ACOUSTIC ANALYSIS OF VOICE OF INDIVIDUALS WITH DIFFERENT PRAKRUTI

Joshi Namita Amey[1], Ambekar Sneha Bhalchandra[2], Kirane Nikita Uday[3], Indapurkar Kavita Vinayak[4]

[1]Associate Professor, [2,3]Undergraduate Student, [4]Head of Department

School of Audiology & Speech Language Pathology

Bharati Vidyapeeth Deemed University, Pune, Maharashtra, India

ABSTRACT

"*Prakruti*", by the medium of various traits defines the constitution of an individual. These traits are encoded within a specific range to express a particular *Dosha* (i.e. *Kapha, Vata, Pitta*). Thus a large similarity is seen in traits across individuals with similar *Doshas*. One such trait that is believed to be influenced by *Prakruti* is "voice". The voice of an individual is known to give an impression of individual's physical as well as psychological attributes. Keeping in mind the review of literature, the amount of research carried out on Prakruti-wise classification of voice is limited. Thus the aim of the study is to explore the acoustic characteristics of individuals with different *Prakruti*.

Keywords: *Prakruti, Doshas*, Voice.

INTRODUCTION

"*Prakruti*" is a Sanskrit term which means nature/constitution of an individual. The balance or imbalance of three *Doshas; Kapha* (mucous, lubricating and protective substances), *Vata* (air, movement, regulatory and controlling phenomenon), and *Pitta* (bile, enzyme, hormone and metabolizing substances) defines *Prakruti*[1]. Permutations and combinations of these three *Doshas*, predominantly govern the overall characteristics of an individual. *Prakruti* is said to be the qualitative and quantitative unchangeable trait a human posses in form of *Dosha* predominance from birth to death[2]. Given below are the characteristics of individuals with different *Prakruti*[3].

Kapha: Individuals with *Kapha Prakruti* are hefty, short and stocky, with strong musculature. They have relaxing habits/interests, thus have a soft and voluminous pulse; with stagnant performance of activity and normal perspiration. They are seen to be emotionally calm and attached and have a soft, sweet and resonating voice. Slow, clear speech patterns with weak long term memory are observed.

Vata: Individuals with *Vata Prakruti* are lean and tall. They have fast rate of speech and are talkative. They are seen to have wavering emotions and are introspective, shy and modest in nature. They are often unsettled and impatient, but are adaptable to change. They seldom show perspiration, and demonstrate irregular and quick pulse. They show irregular short term memory and excellent long term memory.

Pitta: Individuals with *Pitta Prakruti* have medium body weight, and body structure. Thus they possess moderate body strength resulting into excessive perspiration and foul odour. They encompass fast pulse but less in volume. They can be evidence for

sharp and commanding voice with provocative speech pattern. They tend to have a high temperament and powerful memory. These characteristics are assumed to be inherent qualities and are more or less average traits of the human beings. Like other traits, voice of an individual is believed to be majorly influenced by *Prakruti*[6]. *Prakruti* has been extensively researched in the past. A study had revealed that under normal circumstances, people with different *Prakruti* react differently when exposed to similar situations. This phenomenon was attributed to the different characteristics inherited by individuals with different *Prakruti*[1]. Another study postulated the inter-relationship between *Prakruti*-ageing and concluded that ageing can be delayed using appropriate dietary schedules of different *Prakruti*[4]. Research has also been done to list out the factors that influence and are influenced by *Prakruti*[5]. As depicted in Ayurvedic literature the voice of an individual changes according to his/her *Prakruti*[6]. However *Prakruti* of an individual and his/her voice is not much researched upon. Like *Prakruti*, voice is also said to be an impression of an individual's personality. Though *Prakruti* and personality cannot be considered as homonyms; a similarity can be drawn between the two. There have been attempts of studying relationship between emotions, personality and voice but there is a paucity of research in relating acoustical parameters of voice and *Prakruti*. Thus, the present study is aimed at investigating the acoustic changes observed in voice of individuals with different *Prakruti*.

MATERIALS AND METHODS:

Forty three participants in the age range of 18-21years were selected for the study. They consisted of thirteen males and thirty females. Informed consent was priory taken from all participants. A protocol was set for acoustic analysis of voice and all participants were made to undergo this protocol. The acoustic analysis of voice was carried out using CSL 4500 MDVP (Multi Dimensional Voice Profile) for obtaining acoustic parameters. Five acoustic parameters were selected for the study, namely; Fundamental frequency (F0) refers to average value for all extracted momentum pitch periods; Jitter (Jitt) refers to the relative evaluation of the period to period (very short term) variability of the pitch within the analyzed voice sample; Shimmer (Shim) refers to the relative evaluation of the period to period variability of the peak to peak amplitude within the analyzed voice sample; Soft Phonation Index (SPI) refers to average ratio of the lower frequency harmonic energy in the range 70-1550 Hz to the higher frequency harmonic energy in the range 1600-4200 Hz and Noise to Harmonic Ratio (NHR) that refers to average ratio of the inharmonic spectral energy in the frequency range 1500-2500Hz to the harmonic spectral energy in the frequency range 70-4500 Hz. The participants were instructed to take a deep breath and then produce vowel /a/ in habitual pitch and sustain it until cessation of breath. Recording of voice was done in quiet environment with no distortion. Since the physical characteristics and respiratory capacities have been specified to be different for all three *doshas*, Maximum Phonation Duration (MPD)[7] and s/z ratio[8] were calculated to evaluate their respiratory control. All the participants were asked to take a deep breath and produce vowel /a/ at their habitual levels and sustain it to maximum possible duration. This was done three times and the longest duration of /a/ production of all the three trials was

considered to be the MPD for a particular participant.[9] Participants were asked to take a deep breath, produce sounds /s/ and /z/ and sustain until cessation of breath. Ratio between /s/ and /z/ value was calculated to obtain s/z ratio. Similar values MPD and s/z ratio were set as the inclusion criteria so as to nullify the physiological effect on pitch and intensity parameters. Each participant was evaluated for his/her type of *Prakruti* through questionnaires by an Ayurveda professional. Ten participants were found to have *Kapha Pradhan Pitta Prakruti*; eight participants had *Vata Pradhan Pitta Prakruti*; three had *Vata Pradhan Kapha Prakruti*; twelve had *Pitta Pradhan Kapha Prakruti*; eight had *Pitta Pradhan Vata Prakruti* and two had *Kapha Pradhan Vata Prakruti*.

RESULTS/OBSERVATIONS: MANOVA was carried out to see the statistical analysis between the parameters across different *Prakruti*.

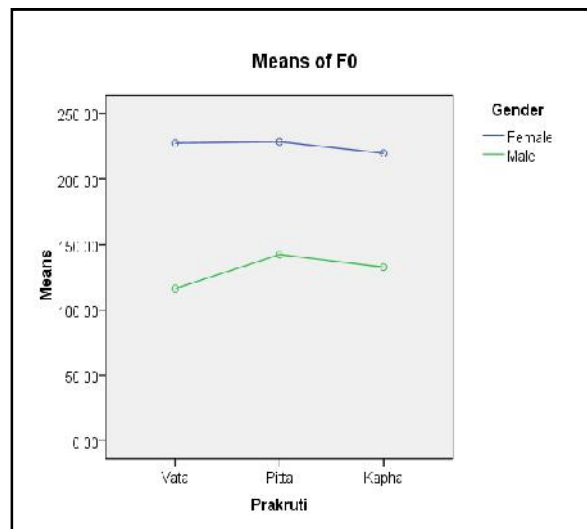**F0**: Fig.1 represents the mean scores of F0 across gender for *Prakruti*.

Fig.1: Mean scores of F0 across *Prakruti* and gender.

As shown in Fig.1 the mean values obtained for F0 across *Prakruti* and gender shows a rise fall pattern. The overall mean value for *Vata* is 227.60 for females and 116.29 for males. The mean for *Pitta* is 228.56 for females and 142.28 for males; and for *Kapha* is 219.76 for females and 132.72 for males respectively. The multivariate tests showed significant results (F=138.44(1), P<0.01) for gender. Post-hoc results indicated significant results in *Pitta Pradhan Kapha Prakruti* across gender as shown in Table 1.

Table 1: **RESULTS FOR F0 ACROSS *PRAKRUTI*.**

	Vata	Pitta	Kapha
Vata	1.00	0.17	0.83
Pitta		1.00	**.006****
Kapha			1.00

**Significance at 0.01 levels.

The significant results can be justified firstly as the largest number of participants of the study were of *Pitta Pradhan Kapha Prakruti* than any other combination. Secondly literature postulates that variations in the length of the vocal tract, anatomical differences of the vocal tract, resonating quality of voice etc. may contribute to the variations in F0[10,11,12]. Thus gender wise

differences in F0 must have been observed.

Jitt: Fig.2 represents the mean scores of Jitt across gender for *Prakruti*.
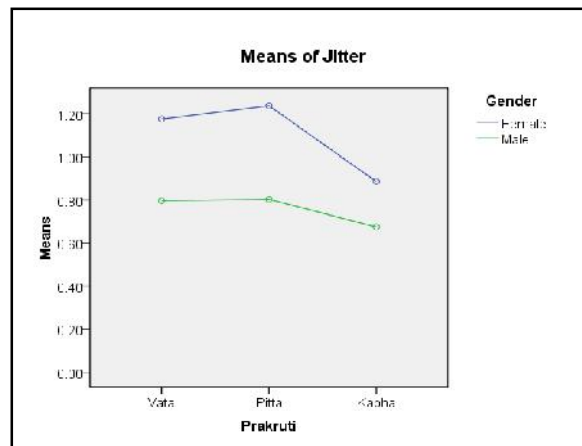

Fig.2: Mean scores of Jitt across *Prakruti* and gender.

As shown in Fig.2 the mean values obtained for Jitt across *Prakruti* and gender shows a variable pattern. The overall mean value for Vata is 1.18 for females and 0.80 for males; for Pitta is 1.24 for females and 0.80 for males; and for Kapha is 0.89 for females and 0.68 for males. The results of MANOVA indicated no significant result (F=1.74 (1) P>0.05). Jitt indicates variation in F0. Since the sample considered was of sustained phonation, it was obvious to have minimum difference in F0 variation across samples. Future studies need to be done on gliding or conversation samples to measure significant Jitt results.

Shim: Fig.3 represents the mean scores of Shim across gender for *Prakruti*.
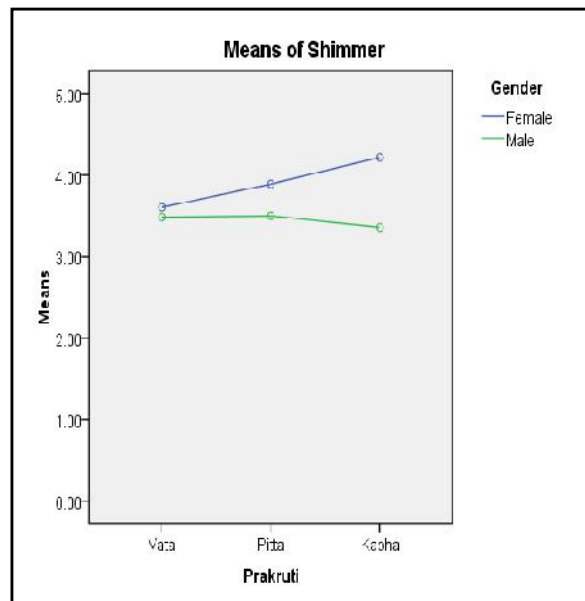

Fig.3: Mean scores of Shim across *Prakruti* and gender.

As shown in Fig.3 the mean values obtained for Shim across *Prakruti* and gender shows a rising pattern. The overall mean value for *Vata* is 3.61 for females and 3.49 for males; for *Pitta* is 3.89 for females and 3.50 for males; and for *Kapha* is 4.22 for females and 3.36 for males. The results of MANOVA indicated no significant result (F=0.19 (1) P>0.05). Post-hoc results indicated insignificant results for Shim.

SPI: Fig.4 represents the mean scores of .

SPI across age and gender for *Prakruti*
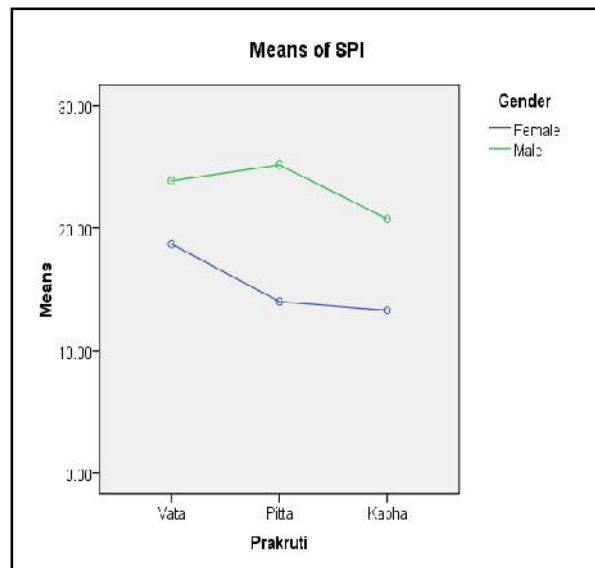

Means of SPI

Fig.**4: Mean scores of SPI across *Prakruti* and gender.**

As shown in Fig.4 the mean values obtained for SPI across *Prakruti* and gender shows a variable pattern. The overall mean value for *Vata* is 23.86 for females and 18.71 for males; for *Pitta* is 25.17 for females and 14.00 for males; and for *Kapha* is 20.76 for females and 13.28 for males. The results of MANOVA indicated significant result (F=15.37 (1) P<0.01). Post hoc

results indicated insignificant results for SPI.

SPI is an evaluation of the poorness of high frequency components that may be an indication of loosely adducted vocal folds during phonation. Studies postulate that alterations in the structure of the vocal tract indicate differences in SPI values[13,14], thus justifying the result.

NHR: Fig.5 represents the mean scores of NHR across age and gender for *Prakruti*.
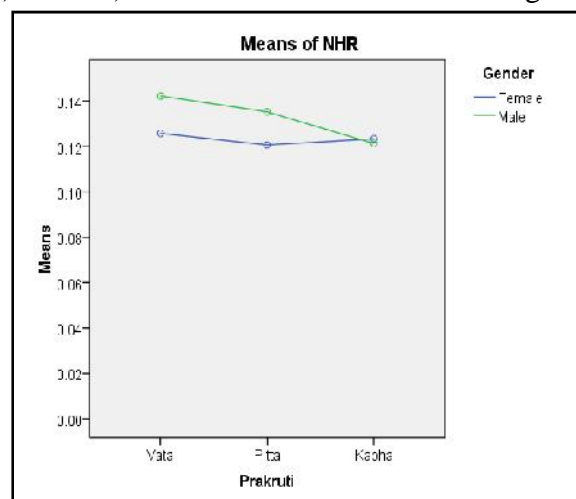

Means of NHR

Fig.**5: Mean scores of NHR across *Prakruti* and gender.**

As shown in Fig.5 the mean values obtained for NHR across *Prakruti* and gender shows a variable pattern. The over-

all mean value for *Vata* is 0.13 for females and 0.14 for males; for *Pitta* is 0.12 for females and 0.13 for males; and for *Kapha* is 0.12 for females and 0.12 for males. The results of MANOVA indicated no signifi-

cant result (F=0.40 (1) P<0.05). NHR was obtained within normal limits as number of harmonics was more than the level of noise. This ratio was found to be below one which is considered to be good for speech quality.

DISCUSSION:

To summarize, there is a high possibility that the postulated voice differences among individuals with different *Prakruti* in the literature are not acoustically identified. Among the parameters explored in the present study only F0 and SPI have shown significant difference across different *Prakruti*. However this difference may not be completely contributed to the types of *Prakruti* since these two parameters also have gender wise significant difference across the population. The present study also supports the literature which shows the gender wise change in F0 and SPI among the other acoustic parameters[10,11,12,13,14]. Thus we may infer that there is a need to find out the differences with other acoustical parameters which are not gender sensitive such as LTAS, formant analysis. The differences observed in the present study across the acoustic parameter are not due to *Prakruti* but due to the gender wise differences[15,16]. Hence the study needs to be done on a larger population to verify the differences stated by classical texts of Ayurveda.

CONCLUSION

The present study concludes the possibility of analyzing the voice acoustically across different *Prakruti*. The present study also gives the directions for further research. Further research can include the above mentioned parameters which are not gender specific and should correlate with different types of *Prakruti*.

REFERENCES:

1. Helen, B. (2005) *The essential guide to holistic and complementary therapy*. 35.
2. S. Ranade, R. Deshpande, S. Chobhe (2012). *A text book of Sharira-Kriya Vijnan (Part 1)*. Chaukhamba Sanskrit Pratishthan, New Delhi.
3. Rajah (2009), National Library of Ayurveda Medicine, www.nlam.in
4. Purvya M.C., Meena M.S.(2011), Effect of Prakruti on Ageing. *An International Quarterly Journal of Research in Ayurveda.* 32(1): 20-24.
5. Dhiman K. & Dhiman K. (2012) *International Journal of Ayurvedic and Herbal Medicine*. 477-487.
6. Charak (700 BC); revised by Sharma, R. K. & Bhagwan D. (2009). *Charak.*
7. Ptacek, P. & Sanders, E., (1963). Maximum duration of phonation, *Journal of speech and hearing disorders*, 28, 171-181.
8. Eckel, F. & Boone, D. (1981). The s.z ratio as an indicator of laryngeal pathology, *The Journal of Speech and Hearing Disorders,* 46(2), 147-149.
9. Colton R.H., & Casper J.K.(1996). Understanding voice problems: *A physiological perspective for diagnosis and treatment (2nd ed.)*. Maryland.
10. Pinczower, R., Oates, J. (2005). Vocal Projection in Actors; The Long-Term Average Spectral Features that distin-

guish comfortable acting voice from voicing with maximal projection in males actors. *Journal of Voice, 19* (3), 440-453.

11. Sheela, E.V. (1974). *A Comparative study of vocal parameters of trained and untrained singers.* Unpublished Masters Dissertation. University of Mysore, Mysore.

12. Rantala, L., Wilkman, E., & Bloigu, R. (2002). Voice changes during work; Subjective complaints and objective measurements for female primary and secondary school teachers. *Journal of Voice, 16,* 344-355.

13. Froscheles, E. (1939). *Twentieth century speech and voice correction.* NY; Philosophical Library.

14. Tavares, E., Labio, R., & Martins, R. (2010). Normative study of vocal acoustic parameters from children from 4-12 years of age without vocal symptoms. A pilot study. *Brazilian Journal of Otorhinolaryngology*, 485-490.

15. Chatterjee, I., Halder, H., Bari, S., Kumar, S. & Roychoudhury, A. (2011). An Analytical Study of Age and Gender Effects on Voice Range Profile in Bengali Adult Speakers using Phonetogram, *International Journal of Phonosurgery and Laryngology, 65-70.*

16. Iseli, M., Shue, Y., & Abeer, A. (2006). Age and gender dependent analysis of voice source characteristics, 389-392; University of California, Los Angeles.

CORRESPONDING AUTHOR

Dr. Ambekar Sneha Bhalchandra
Undergraduate Student
School of Audiology & Speech Language Pathology
Bharati Vidyapeeth Deemed University, Pune, Maharashtra, India
Email: sneha.ambekar96@gmail.com