Normative Values for PRAAT in the Age Range of 5-10 Years Old Typically Developing Children

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Abstract

There are several softwares which have their normative values like MDVP, Dr Speech, and Vaghmi. The present study aims to establish a normative data for PRAAT software in the age range of 5-10 yrs. for Indian population. Two hundred and fifty children (between the age ranges of 5-10 years) participated in the study. Voice samples were elicited by asking each participant to produce sustained phonations of /a/, /i/ and /u/ sounds at his or her habitual levels of pitch and loudness lasting longer than 3 seconds. Each subject's Fundamental Frequency (Fo), jitter, shimmer, signal to noise ratio (SNR) and noise to harmonic ratio (HNR) were measured and analyzed using PRAAT software. Based on the acoustic analysis, the result of the current study is presented below, for children in the age range of 5-10 yrs a mean FO of 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/. Normatives obtained from PRAAT can be further used to compare the characteristics of abnormal and normal population.

Key words: Fo, HNR, SNR, phonation, PRATT

Introduction

Voice is produced by the interactive function of Respiratory, Laryngeal and Resonatory System. The human voice production involves a complex series of events which are controlled by the central nervous system. Age related structural changes to these systems will in-turn change the voice parameters. Acoustic analysis of voice has been used extensively in dealing with voice of the professional voice users and others. Analysis of

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vowel sounds helps us to understand the fundamental frequency (fo), intensity, and the filter characteristics (formant frequencies, jitter, shimmer, etc.). These measures are widely used, in part because of the availability of electronics and microcomputer based instruments, e.g., Kay elemetrics computerized speech Laboratory (CSL) or Multi speech, Real Time, Pitch, Multi – Dimensional voice.

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. Studies have been carried out to establish the acoustic norms using other software's like Dr Speech, MDVP, and Vaghmi, are the software's which measure the acoustic parameters of speech as they have their own normative data. 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.

Studies have been attempted to establish the acoustic norms using other softwares Dr Speech, MDVP and Vaghmi, which measure the acoustic parameters of speech since they have their own normative data. Casiano, Roy, Lundy & Xue (2000), based on comparative study on acoustic analysis of singing and speaking voice in singing students using PRAAT concluded that shimmer and noise harmonic ratio were higher in spoken samples.

James, Panchapakesan, Rao & Zachariah (2011) aimed to establishment of acoustic norms for PRAAT software in 13-15 years old boys and results found that mean FO 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 FO 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 FO 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.

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James, Ashir & Kumaraswamy (2013) did a study to develop a normative data for PRAAT software in the age range of 3 – 5and results found that a mean FO 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/.Hence the present study focused to establish a normative data for PRAAT software in the age range of 5-10 yrs for Indian population.

Materials and Methods

The aim of the study is to establish a normative data of acoustic parameters of voice for children in the age range of 5-10 using PRAAT software for Indian population by analysing the voice parameters.

Participants

The subjects consisted of two fifty healthy Malayalam speaking typically developing children (between the age ranges of 5-10 years) participated in the study. They were divided into 5 age groups (5-6 years, 6-7 years, 7-8 years,8-9 years and 9-10 years) with 50 subjects in each group. All the subjects, included in the study were attending Malayalam medium school. Children participated in this study was from school in Kerala. Subjects selected should be done based on the academic register to rule out any pathologies were there. None of the subjects had a history of vocal pathology or voice disorder, cold, flu, symptoms, allergies, neurological disease, and respiratory dysfunctions.

Voice samples were elicited by asking each participant to produce sustained phonations of the /a/,/i/, and /u/ sound at his or her habitual levels of pitch and loudness lasting longer than 3 seconds. All acoustic analyses were conducted using PRAAT software (version 5.1.04).

Results

The data obtained were statistically analyzed by using the one way ANOVA. The results are discussed below.

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ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
Mean pitch	Between Groups	60234.539	2	30117.270	25.540	.000
	Within Groups	884412.727	750	1179.217		
	Total	944647.266	752			
Jitter	Between Groups	5.547	2	2.773	.975	.378
	Within Groups	2134.107	750	2.845		
	Total	2139.654	752			
Shimmer	Between Groups	4.211	2	2.105	36.033	.000
	Within Groups	43.823	750	.058		
	Total	48.034	752			
SNR	Between Groups	.051	2	.025	14.726	.000
	Within Groups	1.292	750	.002		
	Total	1.342	752			
HNR	Between Groups	8391.409	2	4195.704	323.193	.000
	Within Groups	9736.532	750	12.982		
	Total	18127.941	752			

Table 3 Shows Sum of squares, Mean square, F value of Mean pitch. Jitter, Shimmer, SNR& HNR.

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From One way ANOVA it is clear that significant difference exists between the age groups for mean pitch & Shimmer at 5 % level of significance while for the Jitter, HNR & SNR they are equal on an average irrespective of the categories.
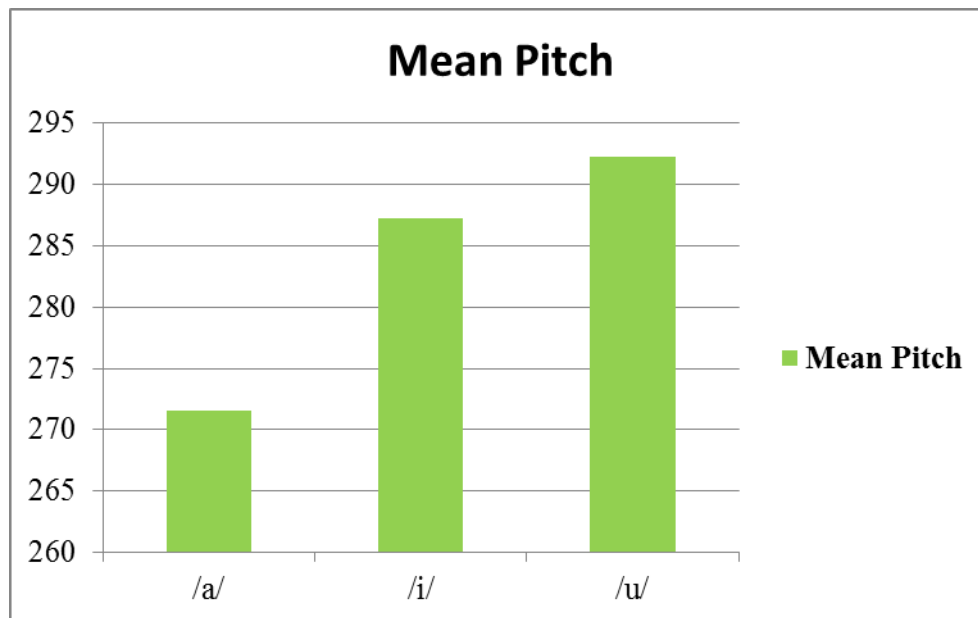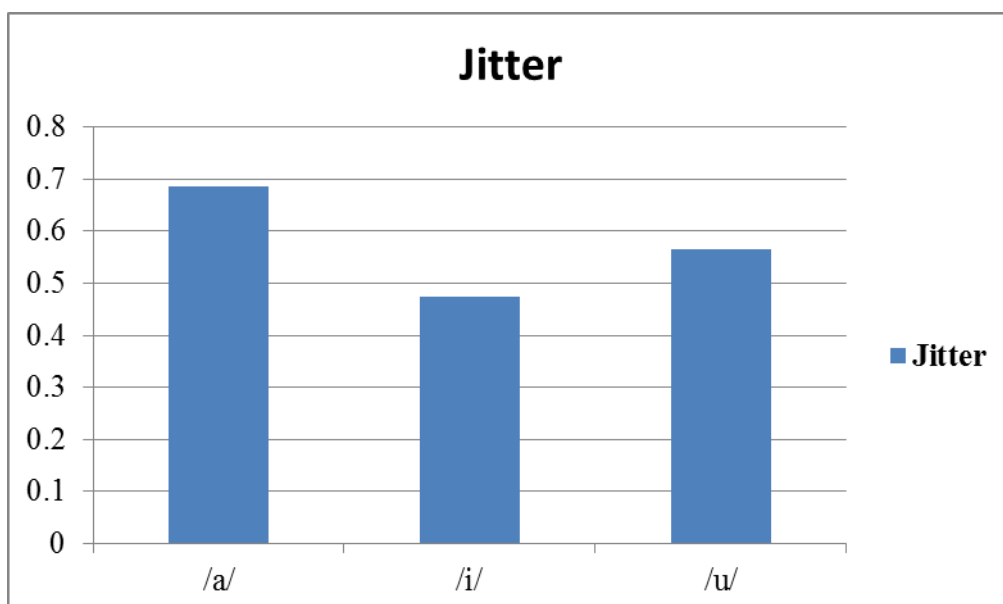

Fig. 1: Depicting mean Fo of for /a/ ,/i/ and /u/.
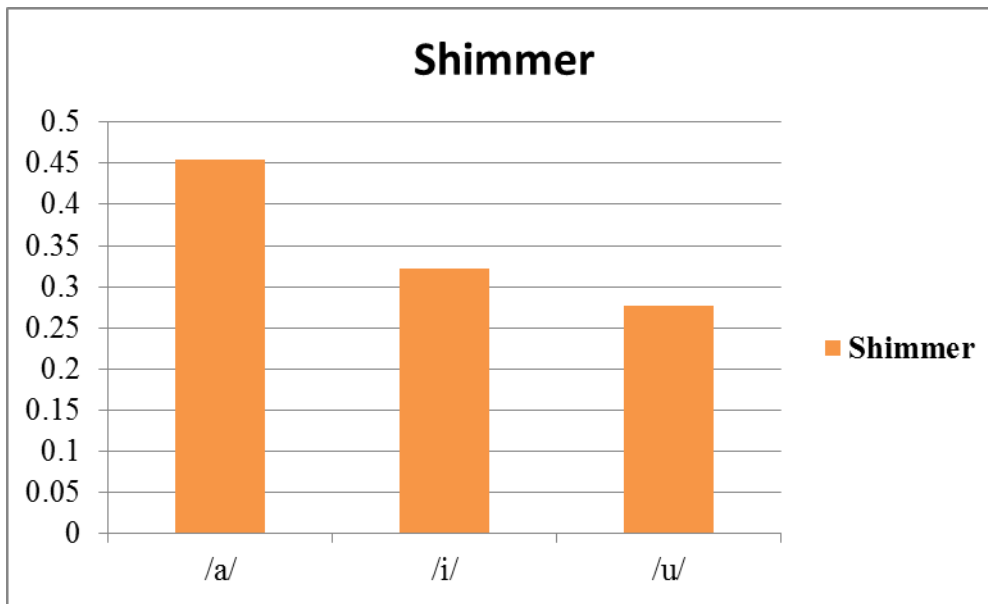

Fig 2: Depicting mean Jitter of /a/, /i/ and /u/

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Fig. 3: Depicting mean Shimmer of /a/,/i/ and /u/
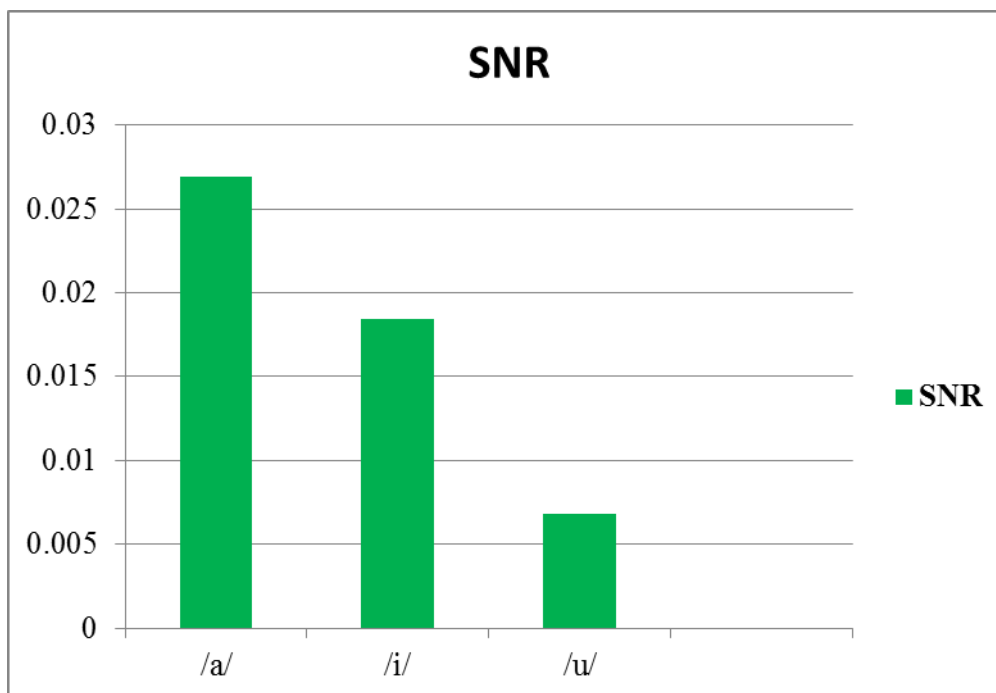
Fig. 4 Depicting mean SNR of /a/, /i/ and /u/

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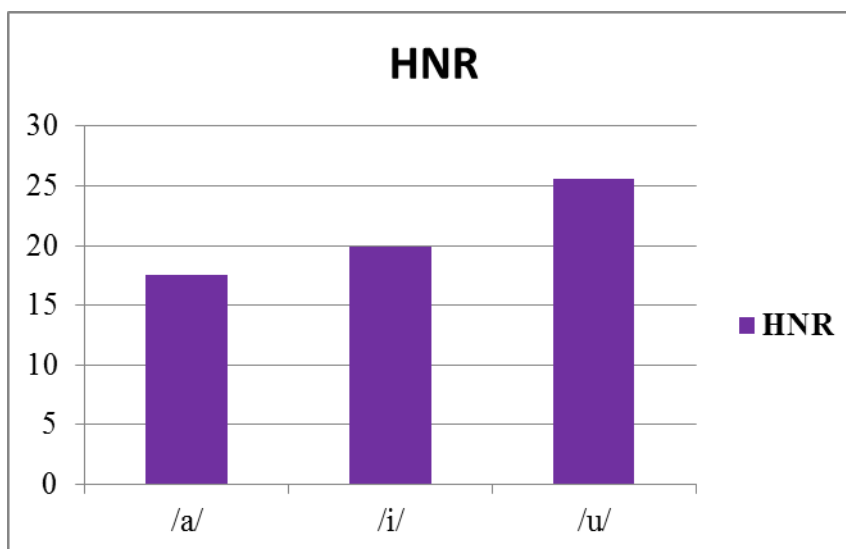
Fig. 5 Depicting mean HNR for /a/ /i/ and/u/.

From the above figures (1, 2, 3, 4 & 5) it's clear that the parameters such as Mean Pitch, Jitter, Shimmer, SNR, HNR varies for /a/,/i/ and/u/ for the age group 5-10yrs typically developing children.

From the above figure (1and 5) the Mean pitch and HNR value is higher for /u/ compared to /a/ and /i/. Likewise in graphs 2, 3 and 4,the jitter, shimmer and SNR value for/a/ is higher compared to /i/ and /u/.

Discussion

The results obtained from the present study provided an acoustic normative value for the acoustic parameters i.e., Fundamental frequency of Mean pitch, Jitter, Shimmer, SNR and HNR of 5-10 years old Typically Developing children using PRAAT.

The present study noted statistically considerable significant difference between /a,/i/ and /u/ for all the parameters except for Jitter at 1% level of significance irrespective of the age group. It is also clear that there exists a significant difference between the age groups for mean pitch & Shimmer at 5 % level of significance while for the Jitter, SNR &HNR, they are equal on an average which is in accordance with James (2013).

Summary and Conclusion

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PRAAT software does not have any normative data. When we assess the acoustic characteristics of speech, we will get an outline about the acoustic parameters so the present study was focused to develop a normative data for PRAAT software in the age range of 5-10 yrs. From the acoustic analysis, result of the current study is presented below:

For children in the age range of 5-10 yrs a mean FO of 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/.

This study gives an understanding to speech language pathologist regarding the various voice parameters that are expected to compare the characteristics of abnormal and normal population. This data can also be used to compare the normal voice with abnormal voice (puberphonia).

In summary, although several softwares have their own normative data; there is no normative data available for the PRAAT software especially in children in the Indian context. So the present study was aimed to establish a normative data for 5-10 yrs Old Typically Developing Children using PRAAT software in Indian population that is the attempt to a set value for Fo, Jitter, Shimmer, SNR and HNR.

Limitations

1. This study measures few parameters of the voice that are available in PRAAT software it's very important that to measure all the parameters of voice. Future studies will incorporate this factor.
2. One of other limitations of this study was the acoustic analysis of voice done in vowels only it is important that the analysis should be done in consonants and connected speech.
3. Future research can be done on large population to standardize the normative data.

Directions for Future Research

- To establish PRAAT norms for 5-10 years Old Typically Developing Boys.
- To establish PRAAT norms for 5-10 years Old Typically Developing Girls.

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- To establish PRAAT norms for consonants and connected speech in Typically Developing Children in the age range of 5-10 yrs.

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