliability was estimated using Cronbach's Alpha. Table 4 shows the Cronbach's Alpha value for pre and post recordings.

Table 4: Inter-rater reliability of CAPE-V parameters

CAPE-V	Pre –recording	Post –recording
Overall	0.668	0.542
Roughness	0.425	0.354
Breathiness	0.491	0.324
Strain	0.401	0.251
Pitch	0.352	0.354
Loudness	0.251	0.325

In the pre recorded sample the reliability was good for the overall (0.668), and average reliability (0.40-0.49) for roughness and breathiness, strain. Poor reliability (> 0.35) was found pitch and loudness. The similar trend was calculated. Results shows that all the parameters in the post recording was rated as higher than pre recording, Also the SD was more in the post recording than pre recordings. Table 5 shows mean, SD, t-value and p-value of the paired t test for CAPE-V parameters noticed in the post recording.

Table 5: Results of paired t-test of CAPE-V parameters for pre and post recordings

CAPE-V	Pre –recording		Post –recording		t -value	p-value
	mean	SD	Mean	SD		
Overall	23.66	1.68	25.77	4.46	2.190	0.03*
Roughness	22.02	2.69	24.42	3.30	4.533	0.00**
Breathiness	21.53	2.48	24.25	3.92	2.321	0.03*
Strain	21.9	2.24	26.49	4.20	5.226	0.00**
Pitch	20.36	2.49	23.94	2.74	5.753	0.00**
Loudness	20.69	2.55	24.14	3.02	5.014	0.00**

*p< 0.05, **p<0.01

Paired sample ‘t’ test was performed to compare the pre recordings with post recordings. Result showed that all the parameters in the CAPE-V were significantly difference at $P < 0.05$. It indicates that during the post recordings the CAPE-V values were higher than pre recordings.

(b) Objective analysis

Mean and standard deviation of the MDVP parameters was calculated. Table 6 mean, SD, t-value and p-value of the paired t test for MDVP parameters. Results shows that majority of the parameters in the post recording was higher than pre recordings.

Table 6: Results of paired t-test of MDVP parameters for pre and post recordings.

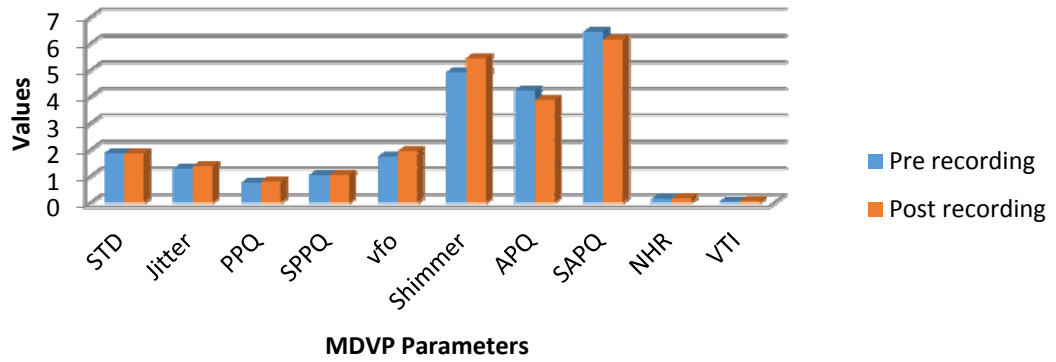
Parameters	Pre –recording		Post –recording		t-value	p-value
	Mean	SD	Mean	SD		
F0	113	21.1	122	21.4	3.896	0.001**
STD	1.87	0.93	1.85	1.82	0.051	0.960
Fftr	3.94	2.04	5.75	3.01	2.442	0.022*
Jitter	1.27	1.03	1.38	2.08	0.279	0.783
PPQ	0.75	0.66	0.80	1.26	0.207	0.838
SPPQ	1.05	0.71	1.06	1.12	0.035	0.972
vfo	1.74	1.02	1.94	1.96	0.197	1.803
Shimmer	4.92	3.09	5.45	4.46	0.733	0.471
APQ	4.24	3.41	3.87	2.69	0.609	0.548
SAPQ	6.44	3.61	6.15	3.22	0.432	0.670
NHR	0.15	0.08	0.16	0.10	0.960	0.347
VTI	0.05	0.05	0.06	0.11	0.468	0.644
SPI	16.4	7.4	17.1	7.8	0.355	0.726

*p< 0.05, **p<0.01

For the comparison Paired sample ‘t’ test was performed to compare the pre recordings with post recordings. Result showed that only F0 and Fftr were significantly difference at $P < 0.05$. It indicates that during the post recordings the MDVP values were higher than pre recordings. Only STD, APQ and sAPQ showed the opposite trend. Figure 1 shows the pre-post comparison MDVP parameters which were not showing significant difference in the paired ‘t’ test.

Figure 1: Comparison MDVP parameters which were not showing significant difference in the paired ‘t’ test.

Pre-Post comparison of MDVP Parameters



DISCUSSION

Present study was aim to investigate the difference in the parameters of voice of 25 bus conductors in the Ernakulum district, before and after the work period. Also voice awareness questionnaire and VHI was used to understand their awareness level and change in quality of life due to voice.

In the first phase of the study questionnaire was used. It had 32 questions which measured the life style, vocal habits and voice symptoms in three different sections. In the session A questionnaire results showed few subjects had an experience of voice changes due to their occupation. Which suggests that bus conductors has an occupational voice hazed. Majority of the private bus conductors works more than 9 hours which again increase the risk of developing voice disorders as against standard 8 hours working period. Voice symptoms like strain, dryness and fatigue was remarkable reported by this population.

In the session B and C questionnaire results showed more than fifty percent of the participants showed the poor vocal habits of continuous chat, loud talking, shouting, screaming, and throat clearing. Intake of hot and spicy food, habits of smoking, consumption of alcohol were evident in the present study group. Psychological factors like the stress, anxiety and tension regarding the job and others were also evident in the results of the present study.

Findings of the study reveal that the bus conductors are in risk group of voice problem mainly because of their prolonged period of voice usage up to 9-10 hours per day. Using voice prolonged period of time can lead to the risk of voice symptoms.

This supported by the findings of Komura et al. (1992) in female aerobic instructors, they states that Instructing classes for more than ten hours per week was significantly associated with reported voice problems. They advised reducing the number of hours taught in order to reduce symptoms. Questionnaire results also showed 37.5 % of them have stress, anxiety and tensions during their job and other time, these psychological factors also can contribute to increase the risk of voice among bus conductors. This was supported by the study of Newman, Kersner, (1998) they mentioned that voice problems were also associated with reported levels of tension or stress; those with higher than average reported tension levels were more likely to have experienced voice problems than those with lower than average levels of tension. Gotaas, Starr (1993) have done study on Vocal fatigue among teachers and evidenced that there is relationship between the vocal fatigue and anxiety in school teachers.

In the second phase VHI -30 was used for all participants and a only 4 among 25 bus conductors had shown some value in VHI. However, only two participants showed mild handicapped in the VHI score. Which suggested nearly 8-10% of bus conductors felt the voice problem with in their 11-12 years of experiences. The percentage of the may increase as the experience and secondly as they become older the voice endurance also may come down. However this statement needs future empirical evidences.

In the third phase recording of phonation and speech samples were done for pre and post work period. The recorded samples were subjected to Perceptual evaluation using CAPE-V.

Results shown that there were significant difference observed in all the parameters (overall voice, roughness, breathiness, strain, and abnormality of pitch and loudness) of CAPE-V for pre recording Vs post recording. This change in the perceptual evaluation shows that the vocal loading on the bus conductors. The long hours of speaking, shouting and speaking under the loud background noise has significant effect on the voice. Middleton and Hiinton (2009) did a preliminary investigation of the vocal behaviors and characteristics of female pastors. The recorded voice of all subjects were subjected to perceptual analysis using CAPE-Trained listeners were subjected to rate the voice samples.

Results showed that all the subjects exhibit perceptually abusive voice characteristics. Experienced listeners indicated from the gathered data, that all of the pastors exhibited perceptually abusive voice characteristics to varying degrees. Participants who were engaged in the most vocally abusive behaviors and exhibited perceptually abusive voice characteristics while preaching scored lowest voice quality rating. Karnell et al. (2007) done a study based on reliability measures of clinician based and client based rating of voice samples of 42 males and 62 females using GRABS and CAPE-V. Results of both groups reveal that high level of agreement between the two rating systems when they were used together. CAPE-V system appeared to be more sensitive to small differences within and among patients than the GRBAS system.

The objective analysis was carried out by MDVP software analyzed the 13 relevant parameters which include both frequency and intensity and noise related measures.

The paired t test showed that fundamental frequency (F0), fundamental frequency tremor (Fftr) showed statistically significant increase in the post recording. Results of MDVP also showed, parameters including STD, APQ and sAPQ are decreased in the post recording measurements when compare to pre - recording. The parameters like, jitter percentage, pitch perturbation quotient, smooth pitch perturbation quotient, fundamental frequency variation, shimmer percentage, noise to harmonic ratio, voice turbulence index, and soft phonation index are increased in the post-recording measurements than the pre-recording. However it was not statistical significant

The increase in the F0 values is because of increased vocal loading in the bus conductors. Lehto, Laaksonen, Vilkmán, and Alku (2008) studied changes in objective acoustic measurements and Subjective Voice Complaints in Call Center Customer-Service Advisors During One Working Day. The result showed statistically significant increase in F0. In many previous vocal loading studies, F0 rise during vocal loading has been observed in both laboratory and field conditions. So in this present study we can assume that the changes of F0 can be one good indicator of vocal loading among this population because of various vocal activities, and this can lead to future voice issues which can hamper their carrier. Garret and Healey (1987) studied an acoustic analysis of fluctuations in the voices of normal adult speakers across three times a day. They found F0 changes without a special voice load and collected data with reading tasks. In their study, both males and females showed an increase of F0 during a day, but only for

males showed statistically significant change. Also, Artkoski, Tommila, Laukkanen (2002) studied changes in voice during a day in normal voices without vocal loading.

They investigated F0 changes during a day without vocal loading in 11 females and 10 male subjects. The results showed that F0 was higher in both groups in the afternoon, but the change during the day was insignificant. Similar results were present in conductor's study and evidenced that, F0 was higher in the evening period after work and F0 was lower in the morning period before work. However few studies showed that the change in F0 was not supporting the vocal loading. Gelfer, Andrews, and Schmidt (1991) studied effects of prolonged loud reading on selected measures of vocal function in trained and untrained singers. Pre- and posttest measures taken using voice samples elicited during speaking and singing tasks. Study concluded that, little effect on the speaking voices of trained singers, although the voices of untrained singers appeared to be more negatively affected. Compared to trained singers, untrained singers showed less consistency in F 0 and intensity in pretest to posttest measures. There has been debate going whether an increase in F0 during a day is a normal phenomenon

The present study also showed intensity measures like shimmer increased in post recording. Doing prolonged vocal activities, or with poor speech habits, results in increased irregularity of vocal fold function, which can be associated with increased intensity measures. In bus conductors the occurrence of pronged use of voice and vocal habits like throat clearing, shouting, speaking in loud voice presence of voice have been noticed. So these factors also contribute the changes in the shimmer values due the irregular and constant vocal fold vibrations.

This finding can be supported by the study done by Gelfer, Andrews, Schmidt (1991). They studied prolonged reading effects on trained and untrained singers in pre and post acoustic measurements.

Results indicated that for trained singers, shimmer values for vowel productions slightly decreased from pretest to post test, indicating improved vocal performance. But for untrained singers shimmer values and intensity seemed to increase in posttest measures which indicated a decrement in voice quality. Walzak, McCabe, Madill, Sheard., (2008) studied acoustic changes in student actors' voices after 12 Months of Training. After training, measures of speaking tasks and phonation tasks were given acoustic to acoustic analysis and results found that shimmer was significantly increased for all subjects after training after the 12 months of training indicated vocal load of training and performance or the use of vocally abusive behaviors. Timmermans (2002) study indicates poor voice quality among the vocal performers and professional voice users due to the life style, increased vocal loading due to performance or vocally abusive behaviors. Their study findings also indicate increased shimmer values due to the vocally damaging behaviors.

In the present study a significant difference was observed in the results of Fundamental frequency tremor (Fftr). The reason for the increased Fftr may be due to the laryngeal muscle fatigue after the vocal load in the bus conductors which might have introduced physical tremor in the laryngeal muscles and vocal fold. Secondly the abnormal voice like breathy and rough voice shows increases Fftr in MDVP measures. This observation was supported by Wolfe, Fitch, and Martin (1997).

They did a study on acoustic measure of dysphonia severity across and within the voice types. Acoustic analysis of voice samples using the MDVP software revealed that difference in Fftr, shimmer & jitter values. Results concluded that, Combined effect of variation of Fftr, shimmer jitter values negatively contributes the voice quality and can results hoarseness.

Another study, by Muñoz, Mendoza, Fresneda, and Lo´pez (2004) investigated the acoustic correlate to voice quality of a group of men and women with and without voice disorders acoustical analysis using the MDVP software. Results shows that males normal, hoarse, rough voice qualities were related to acoustic features: frequency perturbation measures, amplitude perturbation measures, soft phonation index and fundamental frequency tremor (Fftr). For normal voice all the parameters present with normal values but for hoarse voice some deviations in values were observed. High variations in values have in rough voice quality.

Summary and conclusion

Speech is the chief medium of communication and social adaptation. Voice is the basic source for the speech production. Vocal system has to work with full force for the production of voice or speech. Many people have to use their voice or speech for the purpose of livelihood. The income of those people is depends on the hours of voice usage e.g venders, bus conductors etc. Because of the continue usages of voice, the vocal system under goes high lode which may leads voice problem over a period of time. Hence, the current study tries to find out the voice changes in bus conductors before and after their work load and also to find the awareness level an impact of voice on their life. A total of 25 male participants who had minimum of 5 year of experience as private bus conductor. They were in the age range of 23-37 years. The study was carried out in three different 3 phases. In the first phase the questionnaire was administered to know the awareness level. The questionnaire measured the life style, vocal habits and voice symptoms in three different sections. The second phase involve the self-rating of the Voice Handicap Index (VHI) and in the last phase recording of the phonation and the speech samples were done. Olympus (PM-100 linear PCM recorder), a digital audio recorder was used for recording. Perceptual analysis was carried out using Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) and Multi-dimensional voice profile (MDVP) software was used for objective analysis.

The phase one result showed few subjects had an experience of voice changes due to their occupation and majority of participants showed the poor vocal habits of continuous chat, loud talking, shouting, screaming, and throat clearing. Intake of hot and spicy food, habits of

smoking, consumption of alcohol were evident in the present study group. Psychological factors like the stress, anxiety and tension regarding the job and others were also evident in the results of the present study. Findings of the study reveal that the bus conductors are in risk group of voice problem mainly because of their prolonged period of voice usage up to 9-10 hours per day. In the second phase VHI -30 was used for all participants and only 4 among 25 bus conductors had shown some value in VHI. However, only two participants showed mild handicapped in the VHI score.

In the third phase perceptual evaluation (CAPE-V) result showed that there were significant difference observed in all the parameters of CAPE- V for prerecording Vs post recording. This change in the perceptual evaluation shows that the vocal loading on the bus conductors. The long hours of speaking, shouting and speaking under the loud background noise has significant effect on the voice.

The objective analysis (MDVP) result showed that fundamental frequency (F0), fundamental frequency tremor (Fftr) showed statistically significant increase in the post recording. The parameters like, jitter percentage, pitch perturbation quotient, smooth pitch perturbation quotient, fundamental frequency variation, shimmer percentage, noise to harmonic ratio, voice turbulence index, and soft phonation index are increased in the post Vs pre-recording.

In this present study we can assume that the changes of F0 can be one good indicator of vocal loading among this population because of various vocal activities, and this can lead to future voice issues which can hamper their carrier. In bus conductors the occurrence of pronged use of voice and vocal habits like throat clearing, shouting, speaking in loud voice presence of voice

have been noticed. In the present study a significant difference was observed in the results of Fundamental frequency tremor (Fftr). The reason for the increased Fftr may be due the laryngeal muscle fatigue after the vocal load in the bus conductors which might have introduced physical tremor in the laryngeal muscles and vocal fold. Secondly the abnormal voice like breathy and rough voice shows increases Fftr in MDVP measures. The overall results of this study has identified that bus conductors are high-risk group of professional voice users due to the demands placed on their vocal lode and there appears to be a need for adequate voice care advice and voice training for these bus conductor professionals in order to avoid chronic voice problems and the need for clinical intervention.

Limitation

- The numbers of participants in the study are relative less.
- The recording of the voice and speech sample was not done in sound treated room Only
- Single phonation was considered in the present study
- Visual examination of the larynx was not included

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Appendix -I

Statistics				
	Mean	Median	Mode	SD
Question 9	0.92	1.00	1	0.584
Question 10	0.92	1.00	1	0.504
Question 11	0.13	0.00	0	0.338
Question 12	0.00	0.00	0	0.000
Question 13	0.79	1.00	1	0.658
Question 14	0.79	1.00	1	0.588
Question 15	1.67	2.00	2	0.565
Question 16	0.71	1.00	1	0.624
Question 17	0.50	0.50	0	0.511
Question 18	0.92	1.00	1	0.504
Question 19	1.00	1.00	1	0.511
Question 20	0.42	0.00	0	0.584
Question 21	0.29	0.00	0	0.464
Question 22	0.50	0.00	0	0.659
Question 23	0.38	0.00	0	0.576
Question 24	0.17	0.00	0	0.381
Question 25	0.46	0.00	0	0.509
Question 26	0.25	0.00	0	0.442
Question 27	0.25	0.00	0	0.442
Question 28	0.71	1.00	1	0.624
Question 29	0.42	0.00	0	0.584
Question 30	0.29	0.00	0	0.550
Question 31	1.25	1.00	1	0.847
Question 32	0.21	0.00	0	0.415

Appendix – II

QUESTIONNAIRE FOR PREVALENCE OF VOICE DISORDERS IN CONDUCTORS

Name:

Age:

Sex:

Family: Joint /Nuclear

Education:

Married/Unmarried

Personal address:

Instruction:

Section A: Answer in detail to the question no. 1 to 10. Section B and C: Indicate your choice by (V) ticking against the numbers. Each of the numbers refers to

0: No

1: Occasionally

2: Frequently

3: Always

SECTION A:

1. Comments about your voice:
2. Since how long you are working as a conductor? 11.6yrs
3. What is the maximum number of hours you work regularly?
4. What is the minimum number of hours your work regularly?
5. Do you have history of ear infections or hearing problem?
6. Do you suffer from constant upper respiratory infections?
7. Does surrounding noise disturb you during working?

8. What you are think about your voice? Do you feel any changes?

SECTION B:

9. Do you indulge in long continuous chat?

0	1	2	3
---	---	---	---

10. Do you eat spicy or hot food?

0	1	2	3
---	---	---	---

11. Do you live in noisy environment?

0	1	2	3
---	---	---	---

12. Do you live in dusty environment?

0	1	2	3
---	---	---	---

13. Do you smoke?

0	1	2	3
---	---	---	---

14. Do you consume alcohol?

0	1	2	3
---	---	---	---

15. How many glasses of water you take per day?

0	1	2	3
---	---	---	---

16. Do you indulge in loud talking?

0	1	2	3
---	---	---	---

17. Do you indulge in screaming or shouting?

0	1	2	3
---	---	---	---

18. Do you indulge in screaming or shouting at home?

0	1	2	3
---	---	---	---

19. Do you clear your throat frequently?

0	1	2	3
---	---	---	---

0	1	2	3
---	---	---	---

32. Do you feel you are unnecessarily using your voice?

0	1	2	3
---	---	---	---

SECTION C:

20. Does your voice tire very soon?

0	1	2	3
---	---	---	---

21. Do you have any kind of changes in your voice before?

0	1	2	3
---	---	---	---

22. Do you perceive roughness in your voice?

0	1	2	3
---	---	---	---

23. Do you experience sensations like pain, soreness/irritation or lump in throat?

0	1	2	3
---	---	---	---

24. Do you use any solutions/ ayurvedic solutions, salt water, mint etc to relieve your throat? Specify.

0	1	2	3
---	---	---	---

25. Do you feel that you have better voice in the mornings or evenings? Specify

0	1	2	3
---	---	---	---

26. Do you experience episodes of loss of voice/ voice breaks while speaking?

0	1	2	3
---	---	---	---

27. Do you feel difficulty in raising your voice (increase the loudness)?

0	1	2	3
---	---	---	---

28. Do you have sensation of dryness in your throat?

0	1	2	3
---	---	---	---

29. Do you experience acid reflux, chest pain/ heart burn?

0	1	2	3
---	---	---	---

30. Are you allergic to AC, dust, medicine? Specify

0	1	2	3
---	---	---	---

31. Do you suffer from anxiety, mental tension or stress?

0	1	2	3
---	---	---	---

32. Do you feel you are unnecessarily using your voice?

0	1	2	3
---	---	---	---

Appendix -III

Name _____ Date _____ Follow-up _____

Voice Handicap Index (VHI) (Jacobson, Johnson, Grywalski, et al.)

Instructions: These are statements that many people have used to describe their voices and the effects of their voices on their lives. Check the response that indicates how frequently you have the same experience.

(Never = 0 points; Almost Never = 1 point; Sometimes = 2 points; Almost Always = 3 points; Always = 4 points)

Never Almost Never Sometimes Almost Always Always

1. My voice makes it difficult for people to hear me.
2. I run out of air when I talk
3. People have difficulty understanding me in a noisy room
4. The sound of my voice varies throughout the day.
5. My family has difficulty hearing me when I call them throughout the house.
6. I use the phone less often than I would like.
7. I'm tense when talking with others because of my voice.
8. I tend to avoid groups of people because of my voice.
9. People seem irritated with my voice.
10. People ask, "What's wrong with your voice?"
11. I speak with friends, neighbours, or relatives less often because of my voice.

12. People ask me to repeat myself when speaking face-to-face.

13. My voice sounds creaky and dry.

Appendix - VI

VOICE HANDICAP INDEX (VHI) Scoring (Henry Ford Hospital, 1997)

The *VHI* is comprised of a series of questions targeting the patient's perception of her/his own voice. It is a useful tool to help gain insight into the emotional, physical, and functional components of the voice problem as well as measure therapeutic outcomes. Scoring Guidelines Mean values (SD) for VHI subscale and total scale scores as a function of self-perceived severity.

Scale	Group		
	Mild	Moderate	Severe
Functional	10.07 (1.99)	12.41 (1.38)	18.30 (1.50)
Physical	15.54 (1.97)	18.63 (1.37)	22.78 (1.48)
Emotional	8.08 (2.31)	13.33 (1.61)	20.30 (1.74)
Total	33.69 (5.60)	44.37 (3.88)	61.39 (4.21)

Appendix -V

Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)

Name: _____ Date: _____

The following parameters of voice quality will be rated upon completion of the following tasks: 1. Sustained vowels, /a/ and /i/ for 3-5 seconds duration each.

2. Sentence production:

Subject No		Legend: C = Consistent I = Intermittent MI = Mildly Deviant MO = Moderately Deviant SE = Severely Deviant	Pre Test	Post test	
					<u>SCORE</u>
Overall Severity	_____	C I			____/100
	MI MO SE				
Roughness	_____	C I			____/100
	MI MO SE				
Breathiness	_____	C I			____/100
	MI MO SE				
Strain	_____	C I			____/100
	MI MO SE				
Pitch	(Indicate the nature of the abnormality): _____				
	_____	C I			____/100
	MI MO SE				
Loudness	(Indicate the nature of the abnormality): _____				
	_____	C I			____/100
	MI MO SE				

Subject No

Legend: C = Consistent I = Intermittent
MI = Mildly Deviant
MO = Moderately Deviant
SE = Severely Deviant

Pre Test

Post test

SCORE

Overall Severity	_____	C	I	____/100
	MI MO SE			
Roughness	_____	C	I	____/100
	MI MO SE			
Breathiness	_____	C	I	____/100
	MI MO SE			
Strain	_____	C	I	____/100
	MI MO SE			
Pitch	(Indicate the nature of the abnormality): _____	C	I	____/100

	MI MO SE			
Loudness	(Indicate the nature of the abnormality): _____	C	I	____/100

	MI MO SE			