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Point Prevalence of Voice Problems in TeachersUsing Acoustic and Auditory-Perceptual Measures

Abstract

Voice problems in teachers are an imperative concern for the treatment-seeker and treatment-provider alike as possessing a good voice is a must for effective teaching. ***Purpose:*** *The study aimed to estimate the Point prevalence of voice problems in school teachers between January-August 2013 using acoustic and auditory-perceptual analyses.* ***Method:*** *372 teachers from schools in the city and surrounding six taluks of Mysuru district participated. All participants filled a validated questionnaire followed by phonation of vowel /a/ at comfortable pitch and loudness and a monologue on the topic "school". Five experienced Speech Language Pathologists rated the speech samples using GRBAS scale and Dr. Speech software extracted the acoustic quality estimates from phonation samples.* ***Results****: a) Auditory-perceptual analysis revealed 80.7% and 19.3% of the participants had normal and abnormal voice respectively b) On Acoustic analysis, 76.3% and 23.7% of the participants had normal and abnormal voice respectively c) The combined results of acoustic and auditory-perceptual analyses revealed abnormal voice only in 7.5% of the participantsd) Chi-square test revealed a significant association between gender and acoustic analysis e) A multinomial logistic regression analysis identified participants who used their voice to discipline children at home having greater risk of a voice problem on acoustic analysis whereas participants who frequently indulged in long continuous chats, lived in a frequently dusty environment and frequently conducted tuition classes at home had a higher risk of voice problems as per auditory-perceptual analysis.* ***Conclusion:*** *Results entail the formulation of appropriate voice care programs and management options for safe-guarding the voice of teachers.*

Key words: Point Prevalence; Acoustic analysis; Auditory-Perceptual analysis; GRBAS; Teachers

INTRODUCTION

Teachers are *the Professional Voice User, Level II*, persons for whom a moderate vocal problem might prevent adequate job performance (Koufman& Isaacson, 1991). Teachers have three times greater risk of developing voice problems than other professional voice users (Smith, Gray, Dove, Kirchner & Heras, 1997). Some of the causes for developing voice problems are vocal loading, background noise, medical conditions, medications and respiratory allergies, humidity levels, personality related issues, etc.

Teachers often report of more vocal symptoms and problems compared to other professionals suggesting that vocal loading (Gotaas& Starr, 1993; Morton & Watson, 1998; Ohlsson, Järvholm&Löfqvist, 1987; Pekkarinen, Himberg, &Pentti,1992; Roy, Merrill, Thibeault, Gray, & Smith, 2004; Roy, Merrill, Thibeault, Parsa, Gray, & Smith, 2004; Sala, Laine, Simberg, Pentti&Suonpää, 2001; Smith, Lemke Taylor, Kirchner, & Hoffman 1998a), background noise, air quality and acoustic conditions (Morton & Watson, 1998; Pekkarinen&Viljanen, 1991; Vilkman, 2004), anumber of medical conditions, certain medications and respiratory allergy have also been identified as potential risk factors for voice disorders (Colton & Casper, 1990; Roy, Merrill, Thibeault, Gray, & Smith, 2004; Roy, Merrill, Thibeault, Parsa, et al., 2004; Sala, Hytönen, Tupaselä, &Estlander, 1996; Gotaas& Starr, 1993; Spiegel, Hawkshaw, &Sataloff, 1991; Stemple, 1995; Woo, 1996), lowerlevels of humidity can have a negative impact on voice (Hemler, Wieneke, &Dejonckere, 1997; Vilkman, Lauri, Alku,

Sala, &Sihvo, 1999; Verdolini, Titze, & Fennell, 1994; Vintturi, Alku, Sala, Sihvo, &Vilkman, 2003) and personality related factors such as, anxiety and stress (Wellens& van Opstal, 2001, Gotaas& Starr, 1993; Morton & Watson, 1998; Sapir, Keidar, &Mathers-Schmidt, 1993) could be the probable causative factors for the voice problems.

Prevalence estimates vary widely across the world (Behlau, Zambon, Guerrieri& Roy, 2012). Miller and Verdolini (1995) reported the past prevalence voice problems with music teachers was 64% compared to 33% in the controls with females having a higher chance than males and younger subjects had a higher probability than older subjects in reporting a past voice problem. According to Russell, Oates and Greenwood (1998), 16%, 20% and 19 % of the teachers had voice problems on the day of the survey, in that teaching year and during their careers respectively. Further, female teachersreported higher rates of voice problems compared to males. A prevalence rate of 32% and 1% of voice problems were found in teachers and non-teachersrespectively by Smith, Lemke, Taylor, Kirchner and Hoffman (1998a).When the effects of teaching on the spectral characteristics of the voice were investigated and correlated with the self-reported problems of voice in teachers, the results revealed greater energy in the high frequency components because of vocal loading. The results also reported that the subjective information from teachers showed a significant correlation with the spectral characteristics, Rantala, Paavola, Korkko and Vilkman (1998).

Laukannen, Ilomaki, Leppanen, and Vilkman (2008)investigated the relation of symptoms of vocal fatigue to acoustic variables reflecting type of voice production and the effects of vocal loading in 79 female primary school teachers. Reading at habitual loudness level and loud voice,

prolonged phonation and a questionnaire about voice quality, ease, or difficulty of phonation and tiredness of throat was completed. After a working day, F0, SPL, and alpha ratio were higher, jitter and shimmer values were lower, and more tiredness of throat was reported. Increase in jitter and mean F0 in loud reading correlated with tiredness of throat. The results suggested that, at least among experienced vocal professionals, voice production type had little relevance from the point of view of vocal fatigue reported. Differences in the acoustic parameters after a vocally loading working day mainly seemed to reflect increased muscle activity as a consequence of vocal loading.

Lopez, Fernandez, Uriondo, and Ruiz (2006) compared dysphonic and non-dysphonic teachers against their weights, age, years of teaching experience, number of hours taught per week, grades taught and the number of students in each class and there were no statistically significant differences for any of these attributes. But they founda significant difference between female and male teachers, in that even though the female teachers were found to have lesser teaching experience, but they also taught more number of classes per week and taught younger students compared to their male counterparts.

Nerriere, Vercambre, Gilbert and Kovess-Masfety (2009) revealed that 50% of the females and 26% of the males had voice disorders. Van Houtte, Claeys, Wuyts, and Van Lierde(2010) found that a significant number of teachers (51.2%)experienced voice problems comparedto the controls (27.4%) and female teachers(38%)reportedof voice problems more often than male teachers (13.2%). Sataloff, Hawkshaw, Johnson, Ruel, Wilhelm& Lurie (2012) 86.1% (62 out of 72 subjects) reported abnormal findings in strobovideolaryngoscopy, and many of whom had

more than one abnormality. Simões-Zenari, Bitar and Nemr (2012) found a relationship between the presence of noise between the harmonics and voice disorders which in turn correlated with high noise levels in the classroom.

Teachers are susceptible to voice problems irrespective of the region owing to the professional demands on voice. Estimation of prevalence of voice problems in teachers becomes essential to comprehend particular needs of teachers so as to make possible appropriate remedial measures after the problems are identified. This study is part of a project undertaken to estimate the Point prevalence of voice problems between January-August 2013 using acoustic and auditory-perceptual analyses in schools teachers in the city of Mysuru and six taluks of Mysuru district in the state of Karnataka, India.

METHOD

2.1 Participants

A total of 372 school teachers in the age range of 30-45 years with a minimum of 5 years of teaching experience participated in the study. The school teachers were from 60 schools in the city of Mysuru and surrounding six taluks of Mysuru. Among 372 teachers, 327 were females and 45 were males.Teachers who taught mathematics, arts, craft, computers and physical education did not participate in the study.

2.2 Questionnaire

The participants filled avalidated questionnaire byKoul (2004), Koul&Yeshoda (2008) (Appendix I) to obtain information regarding demographic and their profession of teaching. The questionnaire consisted of 41 questions divided into four sections. The details are as follows,

Section A: Classroom condition and general information. It had thirteen questions

Section B: Lifestyle and contained nine questions

Section C: Vocal habits and consisted of a total of six questions.

Section D: Symptoms exhibited. This section had thirteen questions.

The first ten questions in Section A required explanatoryanswers. The remaining questions required the participants to rate their answers on a 4-point rating scale.

2.3 Instrumentation

Olympus LS-100 linear PCM recorder was used to record the voice samples of all the participants maintaining a constant mouth and the microphone distance of 10 cm at 44 kHz sampling frequency with a 16-bit rate and in .wav format.

2.4 Procedure

The written consent was obtained from the participants before the study by explaining the purpose of the study.A quiet environment in the respective schools of the participants formed the venue for the data collection only during the midweek (Wednesdays and Thursdays) and the middle of the day (11.00 am to 3.00pm). The beginning (Mondays) and end of the week (Fridays) were avoided to reduce the effects of vocal rest and increased vocal load respectively, especially noticed in the first and last working days of the week. All the participants completed the questionnaire followed by the voice recordingsindividually. The tasks were (a) phonation of

vowel /a/ at comfortable pitch and loudnessfor minimum of *five* seconds and (b) Monologue on the topic "school" for minimum of 60 seconds. After the appropriate*instructions, all su*bjects performed both the tasks.

Analysis

The recorded data were subjected to both auditory-perceptual and acoustic analyses to confirm the presence of a voice problem.

Auditory-Perceptual analysis

A phonation sample of three seconds and a monologue sample of 30 seconds from each participant wereconverted into a separate .wav file and formed the material for the Auditory-Perceptual experiment. Five experienced male Speech Language Pathologists with a minimum of 3 years of clinical experience listened to the material of every participant and gave a single combined rating against all the parameters (Grade, Roughness, Breathiness, Asthenia and Strain) of the GRBAS (Hirano, 1981) scale. The GRBAS has the following parameters; Grade: overall degree of deviance of voice, Roughness: irregular fluctuation of the fundamental frequency, Breathiness: turbulent noise produced by air leakage, Asthenia: overall weakness of the voice, and Strain: impression of tenseness or excess effort (Dejonckere, Remacle, Fresnel-Elbaz, Woisard, Crevier-Buchman & Millet, 1996). The scores ranged from 0 to 3 wherein 0=normal, 1=mild abnormality, 2=moderate abnormality and 3=severe abnormality. Score sheets (Appendix II) were prepared and used for the perceptual ratings. Suitable statistics were carried out after the compilation of the scores of all the judges.

Acoustic analysis

The phonation samples of all the participants were analysedusing thevocal assessment module of Dr. Speech software. Dr. Speech (Version 4, Tiger Electronics, Seattle, USA) is used for assessment of voice and also for therapeutic purposes. It analyses the voice quantitatively to arrive at the quality estimation including the degree of severity. Quantitatively, the software provides information on Habitual frequency, Jitter, Shimmer, NNE (Normalized Noise Energy), HNR (Harmonics to Noise Ratio), SNR (Signal to Noise Ratio), Mean F0, Maximum and minimum F0, F0 tremor and amplitude tremor. Then quantifies the results qualitatively to provide information on the following vocal quality parameters namely, Harsh, Hoarse and Breathy grading the degree of voice abnormality (when present) with scores ranging from 0 to 3; (0- Normal, 1- Mild deviation, 2- Moderate deviation, 3- Severe deviation). The presence of a voice problem was confirmedwhen a participant obtained a cumulative scoring of >1 from all the three parameters. A criterion was devised by considering the cumulative scores of the acoustic analysis (based on ratings of each participant for the parameters: hoarse, harsh and breathy) which formed the basis to categorize participants as normal, mild, moderate and severe analogous to the scores of auditory-perceptual analysis. An example of the criterion (cumulative scoring) is as shown as follows:

- Normal (Score of 0): Score of 'zero' for all the three parameters (hoarse, harsh and breathy).
- Mild (Score of 1): Score of ≥1 in any one of the parameters (hoarse, harsh and breathy).
- Moderate (Score of 2): Score of ≥2 in any of the two or more parameters (hoarse, harsh and breathy).
- Severe (Score of 3): Score of ≥3 in any one of the parameters (hoarse, harsh and breathy).

Statistical analysis was carried out using SPSS (version 17) and non parametric tests were used to compare the various sections of the questionnaire across different variables owing to

differences in sample size. The choice was Mann-Whitney test when there were two sub-categories of the independent variables but Kruskal-Wallis test when more than two subcategories of independent variables present. Association between independent variables and presence/absence of voice problems was done using Chi-square test. Cronbach's alpha was used to monitor the inter-judge reliability on the auditory-perceptual analysis. Spearman's rank correlation test was used to find out the correlation between objective and perceptual analysis. A multinomial logistic regression analysis was done to evaluate the risk factors associated with voice problems.

RESULTS

The questionnaire helped group all the 372 participants into the following 11 variables and the subcategories noted in the brackets: (1) Gender (Male/Female); (2) Type of locality (Urban/Rural); (3) Type of setup (Private/Government); (4) Number of students in the classroom (below 30/above 30); (5) Classes taught (Primary/Secondary/Nursery/Both); (6) Type of environment (Noisy/Quiet); (7) Teaching experience (below ten years/ above ten years); (8) Subjects taught (languages only/language + others/ others); (9)Number of teaching hours (less than 3/ more than 3); (10) Type of Board used (White /Black/Both) and (11) Acoustic analysis results (Normal/Abnormal).

Table 1

Frequency distribution of participants across the different variables

Category / variable	*Total number of subjects = 372*		
	Sub -Categories	*Frequency*	*Percentage (%)*
Gender	Female	327	87.9
	Male	45	12.1
Type of locality	Urban	331	89.0
	Rural	41	11.0
Type of Setup	Private	362	97.3
	Government	10	2.7
No. of Students in the classroom	Less than or equal to 30	111	29.8
	More than 30	261	70.2
Classes taught	Primary	152	40.9
	Secondary	102	27.4
	Nursery	41	11.0
	Primary and secondary	77	20.7
Type of environment	Noisy	109	29.3
	Quiet	263	70.7
Teaching experience	Less than or equal to 10 yrs	224	60.2
	More than 10 yrs	148	39.8
Subjects taught	Language only	114	30.6
	Language+ others	178	47.8
	Others	80	21.5
No. of teaching hours	Less than or equal to 3	52	14.0
	More than 3	320	86.0
Type of board used	Black	325	87.4
	White (dust free)	22	5.9
	Both	25	6.7
Acoustic analysis (Dr. Speech)	Normal	284	76.3
	Abnormal	88	23.7

Table 2

Prevalence of voice problems in the participants

Type of analysis	*Point Prevalence of voice problems*
Only Acoustic analysis	23.7%
Only Auditory-Perceptual analysis	19.3%
Acoustic and Auditory-Perceptual analysis (Both)	07.5%
Either Acoustic or Auditory-Perceptual analysis	27.9%

Acoustic analysis

The results revealed that 76.3% (284 out of 372) and 23.7% (88 out of 372) of the participants had normal and abnormal voice respectively. Combined acoustic and auditory-perceptual analyses result revealed 240 of 372 (64.5%) to be normal and only 28 participants (7.5%) to be abnormal and 27.9% (104/372) were abnormal either on acoustic or auditory-perceptual analysis. Thus the prevalence of voice disorders according to the combined auditory-perceptual and acoustic analyses results was 7.5%.

Auditory-Perceptual Analysis

The Auditory-Perceptual analysis revealed that 80.6% (300 of 372) of the participants scored "zero" on 'Grade' whereas, 19.3% (72 of 372)scored of ≥1 on 'Grade' in the GRBAS scale indicating normal and abnormal voice respectively.

Inter-rater reliability

Cronbach's alpha test checked the inter-rater reliability of the auditory-perceptual evaluation using the GRBAS scale. The results indicated good inter-rater reliability for the parameters Grade, Breathiness and Roughness at α value ≥ 0.7 and for Asthenia and Strain α value < 0.6.

Associations between variables and results of acoustic analysis

Table 3

Association between different variables and the results of Acoustic *analysis*

	X^2 *Value*	*df*	*p-value*
Gender * Acoustic Analysis	24.97	1	0.000**
Type of Locality * Acoustic Analysis	2.81	1	0.09
Type of Setup * Acoustic Analysis	0.23	1	0.63

No. of Students * Acoustic Analysis	0.22	1	0.64
Classes taught * Acoustic Analysis	2.55	3	0.47
Type of environment *Acoustic Analysis	0.56	1	0.46
Teaching Experience * Acoustic Analysis	0.56	1	0.46
Subjects * Acoustic Analysis	5.56	2	0.06
No. of teaching Hours * Acoustic Analysis	0.06	1	0.81
Board * Acoustic Analysis	1.27	2	0.53

**p-value <0.001

Chi-square tests checked the association between variables and presence/ absence of a voice disorder based on acoustic analysis as shown in Table-3. The results revealed that there was a statistically significant association ($\chi 2$: 24.97, p-value <0.001) only between gender and the acoustic analysis.

Gender: Table-4 reveals the prevalence of voice disorders across gender.

Table 4

Prevalence of voice problems across gender

Evaluation	***Gender***	***N***	***Normal***	***Abnormal***	***Percentage of voice problem***
Acoustic	Female	327	263	64	19.6%
	Male	45	21	24	53.3%
Auditory-perceptual	Female	327	268	59	18%
	Male	45	32	13	28.8%

Risk factors associated with voice problems

The non-teachers formed the reference. A multinomial logistic regression analysis with the odds ratios (OR) at 95% Confidence Intervals (CI) helped identify the factors (in the questionnaire) that proved high-risk for developing a voice problem. The OR (factors with OR greater than one) indicated that those who used their voice to discipline their children at home had a higher risk of

identified with a voice problem (OR: 15.75, p <0.05) according to acoustic analysis. Also, those teachers who frequently indulged in long continuous chats (OR: 13.32, p <0.05), lived in a frequently dusty environment (OR: 173.51, p <0.05) and frequently conducted tuition classes at home (OR: 335.92, p <0.05) had a greater risk of developing a voice problem according to auditory-perceptual analysis.

DISCUSSION

Prevalence of voice problems

Western studies show prevalence rates to be as low as around 11% (Roy et al., 2004; Behlau et al., 2012) and as high as 64% (Miller &Verdolini, 1995) in teachers. An Indian study by Boominathan et al. (2008) reported that the prevalence rates in politicians, vendors and singers were 86%, 74% and 59% respectively. In teachers, the prevalence of voice problems was found to be around 49%. There is no consensus in the reviewed literature regarding the exact prevalence of voice problems in teachers owing to several reasons. Some studies chose population that differed in terms of age, gender, working hours etc. (Jardim, Barreto&Assunção, 2007) and method of data collection and analysis (only questionnaires or only laryngological examinations or a combination of both), geographical location. The present study noted the highest prevalence rate of presence of voice problem for acoustic analysis only (23.7%), followed by auditory-perceptual analysis only (19.3%) and least on both acoustic and auditory-perceptual analyses (7.5%). Hence, the acoustic analysis tool proved highly sensitivity towards identifying a voice problem as more numbers of the participants had a voice problem. Therefore

the present study highlights the importance of a correlation between acoustic and auditory-perceptual analysis for more accurate screening of voice problems.

When compared to western studies the prevalence estimated in the present study is less. Apart from the sample size, other probable reasons are a) the enhanced levels of awareness about voice problems among western teachers which could have led them to notice even a slight deviation in voice characteristics and the same being reported as against Indian teachers who may have perceived subtle changes in voice as a normal consequence of teaching. b) The methods used to ascertain the presence of voice problems, e.g., the inclusion of a laryngological examination along with subjective measures could help detect the early stages of a vocal pathology which may otherwise go unnoticed. In the Indian context, the point prevalence was least (7.5%) in the present study which used acoustic and auditory-perceptual analysis compared to 49% reported by Boominathan et al. (2008) which was a questionnaire survey.

Acoustic analysis

Many studies have reported that acoustic analysis results may reflect the various vocal pathologies caused due to vocal loading which in turn correlate with various degrees of symptoms of vocal fatigue reported (Rantalaa, Paavolaa, Körkköa&Vilkman, 1998; Ma¨ki, Niemi, Lunde´n&Laukkanen, 2001; Rantala&Vilkman, 1999). In contrast, the finding of the present study revealed 76.3% and 23.7% of the participants to have normal and abnormal voice on Acoustic analysis. But, Laukannen, et al. (2008) stated no correlation between the symptoms reported by the primary school teachers and the acoustic measures except for jitter and mean F0

and justified the increased mean F0 as being due to loud reading causing perception of tired voice complained by teachers.

Auditory-Perceptual analysis

Auditory-perceptual analysis showed 80.6% of the participants as having normal voice (those who obtained a score of 0 on 'Grade' in the GRBAS scale) and the remainder 19.3% of the participants were rated as having abnormal voice (those who obtained a score of ≥ 1 on 'grade' in the GRBAS scale). Perceptual judgments have been the most commonly used and readily available tool for voice clinicians in the assessment of voice disorders and in determining the outcomes of therapy. However, the reliability amongst different raters is always an issue that has been the focus of many studies. Several factors have been found to affect perceptual judgments some of which include experience of the listener, voice sample used (sustained phonation of vowels, reading task or conversational speech sample) and the method used in the study (e.g. several presentations of the same stimuli in order to improve the rater agreements) (Kreiman&Gerratt, 2000; Lee, Drinnan, Carding, 2005; Bele, 2005; Chan, Yiu, 2006; Kreiman, Gerratt, 2000; Shrivastav, Sapienza, Nandur, 2005; Shrivastav, 2003; Shrivastav, 2006; Zraick,Wendel, Smith-Olinde, 2005). Law, Kim, Lee, Tang, Lam, van Hasselt and Tong (2011) found that inter-rater reliability did not differ with the type of voice sample used but increased with the increase in severity of dysphonia. Sellars, Stanton, McConnachie, Dunnet, Chapman, Bucknell, and Mackenzie (2009) found that the inter-rater reliability of 64.7 per cent and intra-rater reliability of 69.6 per cent for the grade component in the GRBAS scale.

In the present study, the values of inter-rater reliabilities varied from 0.46 to 0.76 for asthenia (the lowest inter-rater reliability among the perceptual parameters), breathiness (the highest inter-rater reliability among the perceptual parameters) with good inter-rater reliability was obtained for the Grade (α value ≥ 0.7). Several authors (Webb, Carding, Deary, MacKenzie, Steen, Wilson, 2004; De Bodt, Wuyts, Van de Heyning, Croux, 1997; Dejonckere, Remacle, Fresnel-Elbaz, Woisard, Crevier-Buchman, Millet, 1996; Millet &Dejonckere, 1998) have reported that Grade or overall severity in the GRBAS scale showed high levels of inter rater reliability. The present study showed poor inter-rater reliability for the perceptual parameters, Roughness, Asthenia and Strain (α value < 0.6). This finding is similar to Sellars et al. (2009) who reported the inter-rater reliability for Grade as 64.7% and the Asthenia obtaining the lowest inter-rater reliability of 43.4%, and as the voice samples rated mostly belonged to the normal group, this degree of inter-rater reliability is considered good.

Association between variables and presence/ absence of a voice problem using acoustic analysis

Gender difference

The findings of the present study show a significant gender difference (Table-4). Acoustic analysis revealed only 19.6% of the females and 53.3% of the males as having abnormal voice whereas, auditory-perceptual analysis showed 18% of the females and 28.8% of the males as having abnormal voice (Table-4). Thus, here, more numbers of males were found to experience voice problems compared to females. This finding is in contrast to the results of Russell, Oates and Greenwood (1998) and Roy, Merrill, Thibeault, Gray, & Smith, 2004 wherein, female teachers had higher rates of voice problems compared to males. Lopez, et al. (2006) found men

and women teachers had the same risk of developing a voice disorder throughout their careers, and that women suffered from organic lesions more than men whereas, chronic laryngitis was found to be three times more in males compared to females. The authors attributed this finding to the habit of smoking and alcohol consumption which is more prevalent in males rather than females. In the present study, 3% of the participants (all males) reported of consuming alcohol. Further, only one participant had a history of smoking. Alcohol consumption and smoking have been demonstrated to be a risk factor for developing voice disorders by a number of researchers (e.g. Colton & Casper, 1990; Roy, Merrill, Thibeault, Gray, & Smith, 2004; Roy, Merrill, Thibeault, Parsa, Gray, & Smith, 2004). Smoking may lead to changes in vocal quality gradually which are not often recognized by smokers as a voice disorder (Roy, Merrill, Thibeault, Gray, & Smith, 2004; Roy, Merrill, Thibeault, Parsa, Gray, & Smith, 2004). Alcohol has been one of the dehydrating agents associated with increased risk of voice disorders (Miller &Verdolini, 1995). Alcohol being a dehydrating agent may increase the viscosity of the tissue of the vocal folds either internally or externally. The physiologic response consequent to the increase in the tissue viscosity is edema which has been established to be a precursor to the development of nodules (Titze, 1981; Fung, 1981; Colton & Casper, 1990). Also, the severity of vocal nodules has been found to decrease as levels of hydration increased (Verdolini-Marston, Sandage, Titze, 1994). In contrast to the previously mentioned studies, the results of the present study does not agree with many of the previous research findings (Laukkanen, et al. 2008; Rantala, Vilkman, &Bloigu, 2002; Roy, Merrill, Thibeault, Parsa, et al., 2004; Verdolini&Ramig, 2001; Villanueva-Reyes, 2011). The present study is also not in consonance with the study by Smith, Kirchner, Taylor, Hoffman, and Lemke (1998) who found that female teachers were more likely to develop voice

problems than male teachers even when the number of hours taught, subjects taught and years of teaching experience were kept constant.

Risk factors

The risk factors for developing a voice problem according to this study were 'using voice to discipline their children at home' (according to objective analysis), 'frequently indulging in long continuous chats', 'living in an environment that involves frequent exposure to dust' and 'frequently conducting tuition classes at home' (according to perceptual analysis). All the factors except the 'living in a dusty environment'were risks that added to vocal loading in addition to the vocal load experienced by teachers due to routine teaching in classrooms. Numerous research studies have established that vocal loading has been one of the important factors contributing to a voice problem in professional voice users (Gotaas& Starr, 1993; Morton & Watson, 1998; Ohlsson, Järvholm&Löfqvist, 1987; Pekkarinen, Himberg, &Pentti, 1992; Roy, Merrill, Thibeault, Gray, & Smith, 2004; Roy, Merrill, Thibeault, Parsa, Gray, & Smith, 2004; Sala, Laine, Simberg, Pentti, &Suonpää, 2001; Smith, Lemke Taylor, Kirchner, & Hoffman 1998a). Disciplining the children at home and frequently indulging in long chats are inherent in the Indian culture which demands vocal usage. Apart from this, the teaching job makes the voices of Indian female teachers more vulnerable to voice problems. Laukkanen et al. (2008) reported that acoustic measures changed at the end of the working day when compared to the beginning of the working day and posited that this may be due to the increased activity of the muscles due to vocal loading. Numerous researches have suggested that voice problems in teachers are due to their job related vocal load. Few studies have demonstrated that teachers, when compared to hospital nurses, speak for a longer duration and with a higher level of SPL (Pekkarinen,

Himberg, Pentti, 1992; Sala, Laine, Simberg, Pentti, Suonpa¨a¨, 2002; Sala, Airo, Olkinuora, Simberg, Ström, Laine, Pentti, Suonpää, 2002). It has also been demonstrated that teachers have voice complaints during the school term which would reduce or subside during the vacations (Sala et al., 2002; Jonsdottir, 2002). Many acoustic changes were seen after vocal loading tasks in laboratory conditions and field conditions (Gelfer, Andrews &Schmidt, 1991; Stemple, Stanley & Lee, 1995; Rantala, Lindholm&Vilkman, 1998; Vilkman, Lauri, Alku, Sala &Sihvo, 1999; Rantala, Paavola, Ko¨rkko¨ &Vilkman, 1998; Novak, Dlouha, Capkova&Vohradnik, 1991). It has also been found that those teachers who used higher levels of F0 and SPL during the vocal loading tasks experienced more vocal fatigue symptoms after the completion of the test (Ma¨ki, Niemi, Lunde´n&Laukkanen, 2001).

Similarly, those teachers who used higher levels of F0 and SPL during teaching in classrooms also reported higher vocal symptoms than their co-workers (Rantala&Vilkman, 1999). Also, the changes in the amount of vocal load related acoustic parameters have helped in differentiating between those with and without voice complaints. Those teachers with more voice complaints showed a higher increase in the levels of F0 and SPL used and they demonstrated a greater spectral tilt reduction compared to their colleagues with fewer or no voice complaints (Rantala&Vilkman, 1999). Laukkanen et al. (2008) proposed that these findings suggest that the teachers demonstrated voice production that washyperfunctional. Rajasudhakar and Savithri (2010) studied the effects of vocal loading (teaching) and voice rest on the acoustic characteristics of voice in primary school female teachers. They measured acoustic parameters thrice: baseline condition, after vocal loading (end of the working day), after voice rest (beginning of the next day). They found that frequency related parameters (F0 related

parameters) and perturbation parameters increased after vocal load. These parameters reverted to normal after voice rest. Physiologically, the increase in frequency related parameters has two possible reasons. The first being stiffening of the cover and transition layers of the vocal folds due to the weakness in the thyroarytenoid muscle and this stiffening increases the rate of vibration of vocal folds and thus leading to increased F0 related parameters (Stemple, Stanley & Lee, 1995). Secondly, a speaker may increase the frequency of vocal fold vibration (also the forces of vocal fold adduction) as a compensatory reaction to the physiological changes due to vocal loading such as changes in the mucosa, leading to increased subglottal pressure, in turn, leading to increased tension in the vocal folds and subsequent increase in F0 (Vilkman, Lauri, Alku, Sala &Sihvo, 1999).

Conclusion

Investigating the point prevalence of voice problems teachers becomes vital to understand the job-related vocal demands. In the present study, males had more voice problems compared to females highlighting the importance of gender in the occurrence of voice problems and the need for differential management of such clients with voice problems. Risk factors identified were: participants using their voice to discipline their children at home apart from teaching at school, conducting tuition classes at home, frequently indulging in long continuous chats and frequent exposure to the dusty environment.The results also proved that the effects of physical, personal and environmental factors influenced voice cautioning the professionals to devise suitable hygiene programs to minimize the consequences of such factors and emphasize the magnitude of

such factors during regular counseling.Further, formulation of appropriate voice care programs and management options for safe-guarding the voice of teachers is of significance.

APPENDIX I

QUESTIONNAIRE FOR PREVALENCE OF VOICE DISORDERS IN TEACHERS

Name: (ಹೆಸರು) Age: (ವಯಸ್ಸು) Sex: (ಲಿಂಗ)

Family: Joint /Nuclear ಕುಟುಂಬ : ಅವಿಭಕ್ತ/ ವಿಭಕ್ತ Education: ವಿದ್ಯಾರ್ಹತೆ: Married/Unmarried ವಿವಾಹಿತ/ಅವಿವಾಹಿತ

Personal address: (ಮನೆಯ ವಿಳಾಸ) School address: (ಶಾಲೆಯ ವಿಳಾಸ)

Instruction:

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

0: No 1: Occasionally 2: Frequently 3: Always

ವಿಭಾಗ Aಸಂಖ್ಯೆ 1 ರಿಂದ 10 ರವರೆಗಿನ ಪ್ರಶ್ನೆಗಳಿಗೆ ವಿವರವಾಗಿಉತ್ತರಿಸಿ. ವಿಭಾಗ B, C ಮತ್ತು Dಗಳಿಗೆ ನಿಮ್ಮ ಆಯ್ಕೆಯನ್ನು 0,1, 2,3ಸಂಖ್ಯೆಗಳ ಮುಂದೆ ಟಿಕ್ (V) ಹಾಕುವ ಮೂಲಕ ಸೂಚಿಸಿರಿ. ಪ್ರತಿಯೊಂದು ಸಂಖ್ಯೆಯ ಅರ್ಥ:

0:(ಇಲ್ಲ)1 :(ಒಮ್ಮೊಮ್ಮೆ) 2 :(ಮತ್ತೆ ಮತ್ತೆ) 3:(ಯಾವಾಗಲೂ)

SECTION A: Classroom condition and General information (ತರಗತಿಯ ವ್ಯವಸ್ಥೆ ಹಾಗೂ ಸಾಮಾನ್ಯ ಮಾಹಿತಿ)

1. Comments about your voice:

ನಿಮ್ಮಧ್ವನಿಯಬಗ್ಗೆವ್ಯಾಖ್ಯಾನ ನೀಡಿ.

2. How many students are there in your class?

ನಿಮ್ಮತರಗತಿಯಲ್ಲಿಎಷ್ಟುಜನವಿದ್ಯಾರ್ಥಿಗಳಿದ್ದಾರೆ?

3. Do you teach primary or secondary grade classes?

ನೀವು ಪ್ರಾಥಮಿಕ ತರಗತಿಗಳಿಗೆ ಭೋಧಿಸುತ್ತೀರಾ ಅಥವಾ ಪ್ರೌಢ ತರಗತಿಗಳಿಗೆ ಭೋಧಿಸುತ್ತೀರಾ?

4. Where is your school located—Noisy environment/Quiet environment?

ನಿಮ್ಮಶಾಲೆಯ ವಾತಾವರಣವು ಶಬ್ದಮಾಲಿನ್ಯದಿಂದ ಕೂಡಿದವಾತವರಣದಲ್ಲಿಇದೆಯೇ ಅಥವ ನಿಶ್ಯಬ್ದವಾಗಿರುವ ವಾತಾವರಣದಲ್ಲಿ ಇದೆಯೇ?

5. Since how long you are working as a teacher?

ನೀವುಎಷ್ಟುವರ್ಷಗಳಿಂದಶಿಕ್ಷಕರಾಗಿಕೆಲಸಮಾಡುತ್ತಿದ್ದೀರಾ?

6. Mention the subjects you teach (past and present)

ನೀವು ಈಗ ಮಕ್ಕಳಿಗೆಯಾವಯಾವವಿಷಯಗಳನ್ನುಭೋಧಿಸುವಿರಿ (ಮೊದಲು ಹಾಗೂ ಈಗ)?

7. What is the maximum number of hours you teach regularly?

ನೀವುದಿನಕ್ಕೆಹೆಚ್ಚುಅಂದರೆಎಷ್ಟುತಾಸುಪಾಠಭೋಧಿಸುವಿರಿ?

8. What is the minimum number of hours you teach regularly?

ನೀವುದಿನಕ್ಕೆಕಡಿಮೆಅಂದರೆಎಷ್ಟುತಾಸುಪಾಠಭೋಧಿಸುವಿರಿ?

9. Do you have history of ear infections or hearing problem?

ನಿಮಗೆ ಕಿವಿಯ ಸೋಂಕು ಅಥವಾ ಕೇಳಿಸಿಕೊಳ್ಳಲು ತೊಂದರೆ ಇದೆಯೇ?

10. Do you use black board or white board? Specify.

ನೀವು ಭೋಧನೆಗೆ ಕಪ್ಪು ಹಾಗೂ ಬಿಳಿ ಬೋರ್ಡ್ ಗಳಲ್ಲಿ ಯಾವುದನ್ನು ಉಪಯೋಗಿಸುತ್ತೀರಾ?ತಿಳಿಸಿ.

11. Do you suffer from constant upper respiratory infections?

ನೀವು ಶ್ವಾಸಕೋಶಕ್ಕೆ ಸಂಬಂಧಪಟ್ಟ ಸೋಂಕುಗಳಿಂದ(ಗಂಟಲು ನೋವು, ಶೀತ, ಕೆಮ್ಮು) ಪದೇ ಪದೇ ಬಳಲುತ್ತಿರುತ್ತೀರಾ?

0	1	2	3

12. Does surrounding noise disturb you during teaching?

ನಿಮಗೆ ವಾತಾವರಣದಲ್ಲಿನ ಶಬ್ದಮಾಲಿನ್ಯದಿಂದ ಪಾಠ ಮಾಡಲು ತೊಂದರೆಯಾಗುತ್ತದೆಯೇ?

0	1	2	3

13. Do you clear your throat while teaching?

ಪಾಠ ಮಾಡುವಾಗ ಗಂಟಲು ಸರಿಮಾಡಿಕೊಳ್ಳುವ ಅಭ್ಯಾಸ ನಿಮಗೆ ಇದೆಯೇ?

0	1	2	3

SECTION B: Lifestyle (ಜೀವನ ಶೈಲಿ)

14. Do you indulge in long continuous chat?

ನೀವು ಸ್ವಭಾವತಃ ತುಂಬಾ ಹೊತ್ತು ಮಾತನ್ನಾಡುವಿರಾ?

0	1	2	3

15. Do you eat spicy or hot food?

ನಿಮಗೆತುಂಬಾಖಾರವಾದ ಅಥವಾ ಬಿಸಿಯಾದಆಹಾರವನ್ನುಸೇವಿಸುವ ಅಭ್ಯಾಸವಿದೆಯೇ?

0	1	2	3

16. Do you live in noisy environment?

ನಿಮ್ಮ ಮನೆಯು ಶಬ್ದಮಾಲಿನ್ಯದಿಂದ ಕೂಡಿದ ವಾತಾವರಣದಲ್ಲಿ ಇದೆಯೇ?

0	1	2	3

17. Do you live in dusty environment?

ನಿಮ್ಮ ಮನೆಯು ವಾಯು ಮಾಲಿನ್ಯ, ಧೂಳು ಅಥವಾ ಹೊಗೆಯಿಂದ ಕೂಡಿದ ವಾತಾವರಣದಲ್ಲಿ ಇದೆಯೇ?

0	1	2	3

18. Do you smoke?

ನೀವುಧೂಮಪಾನ ಮಾಡುವಿರಾ?

0	1	2	3

19. Do you consume alcohol?

ನೀವುಮದ್ಯಪಾನಮಾಡುವಿರಾ?

0	1	2	3

20. Do you take tuition? If yes, for how many hours?

ನೀವು ಮಕ್ಕಳಿಗೆ ಮನೆ ಪಾಠವನ್ನು ಹೇಳಿಕೊಡುತ್ತೀರಾ? ಹೌದೆಂದರೆ ಎಷ್ಟು ಹೊತ್ತು ಹೇಳಿಕೊಡುತ್ತೀರ. ತಿಳಿಸಿ.

0	1	2	3

21. Do you indulge in any of the following? If yes, indicate the number of hours against your choice/s

- Lecturing - Chanting - Announcement - Singing - Cheering

ನೀವು ಈ ಕೆಳಗಿನವುಗಳಲ್ಲಿ ಯಾವುದನ್ನಾದರು ಮಾಡುತ್ತೀರಾ? ಹೌದೆಂದರೆ ಪ್ರತಿಯೊಂದು ಕೆಲಸಗಳಿಗೆ ಎಷ್ಟು ಸಮಯ/ತಾಸು ಕಳೆಯುತ್ತೀರ ಎಂದು ಪ್ರತಿಯೊಂದು ಆಯ್ಕೆಯ ಮುಂದೆ ಬರೆಯಿರಿ.

- ಉಪನ್ಯಾಸ ನೀಡುವುದು - ಭಜನೆ ಮಾಡುವುದು - ಘೋಷಣೆ ಕೂಗುವುದು

-ಹಾಡುವುದು - ಉದ್ಘೋಷಿಸುವುದು

0	1	2	3

22. Do you use voice to discipline children at home?

ನೀವು ಮನೆಯಲ್ಲಿ ಮಕ್ಕಳಿಗೆ ಶಿಸ್ತನ್ನು ಕಲಿಸಲು ಧ್ವನಿಯನ್ನು ಉಪಯೋಗಿಸುವಿರಾ?

0	1	2	3

SECTION C: Vocal habits (ಧ್ವನಿಗೆ ಸಂಭಂಧಪಟ್ಟ ಹವ್ಯಾಸಗಳು)

23. Do you indulge in loud talking?

ನಿಮಗೆ ಏರು ಧ್ವನಿಯಲ್ಲಿ (ಜೋರಾಗಿ)ಮಾತನಾಡುವಅಭ್ಯಾಸಇದೆಯೇ?

0	1	2	3

24. Do you indulge in screaming or shouting in classroom?

ನಿಮಗೆತರಗತಿಯಲ್ಲಿ ಜೋರಾಗಿ ಕೂಗಾಡುವ ಅಭ್ಯಾಸ ಇದೆಯೇ?

0	1	2	3

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

ನಿಮಗೆ ಮನೆಯಲ್ಲಿಜೋರಾಗಿಕೂಗಾಡುವ ಅಭ್ಯಾಸ ಇದೆಯೇ?

0	1	2	3

26. Do you clear your throat frequently?

ನಿಮಗೆ ಗಂಟಲನ್ನು ಪದೇ ಪದೇ ಸರಿ ಮಾಡಿಕೊಳ್ಳುವ ಅಭ್ಯಾಸ ಇದೆಯೇ?

0	1	2	3

27. Do you have habit of singing loudly?

ನಿಮಗೆಜೋರಾಗಿಹಾಡುವಅಭ್ಯಾಸಇದೆಯೇ?

0	1	2	3

28. Do you practice any vocal exercises to project/improve your voice? Specify.

ನಿಮ್ಮ ಧ್ವನಿಯ ಸುರಕ್ಷತೆಗೆ ಅಥವಾ ಧ್ವನಿಯನ್ನು ಉತ್ತಮಗೊಳಿಸಿಕೊಳ್ಳಲು/ ಸಮರ್ಪಕವಾಗಿ ಉಪಯೋಗಿಸಲು

ನೀವು ಯಾವುದಾದರೂ ಧ್ವನಿಗೆ ಸಂಬಂಧಪಟ್ಟ ವ್ಯಾಯಾಮಗಳನ್ನು ಮಾಡುತ್ತಿರುವಿರಾ? ವಿವರಿಸಿ.

0	1	2	3

<u>SECTION D: Symptoms exhibited (ರೋಗಲಕ್ಷಣಗಳು)</u>

29. Does your voice tire very soon?

ನಿಮ್ಮಧ್ವನಿಯುಬೇಗನೆಆಯಾಸಗೊಳ್ಳುವುದೇ?

0	1	2	3

30. Do you perceive roughness in your voice?

ನಿಮ್ಮ ಧ್ವನಿಯು ಗಡಸಾಗಿದೆ ಅಥವಾ ಕರ್ಕಶವಾಗಿದೆ ಎಂದು ನಿಮಗೆ ಭಾಸವಾಗುತ್ತದೆಯೇ?

0	1	2	3

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

ನಿಮಗೆ ಗಂಟಲು ನೋವು, ಗಂಟಲಿನಲ್ಲಿ ಕಿರಿಕಿರಿ ಅಥವ ಗಂಟಲಿನಲ್ಲಿ ಒತ್ತುವಂತೆ ಭಾಸವಾಗುತ್ತದೆಯೇ?

0	1	2	3

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

ನಿಮ್ಮ ಗಂಟಲನ್ನು ಸರಿ ಮಾಡಿಕೊಳ್ಳಲು ನೀವು ಯಾವುದಾದರೂ ಆಯುರ್ವೇದದ ಔಷಧ ,ಉಪ್ಪುನೀರು,ಚೂರ್ಣ, ಪೆಪ್ಪರ್ ಮಿಂಟು ಅಥವ ಬೇರೆ ಯಾವುದಾದರೂ ದ್ರವ್ಯವನ್ನು ಉಪಯೋಗಿಸುತ್ತೀರಾ? ವಿವರಿಸಿ.

0	1	2	3

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

ನಿಮ್ಮ ಧ್ವನಿಯು ಬೆಳಗ್ಗಿನ ಹೊತ್ತು ಅಥವಾ ಸಂಜೆಯ ಹೊತ್ತು ಉತ್ತಮವಾಗಿರುತ್ತದೆಯೇ? ವಿವರಿಸಿ.

0	1	2	3

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

ನಿಮಗೆ ಧ್ವನಿಯನ್ನು ಏರಿಸಿ (ಜೋರಾಗಿ) ಮಾತನಾಡಲು ಕಷ್ಟವಾಗುತ್ತದೆಯೇ?

0	1	2	3

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

ಕೆಲವು ಸಮಯಧ್ವನಿಯ ಒಡಕು ಅಥವಾ ಧ್ವನಿಯು ಹೊರಡದೆ ಇರುವ ಪ್ರಮಯಗಳಿವೆಯೇ?

0	1	2	3

36. Have you undergone any of the following operations? a. Thyroidectomy b. Adenoidectomy c. Tonsillectomy d. Others related to head and neck.

If yes, did you notice any voice change after the operation?

ನೀವು ಈ ಕೆಳಗಿನ ಯಾವುದಾದರೂ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗಳನ್ನು ಒಳಗೊಂಡಿದ್ದೀರಾ? ಅ. ಥೈರಾಯ್‌ಡೆಕ್ಟಮಿ

ಆ. ಅಡಿನಾಯ್‌ಡೆಕ್ಟಮಿ ಇ. ಟಾನ್ಸಿಲ್ಲೆಕ್ಟಮಿ ಈ. ತಲೆ ಹಾಗೂ ಕತ್ತಿನ ಸಂಬಂಧಿ ಇತರೆ ಶಸ್ತ್ರಚಿಕಿತ್ಸೆ. ಹೌದೆಂದರೆ ಈ

ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಯ ನಂತರ ನಿಮ್ಮ ಧ್ವನಿ ಬದಲಾಗಿದೆಯೇ?

0	1	2	3

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

ನಿಮಗೆಗಂಟಲುಒಣಗಿದಹಾಗೆಅನಿಸುತ್ತದೆಯೇ?

0	1	2	3

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

ನೀವು ಹುಳಿ ತೇಗು, ಎದೆ ನೋವು, ಎದೆ ಉರಿಗಳಿಂದ ಬಳಲುತ್ತಿದ್ದೀರಾ?

0	1	2	3

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

ನಿಮಗೆ ಎ.ಸಿ.,ಧೂಳಿಗೆ ಅಥವಾ ಔಷಧಕ್ಕೆ ಅಲರ್ಜಿ ಇದೆಯೇ?ವಿವರಿಸಿ.

0	1	2	3

40. Do you feel that your voice is influenced by any of the following medical problems and or subsequent medication? (a) Diabetes (b) High blood pressure (c) Others

ನಿಮ್ಮ ಧ್ವನಿಯ ಮೇಲೆ ಈ ರೋಗಗಳು ಪರಿಣಾಮ ಬೀರುತ್ತದೆಯೆಂದು ನಿಮಗೆ ಅನಿಸುತ್ತದೆಯೇನು?

ಅ. ಮಧುಮೇಹ, ಆ. ರಕ್ತದೊತ್ತಡ, ಇ. ಇತರೆ ರೋಗಗಳು.

0	1	2	3

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

ನೀವು ಉದ್ವೇಗ, ಚಿಂತೆ ಅಥವಾ ಮಾನಸಿಕ ಒತ್ತಡದಿಂದಬಳಲುತ್ತಿದ್ದೀರಾ?

0	1	2	3

APPENDIX II

GRBAS SCALE

0- Normal, 1- Mild, 2- Moderate, 3- Severe

Sample Number:

Overall grade of severity	
Roughness	
Breathiness	
Asthenia	
Strain	

Sample Number:

Overall grade of severity	
Roughness	
Breathiness	
Asthenia	
Strain	

Article12

ORIGINALITY REPORT

15%	7%	11%	11%
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