

Establishment of Acoustic Norms for PRAAT Software in 20-25 Year Old Indian Adults

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Abstract

PRAAT Software has very few norms in Indian population; especially in adult population has not been established. The present study was aimed to establish PRAAT norms for the adults in the age range of 20-25 years. A total of 180 subjects were selected which included 90 males and 90 females. A voice sample was taken for the production of /a/, /i/ & /u/. Voice parameters such as mean pitch, Jitter, Shimmer & HNR were assessed. Result showed significant difference between both genders and age groups for all voice parameters. Very less sample size & limited parameters were considered; hence that will be the limitations of the study. Future studies can be done on other adult groups particularly on geriatric group with other voice parameters on consideration.

Key words: PRAAT, Jitter, Shimmer, HNR, Geriatrics.

Introduction

“Voice presents an opening window to a person’s personality”. The human voice is extraordinary. Voice is the primary instrument through which most of the people project their personality and influence their environment. The production of human voice involves a complex series of events in the peripheral phonatory organs which are controlled by the central nervous system (Sataloff, 2006).

Analysis of voice can be carried out in several ways. Acoustic analysis is the one preferred the most and has been considered as the basic tool in the investigation of the voice disorder. Acoustic analysis enables one to objectify elements heard in the voice- pitch, loudness, hoarseness and so forth. Acoustic analysis has always been an important measure

obtained in clinical laboratories. However, there has been little standardization in measurement across laboratories.

The rationale for performing acoustic analysis is that it provides objective data relative to a set of normal values. While there can be a wide degree of variability among individuals performing the same vocal task – for different sex, age, smoking history, voice use – the value of acoustic analysis lies in the comparison of voice production for the same individual at different points in time.

There are several basic acoustic measures that are part of a standard acoustic analysis.

Fundamental Frequency - Fundamental frequency (F_0) is the number of vibrations per second produced by the vocal fold. Pitch is considered to be the perceptual correlate to fundamental frequency. The faster the vocal folds vibrate, the greater the fundamental frequency and the higher the pitch appears to the ear.

Intensity - Vocal intensity is the physical correlate of loudness and is primarily modulated by the sub glottal pressure, amplitude of vibration, and the duration of the closed phase of the glottal cycle.

Perturbation measures - Perturbation refers to cycle – to – cycle changes of period and amplitude during phonation. Two types of perturbation measures are typically used to characterize aperiodicity in the pitch and loudness of the voice. Jitter refers to cycle to cycle variability in the period (frequency); shimmer refers to cycle to cycle variability in the amplitude. Perturbations are thought to reflect changes in the vocal fold vibrations due to asymmetries in mass, neuromuscular activity, tension, biomechanical characteristics of the vocal fold, aerodynamic turbulence and systolic pressure shifts within the vocal fold blood vessels.

Spectral based measures- The spectrogram reflects sound information both in terms of the source and the filter. A narrow band setting of up to 50 Hz captures individual harmonics produced by the vocal folds and a wide band captures formants of the vocal tract. One useful measure to objectively quantify the degree of hoarseness in a patient is the harmonic to noise ratio. A high HNR represents a high quality periodic signal, common in normal voice quality. Dysphonia typically increases the noise component of the signal and hence the results in a lower HNR. PRAAT declares that a healthy voice phonating /a/ or /i/ should have an HNR of

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20, and 40 for the phonation of the vowel /u/. Consequently, an HNR below 20 is considered to be a measure of noticeable hoarseness.

PRAAT

PRAAT is a program for speech analysis and synthesis that was created by Paul Boersma and David Weenink at the department of English Phonetics of the University of Amsterdam, 1992. It is most often used with speech sounds, in which case the pitch contour is associated with the vibration of the vocal folds and the formant contours are associated with resonances in the vocal tract. There are various acoustic parameters in PRAAT they are, mean fundamental frequency of phonation, standard deviation of fundamental frequency, fundamental frequency of speech/reading, jitter, shimmer, signal to noise ratio and harmonic to noise ratio.

Literature Review

Normal standards are important for guiding voice professionals, since normal voice varies widely, given that it is a personal feature and no voice is perfectly equal to another. Normative or normal standards are needed based on the extraction and quantification of precisely defined voice signal standards to guide voice care professionals, particularly because of a paucity of studies with acoustic measures of normal voice in young female adults.

James, Panchapakesan, Rao & Zachariah (2011) did a study to establish the acoustic norms for PRAAT software in 13-15 years old boys and results revealed that mean F_0 for vowel /a/ is 177 Hz, Minimum pitch is 165 Hz, Maximum pitch is 185Hz, Jitter is 0.68%, Shimmer is 0.73 dB, HNR is 14.19 dB. Mean F_0 for vowel /i/ is 185Hz, Minimum pitch 170 Hz, Maximum pitch 195 Hz, Jitter is 0.63%, Shimmer is 0.802 dB, HNR is 15.24 dB. Mean F_0 for vowel /u/ is 196.85Hz, Minimum pitch 180 Hz, Maximum pitch 200 Hz, Jitter is 0.82%, Shimmer is 0.78 dB, HNR is 16.32 dB.

James, Ashir & Kumaraswamy (2013) developed a normative data for PRAAT software in the age range of 3 – 5 and results showed that a mean F_0 of 258.220 for /a/, 277.239, /i/ and 262.273, /u/; jitter of 0.556 % for /a/, 0.572 % for /i/ and 0.532 for /u/; shimmer of 0.484dB for /a/, 0.667 dB for /i/ and 0.815 dB /u/; HNR 0.077dB for /a/, 0.037dB for /i/ and 12.73dB /u/.

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Reshmi & Santhosh (2015) established a normative values of adults voice in Indian population using PRAAT and result revealed that f_0 /a, i, u/ of females were seemed to be higher in comparison to that of males. The f_0 /a, i, u/, jitter absolute /a/, f_1 /a/, f_2 /a/, f_3 /a, i, u/ have significant difference across the genders. Limitations of the study were limited data.

Shruthi & Kumaraswamy (2015) established a normative value for PRAAT software in the age range of 5 – 10 year old typically developing children and result showed a mean F_0 for /a/ is 271.6, /i/ is 287.2 and /u/ is 292.3; jitter of 0.6851 % for /a/, 0.4752% for /i/ and 0.5657% for /u/; shimmer of 0.4549 for /a/, 0.3220 /i/ and 0.2775/u/; SNR of .0269 for /a/; 0.0184 for /i/ and 0.0068 for /u/; HNR for /a/ is 17.5413, 19.9144 for /i/ and 25.5379 for /u/.

Need of the Study

Most of the voice analysis software's have got norm values but PRAAT software does not have norms for Indian population. Somewhat less amount of research has been done to know the norm values for PRAAT software, children's norms were already established as shown in literature, but the adult group PRAAT norms were not established. Hence the present study aims to establish PRAAT norm values for adult group.

Aim

The aim of the study is to establish acoustic norms for PRAAT software in 20-25 year old Indian adults by analysing the voice parameters.

Methodology

Subjects

A total of 180 subjects were selected which included 90 males and 90 females, age range was 20 -25 years, without the sign and symptoms of voice disorders. Criterion of selection was no history of vocal pathology or voice disorder, cold, flu, symptoms, allergies, neurological disease, and respiratory dysfunctions.

Procedure

The vocal signal was recorded and analyzed using the PRAAT software (version 5.1.04), assisted by a personal computer, with a microphone at a distance of 20 cm from the

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lips, in a quiet room. Vocal samples were all digitally recorded at a sampling rate of 41000 kHz. Subjects were instructed to take a deep breath and phonate /a/, /i/, and /u/ as long as possible. Following parameters were analyzed: mean pitch, jitter, shimmer & HNR.

Result and Discussions

The collected data were analyzed using ANOVA and results are discussed below for parameters such as mean pitch, jitter, shimmer and HNR across the group, within the group and between the genders.



Figure 1: mean values for mean pitch /a/, /i/ & /u/ values for both genders aged 20-25 year old Indian adults.

The above figure clearly shows a highly significant difference for mean pitch /a/in both genders of 6 groups (20 yrs – 136.260 for males, 233.400 for females) (21 yrs- 131.838for males, 220.101for females) (22 yrs -140.305for males, 224.778for females) (23 yrs – 139.660for males, 229.219for females) (24 yrs – 126.414for males, 220.976for females) (25 yrs – 130.639for males, 229.225for females).

Also for mean pitch /i/ result showed highly significant difference for both genders in 6 groups (20 yrs – 143.432 for males, 235.981 for females) (21 yrs- 133.310for males, 227.030for females) (22 yrs -143.254for males, 236.146for females) (23 yrs – 137.505for males, 231.410for females) (24 yrs –128.529 for males, 226.235for females) (25 yrs – 134.102for males, 227.737for females).

Also for mean pitch /u/ result showed highly significant difference for both genders in 6 groups (20 yrs – 144.614 for males, 237.700 for females) (21 yrs- 136.358for males,

229.601for females) (22 yrs -147.554for males, 233.701for females) (23 yrs – 140.775for males, 234.823for females) (24 yrs –132.230 for males, 214.814for females) (25 yrs – 133.456for males, 228.917for females).



Figure 2: mean values for jitter /a/, /i/ & /u/ values for both genders aged 20-25 year old Indian adults.

The statistical result showed that there is no difference for jitter /a/ in both genders except for 22 year group(22yrs /a/: 0.671for males, 1.870for females) and also similar findings were found for jitter /i/ in 21 year group (21 yrs /i/: 1.463for males, 3.208for females).

Jitter /u/ values for 22 year group and 25 year group has showed highly significant difference between both genders, (22 yrs/u/: 1.002for males, 3.272for females) (25 yrs/u/:0.990for males, 1.872for females) and 23 year group and 24 year group has showed significant difference for both genders (23 yrs /u/: 0.918for males, 1.721for females) (24 yrs /u/: 0.775for males, 1.393for females)



Figure 3: mean values for shimmer /a/, /i/ & /u/ values for both genders aged 20-25 year old Indian adults.

The statistical result showed that there is no difference for shimmer /a/, /i/ & /u/ in both genders for all age groups except for shimmer /u/ of 22 year group showed a highly significant difference seen in both genders (22 yrs /u/: 1.206for males, 1.858for females).

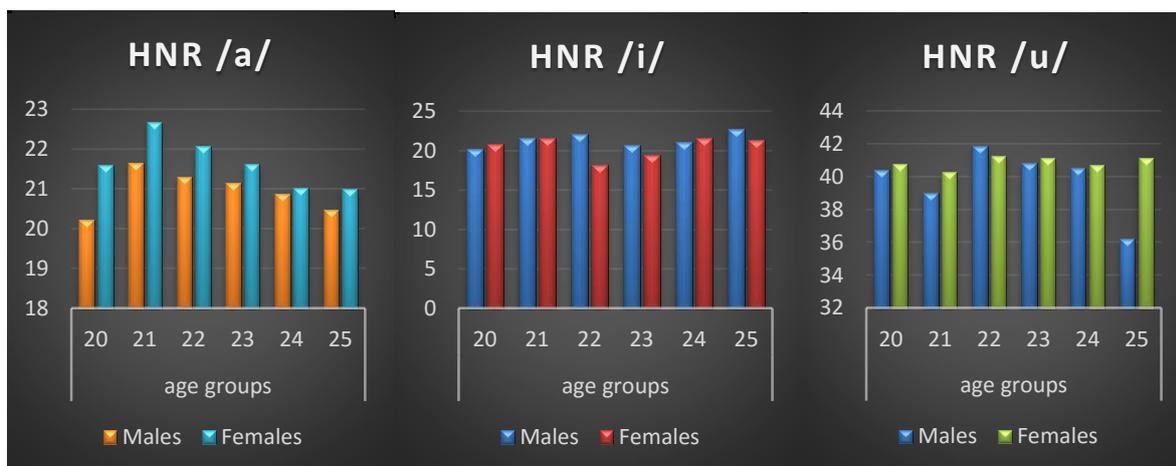


Figure 4: mean values for HNR /a/, /i/ & /u/ values for both genders aged 20-25 year old Indian adults.

The statistical result showed that there is no difference between HNR /a/, /i/ & /u/ values for both genders in all age groups. From the all above figures it clearly shows that there is a significant difference between, within group and both genders for all /a/, /i/ & /u/ values for mean pitch, jitter, shimmer and HNR.

Summary and Conclusions

The present study aimed to establish the PRAAT norm values for 20 -25 year old Indian adults. 180 adults were taken for the study in 6 groups (20, 21, 22, 23,24, and 25). In each group, 30 were present and they were further divided into 2 groups: 15 males &15 females. Subjects were asked to sustain /a/, /i/ &/u/ and were recorded using PRAAT software. Result showed highly significant differences between mean pitch of both gender for /a/, /i/ & /u/ values. No significant difference was seen for jitter /a/ and /i/ values but jitter /u/ values showed significant difference in all age groups for both genders. And also there was no significant difference seen for Shimmer and HNR /a/, /i/, &/u/ values for all age groups in both genders.

And the present study concluded that, the present normative values can be used as reference by speech language pathologists to deal with the diagnosis of voice disorders. Limitations of the study were the small sample size. We need large sample size for standardizing the norm values. Therefore further research can be done in large group for standardization. And study can also be done in other age groups with other voice parameters.

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References

- Araújo, S. A., Grellet, M., Pereira, J.C., & Rosa, M.O. (2002) Normatização de medidasacústicas da voz normal. Rev Bras Otorrinolaringol.; 68 (4):540-4.
- Benn Inger, S.M. Jacobson, H.B., &Johnson, F. A. (1994) Vocal arts medicine The care and prevention of professional voice disorders, Thieme Medical Publishers, Inc. New York. 141 -144.
- Boersama, P. & Weenink, D. (1992). Doing phonetics by computer software Available
- Edwin M-L. Yiu (2013) International Perspectives on Voice Disorders, multilingual matters,New York, Canada.182
- Guimarães,I., &Abberton,E. (2005) Fundamental frequency in speakers of portuguese for different voice samples. Journal of Voice 19(4):592-606

- James, T., Panchapakesan, P., Rao, S., & Zachariah, D. E. (2012). Establishment Of Acoustic Norms For PRAAT Software In 13-15 Years Old Boys, Paper Presented in 47th ISHA Conference at Chennai, India.
- James, J. S., Panchapakeshan, P. A., & Kumaraswamy, S. (2013). Normative Values For Acoustic Parameters Of Voice In Children In The Age Range Of 3 – 5 Using PRAAT Software in Indian population, Paper Presented in 46th ISHA Conference at Kochi, Kerala.
- Reshmi, M. & Kumar, S. (2015) Normative Values of Adult's Voice in Indian Population Using Praat. *International journal of scientific research*, vol. 4:10, 421-422
- Santos, I. R. (2005) Análiseacústica da voz de indivíduos naterceiraidade [dissertação]. São Carlos:Universidade de São Paulo (USP)
- Sataloff, T. R. (2006) Vocal Health and Pedagogy. 2nd Edition, San Diego: Plural publishing.
- Sataloff, T. R. & Benninger, M.S.(2016) Sataloff's comprehensive Textbook of Otolaryngology: Head & Neck Surgery, Jaypee Brothers Medical Publishers (p) Ltd. Daryaganj, 157.
- Shruthi, L. & Kumaraswamy, S. (2015) Normative Values for PRAAT in the Age Range of 5-10 Years Old Typically Developing Children. *Language in India*, vol. 15:5, 350-359.
- Williamson, G. (2014) Acoustic Measures (Norms). Retrieved from SLTinfo:
<http://www.sltinfo.com/acoustic-measures-norms/>

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