



ACOUSTIC ANALYSIS OF VOICE IN NEPALESE BHIKKHUS

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ABSTRACT Bhikkhus commonly known as monks are the devoted followers of Buddhism. Bhikkhus indulge themselves in various vocal activities on a regular basis, hence they may be susceptible to various voice problems. However, till date no study has been done on the voice characteristics of Bhikkhus. The objective of this study was to uncover the acoustic characteristics of Nepalese Bhikkhus. The study was conducted on 30 Bhikkhus 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 %, RAP, PPQ and sPPQ in both the groups. The results suggest there is significant difference in the voice characteristics of normal and the Bhikkhus. These results also suggest the need for counseling, awareness and vocal hygiene measures among bhikkhus regarding the better care of their voice which will in turn helps in improving their quality of life.

KEYWORDS : Bhikkhus, Monks, Acoustic analysis, MDVP

INTRODUCTION

A **voice disorder** is characterized by the abnormal production of vocal quality, pitch, loudness, resonance, and/or duration, which is inappropriate for an individual's age and/or sex⁽¹⁾. The etiology of voice disorder can be either congenital or acquired wherein the misuse/abuse of voice is one of the common acquired cause of voice disorder. Certain individuals use their voice extensively to fulfill the demands of their lifestyle/ profession one among them are "Bhikkhus". A bhikkhu is an ordained male monastic and bhikkhuni is an ordained female monastic and are members of the Buddhist community. Nepal being a culturally rich and religiously diverse country, it consists of various religions such as Hinduism, Buddhism, Islam, Kiratism, etc. where in According to census 2011, Buddhism is the second largest religion comprising of 9% of the total population⁽²⁾. Buddhism is a religion that encompasses a variety of traditions, beliefs and spiritual practices mainly based on the teachings attributed to Gautam Buddha. Both bhikkhus and bhikkhunis follow a typical lifestyle according to a set of rules called the prātimokṣa that support a spiritual practice.

The bhikkhus indulge in various vocal activities such as recitation, praying, chanting and debate competitions. These activities are a part of their daily routine. Hence, their voice is used extensively for these activities (about 6-8 hours per day), most of which comprises the chanting of the religious mantras. However, till date no studies have been done on voice characteristics of bhikkhus so, the main objective of this study is to uncover the voice characteristics of bhikkhus.

There are numerous studies conducted on various groups of professional voice users. Studies have explored the prevalence and risk factors for voice problems among catholic priests and reported that 85.6% had voice problems during their career and 15.9% experienced frequent voice problems⁽³⁾. Studies have examined the voice of Indian hindu purohitis and the results revealed they exhibited more voice problems compared to normal controls⁽⁴⁾. They reported CPPCS (Cepstral Peak Prominence for Communicative Speech) was higher in the voice of purohitis compared to normal controls. Studies have also reported significant reduction in Maximum Phonation duration and more voice problems in clergy men compared to normal controls⁽⁵⁾. However, bhikkhus are involved in even more vocal demands like chanting, recitation, etc for about 6- 8 hours per day along with religious debates which makes them even more susceptible to voice problems compared to the above two groups. Therefore it is important to study the voice characteristics in bhikkhus using acoustical analysis.

METHOD

Participants: The sample population included a total of 60 male

adults. The experimental group consisted of thirty Nepalese bhikkhus 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 participants were seated comfortably in a quiet, noise free room. The task was demonstrated and the subjects were asked to phonate the vowel /a/ at their comfortable pitch and loudness. This was recorded using a portable digital Sony recorder- ICD UX81F with a constant mouth-to-microphone distance of 10 cm and 45° off-axis positioning. Three trials were recorded and the best of three was selected for further analysis.

INSTRUMENTATION:

The phonation sample was line-fed into the module of CSL 4500 (Kay Pentax, New Jersey) at 22 KHz sampling rate. The signal was displayed on the Multi Dimensional Voice Program (MDVP) of the CSL 4500 module and a 3 seconds 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 fundamental frequency measures, short and long term frequency perturbation measures were compared. Independent t-test was used to find out significant difference between all parameters of two groups.

RESULTS

The results of independent t- test indicated a significant difference between participants in both the groups in all the five parameters. The mean fundamental frequency of the bhikkhus (BKs) was 102 Hz, while that of normal controls (NC) was 130Hz (p<0.01). The mean Jitter % values for BKs were 2.8 % while for NC it was 0.73 % (p<0.01). The Relative Average Perturbation (RAP) values for BKs was 1.68, while that of NC was 0.44 (p<0.01). The Pitch Period Perturbation Quotient (PPQ) for BK was 1.94 while that of NC was 0.44 (p<0.01). The Smoothed Pitch Perturbation quotient (sPPQ) for BKs was 3.19 while that of NC was 0.63 (p<0.01).

Parameters	Bhikkhus	Control group	p-value
Mean fundamental frequency	102 Hz	130 Hz	<0.01
Mean Jitter %	2.8%	0.73%	<0.01
Relative Average Perturbation	1.66	0.44	<0.01
Pitch Period Perturbation Quotient	1.94	0.44	<0.01

Smoothened Pitch Perturbation quotient	3.19	0.63	<0.01
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Table 1: Table showing the mean values and p values of Bhikkus and Normal controls in terms of mean fundamental frequency, Mean jitter %, Relative Average Perturbation, Pitch Perturbation quotient & Smoothened Pitch Perturbation quotient

DISCUSSION

Excessive daily use of voice leads to various voice problems. As the literature suggests, various professional voice users are subjected to more voice problems than other groups. According to the results obtained the voice characteristics of Bhikkhus are significantly deviant from the normal. The increase in the frequency perturbation measures in BKs can be due to the phonatory instability as a result of vocal abuse and misuse. These might be due to excessive chanting, prolonged use of voice, throat clearing and use of loud voice during religious debates which in turn has an effect to their voice. Perturbation measures tap sudden and involuntary changes. A high degree of frequency perturbation measures results in a voice with roughness, which is usually perceived in the recordings of pathological voices. The above results are in consensus with previous studies^(3,4).

CONCLUSION

The present study was an attempt to document voice characteristics in Nepalese bhikkus in the age range 20-25 years and to compare them with adult male Nepalese norms of the same age group. The study throws light into the voice characteristics in terms of frequency perturbation measures in bhikkus. 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 bhikkus regarding the better care of their voice which will in turn help 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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