



ORIGINAL RESEARCH PAPER

Otolaryngology

ACOUSTIC ANALYSIS OF VOICE IN SAWMILL WORKERS

KEY WORDS: Sawmill workers, Wooddust, Acoustic analysis

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ABSTRACT

Sawmills are industries where trees are cut into sawn wood in dusty processes. The inhalation of wood dust has been associated with upper and lower respiratory symptoms in humans including cough, wheezing, sputum production and shortness of breath which may have an adverse effect on their voice characteristics of saw mill workers. However, till date no study has been done on the voice characteristics of sawmill workers. The purpose of the study was to check their acoustical characteristics. The study was conducted on thirty sawmill workers and compared it on age and gender matched normal controls. The phonation of the vowel /a/ was recorded, fed into CSL 4500 module (Kay Pentax, New Jersey) and further analysis was carried out using the MDVP (Multi Dimensional Voice Program). The fundamental frequency measures, short and long term frequency perturbation measures were compared across both the groups. Significant differences were found in mean fundamental frequency, Jitter %, and RAP in both the groups. The results suggest there is significant difference in the voice characteristics of normal and the sawmill workers. These results also suggest the need for counseling, awareness and vocal hygiene measures among sawmill workers regarding the better care of their voice which will in turn help in improving their quality of life.

INTRODUCTION

Voice disorders are characterized by the abnormal production of vocal quality, pitch, loudness, resonance, and/or duration, which is inappropriate for an individual's age and/or gender. The etiology of voice disorder can be either congenital or acquired wherein the misuse/ abuse of voice is one of the common acquired cause. Certain occupations are associated with the continuous exposure of chemicals, dust etc during the processing and one among those is saw mill industry. Apart from the detrimental effects of the wood itself, microbial contamination has also been manifested to be a major exposure factor in this industry, particularly in the beginning phases of lumber milling. The major concerns of exposure include both bacteria and fungi, with airborne endotoxin presumed to be a major mediator of at least some wood dust-associated adverse effect. reported respiratory symptoms mainly cough chest pain and sputum production are reported amongst saw mill workers^[1]. Studies have also reported that fungal *Candida sp.* was detected in sputum of sawmill workers which was also associated with respiratory problems and reduced lung capacity^[2]. Studies have also reported that wood pellet workers experience higher frequency of nasal symptoms like dry cough and asthma compared to general population^[3]. Studies have also reported a significant difference in pulmonary function test parameters between the subjects of the study group exposed to sawdust and the control group and there is inverse relationship between different pulmonary function test parameters and duration of exposure in years^[4] and hypersensitivity in wood furniture workers^[5]. Similarly **studies have also** reported that occupational exposure to wood dust implication is that upper respiratory tract involvement was more likely compared to lower respiratory tract involvement, the latter presenting with wheeze, chest pain, breathlessness and tightness. Excessive talking, yelling, throat clearing, coughing, inhaling irritants, smoking & alcohol consumption are commonly seen in sawmill workers which results in injury to vocal folds.. Due to the associated respiratory problems there is a risk for them to develop voice problems. Therefore it is important to study the voice characteristics in sawmill workers using acoustical analysis. The aim of the present study was to investigate the voice characteristics of sawmill workers in terms of frequency perturbation measures.

METHOD

Participants: The sample population included a total of 60 male adults. The experimental group consisted of thirty sawmill workers in the age range of 20-25 years. The control group consisted of thirty males, age and gender matched normal individuals who were neither monk nor were professional voice users. Both groups

did not have any neurological or psychological symptoms neither did they have any history of smoking/ alcohol use also.

Procedure: The experimental group consisted of thirty male sawmill workers between the age group of 25-35 years who had a working experience of seven years. The participants were seated comfortably in a quiet noise free room. The subjects were asked to phonate vowel /a/ at their comfortable pitch and loudness. This was recorded using a portable digital Sony recorder- ICD UX81F using a constant mouth-to-microphone distance of 10 cm and 45° off-axis positioning. The best of three trials was selected for further analysis.

Instrumentation: The phonation sample was line-fed into the module of CSL 4500 (Kay Pentax, New Jersey) at 22k Hz sampling rate. The signal was displayed on the Multi Dimensional Voice Program (MDVP) program of the CSL 4500 and a 3 sec steady portion of the phonated vowel was identified and was subjected to acoustic analysis. MDVP provides a total of 33 parameters which can be classified under frequency measures, perturbation measures, noise measures, tremor measures and voice irregularity measures. In the present study, mean fundamental frequency, Jitter %, and Relative Average Perturbation measures were extracted. SPSS 20 was used for statistical analysis. Independent t-test was used to find out significant difference between groups on all parameters.

RESULTS & DISCUSSION

The aim of the present study was to compare the voice characteristics among sawmill workers and normal controls in terms of frequency perturbation measures. The results of independent t- test indicated a significant difference between participants in both the groups in all the three parameters. The mean fundamental frequency of the sawmill workers was 175 Hz, while that of normal controls (NC) was 130Hz (p<0.01). The jitter % was 2.8 for carpenters compared to 0.78 for normal(p<0.01).and Relative Average Perturbation (RAP) was 1.13 compared to 0.44 for normals(p<0.01) as shown in Table 1.

Parameters	Sawmill workers	Control group	p-value
Mean fundamental frequency	175 Hz	130 Hz	<0.01
Mean Jitter %	2.8%	0.78%	<0.01
Relative Average Perturbation	1.13	0.44	<0.01

Table 1: Table showing the mean values and p values of sawmill workers and Normal controls in terms of mean fundamental

frequency, Mean jitter %, Relative Average Perturbation values

Thus obtained measures can be used in differentiating normal from abnormal voices, screening individuals who are at risk for developing voice disorders, and for documenting therapeutic and surgical treatment outcomes. The results suggests that sawmill workers are at higher risk of experiencing voice disorders including hoarseness, discomfort, increased effort while using their voice, tiring or change in voice quality. The increase in mean Fundamental frequency in carpenters may be due to the pitch breaks evident from discontinuous vocal fold vibrations. The increase in the frequency perturbation measures in sawmill workers can be due to the phonatory instability.

CONCLUSION

The present study was an attempt to document voice characteristics in sawmill workers in the age range 20-25 years and to compare them with adult male norms of the same age group. The study throws light into the voice characteristics in terms of frequency perturbation measures in sawmill workers. The results revealed a significant difference of the mean values of the perturbation measures when compared with those of the normal adults. These results also suggest the need for counseling, awareness and vocal hygiene measures among sawmill workers regarding the better care of their voice which will in turn helps in improving their quality of life. The study may be replicated in a large population with larger sample size under each age group and by better controlling the factors that affect perturbation for better validation of the results.

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