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A STUDY OF ACOUSTIC PARAMETERS OF NORMAL VOICE IN MEDICAL UNDERGRADUATE STUDENTS

Otorhinolaryngology

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ABSTRACT

Introduction: The study of normative data of voice is very important to aid in the identification of pathological voices.
Aim: To establish a database of normal acoustic parameters in medical undergraduate students.
Materials & Method: The study was carried out at the Department of Otorhinolaryngology, on 200 medical undergraduates of both sexes, aged from 18 to 25 years. All were subjected to computerized acoustic analysis using FONOS software. The analyses of the vocal parameters were carried out with the sustained /a/ vowel. The studied acoustic parameters were the fundamental frequency, shimmer and jitter disturbance measures, and the harmonic/noise ratios.
Results: The group mean (standard deviations) for males and females for fundamental frequency were 150Hz(39.03) and 208 Hz(44.78) respectively. Jitter (SD) for males and females were 2.54 %(3.11) and 2.21 %(3.14) respectively. Shimmer mean (SD) for males and females were 0.90 dB(0.80) and 0.92 dB (1.13) respectively. HNR (SD) for males and females were 6.01 dB(4.57) and 5.30 dB(5.03) respectively.
Conclusion: The significant difference in the fundamental frequency average values in function of gender, found in the present study was expected, since it is influenced by the length of the vocal folds, which is longer in males. This difference has been often pointed out in the literature.

KEYWORDS

Aging–Voice–Acoustic analysis–Jitter–Shimmer–Harmonic Noise Ratio

INTRODUCTION

Voice is the laryngeal modulation of the pulmonary air stream, which is then modified by the configuration of the vocal tract (Michel & Wendahl, 1971).

Acoustic analysis is one of the components of computerized voice labs, and it is useful to supplement voice assessment [1] and to assess speech.[2] Computerized acoustic vocal analysis, besides providing qualitative data, it also allows for a quantitative analysis of vocal parameters, through the use of vocal assessment parameters is able to provide different vocal assessment parameters and the most studied ones are the fundamental frequency, shimmer and jitter disturbance measures, and the harmonic to noise ratios. [3] The lack of homogeneity in the results from many studies shows the importance of doing additional studies with larger samples and the purpose of this investigation was to explore possible differences as a function of gender in perturbation (jitter and shimmer) and harmonics to noise ratio (HNR) among young male and female speakers.

Normative voice data are important for recognizing voice pathology and evaluating treatment success. For instance, the voices of speakers with organic disorders of the larynx have higher jitter and shimmer and a lower harmonics-to-noise ratio (HNR) relative to the voice of normal speakers[4], and measures of vocal jitter and shimmer in patients change to resemble those of healthy controls after the removal of vocal fold polyps. Although many studies have investigated the voice properties of healthy adults, a recent review on acoustic voice analysis concluded that measurement reliability between studies has been limited due to methodological differences such as variation in recording protocols, equipment, and acoustic analysis programs. In addition, there is a lack of normative data on some acoustic measures such as harmonic noise ratio, which may be one of the best acoustic predictors of perceptual qualities such as breathiness or dysphonia severity. Finally, past studies on healthy adults have often measured small numbers of participants, ranging from a sample.

The main objective of this study was to provide reference values on a wide range of voice acoustic measures from a large number of healthy younger, which were collected using a standardized protocol and measured using a robust waveform-matching technique, we recorded participants in a sound-attenuating booth using a high-quality microphone and a high sampling rate. Because combinations of voice quality measures may be more effective than single measures for distinguishing normal and pathologic voices.

There is an increased need for age-specific normative data as the population ages; thus, the reference values from this study may serve as a baseline for comparison with clinical populations. The data may also be used to investigate how voice changes with aging and it also used for better distinguish normal age related changes from pathologic changes.

AIM

The Aim of the present study was extracting and objectively evaluating various factors related to the acoustic waveform using FONOS software in normal subjects.

OBJECTIVES

The objective of this study is an analysis of the patient phonation, extracting the following parameters:

- Fundamental frequency F0
- Energy and peak-to-peak amplitude
- Jitter (frequency perturbation) as absolute and %
- Shimmer(amplitude perturbation) as absolute and %
- Harmonic to Noise Ratio, with graphical comparison to normative data

MATERIALS AND METHODS

Study design: Prospective observational study

Sample size: 200

Study centre: Department of Otorhinolaryngology
Dhiraj Hospital, S.B.K.S Medical Institute and Research Centre

Inclusion Criteria:
The inclusion criteria are under graduates medical student of both gender equally with otorhinolaryngeal diagnosis of normal larynx

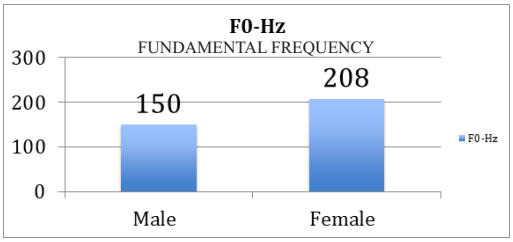
Exclusion Criteria
The exclusion criteria are: medical record for neurologic, psychiatric, endocrinologic or gastric disease; vocal complaints (hoarseness, vocal fatigue, voice gaps, etc.)

Procedure:
The samples obtained from the subject by holding a microphone 10 cm in front of their mouth and producing sustained phonation of a/a/vowel, with elimination of the irregularities in the beginning and end of utterance. The room for sampling is situated away from noise.

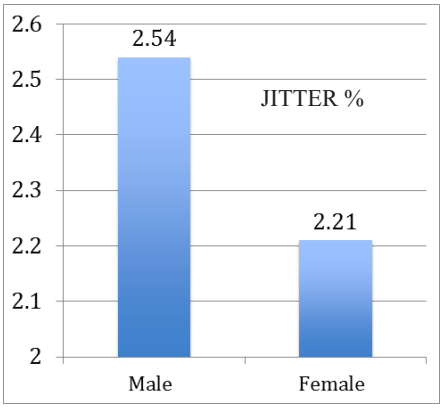
All voice samples are then subjected to computerized acoustic analysis using Multidimensional voice program software –FONOS.

Data collection was carried out in a sound treated room, using the acoustic analysis software FONOS. The microphone used was a SENNHEISER E 835, and it was kept at a fixed distance of 10 cm in front of the subject's mouth. We used the sustained vowels /a/ and /é/, in a comfortable and habitual way, after deep inhaling. The sustained vowel is preferred over regular speech in vocal acoustic assessment[5]

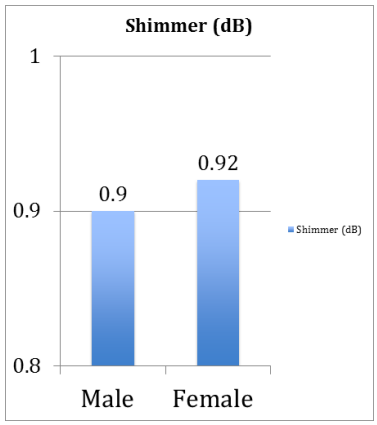
RESULTS



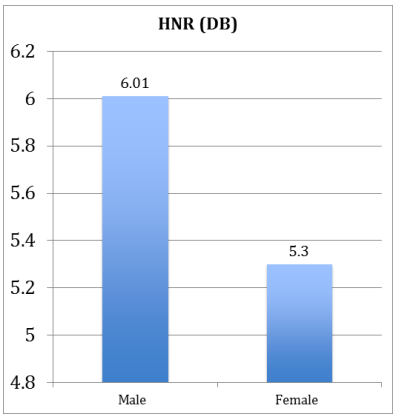
The participant data were analyzed for differences in gender groups on the dependent variables of fundamental frequency jitter, shimmer and HNR. Individual means were calculated immediately across the three trials of /a/ and only the individual average was saved for evaluation. Those individual averages were then combined for each gender and averaged to determine the gender group mean. The group mean (standard deviations) for males and females for fundamental frequency is 150(39.03) and 208(44.78) respectively.



Jitter (SD) for males and females were 2.54 %(3.11) and 2.21 %(3.14) respectively.



Shimmer means (SD) for males and females were 0.90 dB(0.80) and 0.92 dB (1.13) respectively



HNR(SD) for males and females were 6.01 dB(4.57) and 5.30 dB(5.03) respectively

DISCUSSION

The group mean (standard deviations) for males and females for fundamental frequency is 50Hz(39.03) and 208 Hz(44.78) respectively which is similar to what was observed in Bennett's study[6].

In our study the Jitter (SD) for males and females were 2.54 %(3.11) and 2.21 %(3.14) respectively

Shimmer mean (SD) for males and females were 0.90(0.80) and 0.92(1.13) Respectively

HNR(SD) for males and females were 6.01 dB(4.57) and 5.30 dB(5.03) respectively

VARIABLE	MALE (SD) n= 100	FEMALE (SD) n=100	p Value
AGE	20.9(2)	20.8(1.9)	
FUNDAMENTAL FREQUENCY HZ	150(39.03)	208(44.78)	<0.001
JITTER %	2.54(3.11)	2.21(3.14)	0.45
SHIMMER (DECIBELS)	0.90(0.80)	0.92(1.13)	0.89
HARMONIC NOISE RATIO (DECIBELS)	6.01(4.57)	5.30(5.03)	0.29

CONCLUSION

Gender group mean for each measure were then compared using t-tests with significance level set at $p < 0.05$, where the t value is the probability of type one error. The results for the t-tests between genders were fundamental frequency<0.001

jitter (%) p= 0.45, shimmer (db) p= 0.89, and HNR p= 0.29 . The results across all three measures revealed no statistically significant differences between genders when measuring perturbation and HNR.

The fundamental frequency average values in function of gender were significantly different which can be explained by the length of the vocal folds, which is longer in males. This difference has been often pointed out in the literature.

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