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OBJECTIVE ACOUSTIC EVALUATION OF VOICE CHARACTERISTICS IN RELATION TO SHARIRPRAKRITI USING THE MULTIDIMENSIONAL VOICE PROFILE MODULE: AN OBSERVATIONAL STUDY

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ABSTRACT
Ayurveda places major emphasis on Sharir Prakriti as an individualized constitutional baseline. Classical texts describe characteristic voice qualities in Vata, Pitta and Kapha dominant constitutions; however, such descriptions have traditionally remained qualitative. The present manuscript converts the thesis work into a structured research paper by presenting an objective acoustic assessment of voice characteristics in relation to Dwandwaj Prakriti using the Multidimensional Voice Profile (MDVP) module.
To assess whether selected MDVP parameters - fundamental frequency (F0), Jitter, Shimmer, Noise-to-Harmonic Ratio (NHR) and Soft Phonation Index (SPI) - vary across Sharir Prakriti groups and to interpret the measurable voice findings in relation to classical Ayurvedic Swar descriptions.
Methods: This observational study was conducted among 33 healthy participants aged 18-24 years at Bharati Vidyapeeth (Deemed to be University) College of Ayurved and the School of Audiology and Speech Language Pathology, Pune. Prakriti was assessed using the CCRAS Prakriti Parikshan portal. Voice samples were recorded using the sustained vowel /aa/ in a quiet room with a microphone placed approximately 10 cm from the mouth. The best sample from 3-5 recordings was analyzed through MDVP. Data were compared using ANOVA.
Significant differences were found in F0, Jitter, Shimmer and NHR among the Prakriti groups. Vata-Pitta showed the highest F0 (253.00 +/- 6.71 Hz), Jitter (1.66 +/- 0.62%) and NHR (0.96 +/- 0.50). Vata-Kapha showed the second highest F0 (241.17 +/- 5.60 Hz), Jitter (1.06 +/- 0.55%) and NHR (0.25 +/- 0.32). Pitta-Vata demonstrated the highest Shimmer (3.20 +/- 0.28%) and SPI (18.30 +/- 5.27), while Kapha-Pitta showed the lowest F0 (162.67 +/- 36.02 Hz), Shimmer (2.04 +/- 0.23%) and NHR (0.09 +/- 0.02). SPI did not differ significantly among groups.

KEYWORDS: Sharir Prakriti; Swar; Ayurveda; MDVP; Fundamental frequency; Jitter; Shimmer; NHR; SPI; Voice analysis.

1. INTRODUCTION

Ayurveda describes Sharir Prakriti as an individual constitutional pattern based on the relative expression of Vata, Pitta and Kapha. It is used as a stable baseline for understanding structural, physiological and behavioural variation and is increasingly discussed as a traditional framework for personalized health care.[1-6]
Voice, or Swar, is an observable feature of communication and health. Classical texts describe Vata-associated voice as rough, weak or unstable; Pitta-associated voice as clear, soft or sharp; and Kapha-associated voice as pleasant, smooth and stable.[1-3]
Modern acoustic analysis quantifies voice through measures such as fundamental frequency (F0), Jitter, Shimmer, Noise-to-Harmonic Ratio (NHR) and Soft Phonation Index (SPI). These parameters represent pitch, cycle-to-cycle frequency and amplitude variation, harmonic noise and soft or breathy phonation.[8-10]
The present observational study therefore examined whether these MDVP parameters differ across Dwandwaj Sharir Prakriti groups and whether the measurable trends correspond with classical Ayurvedic descriptions of Swar.

2. Rationale and Research Gap

Classical descriptions of Swar are clinically meaningful but remain largely qualitative and observer-dependent. Prakriti research also requires transparent and standardized assessment, while acoustic voice measures are known to vary with sex, vocal intensity, vowel and recording conditions.[7,11-14] Limited work has objectively compared all five MDVP parameters across Dwandwaj Prakriti groups. This study addresses that gap by applying a standardized sustained-vowel protocol and MDVP analysis without proposing voice as a stand-alone diagnostic test for Prakriti.

3. Conceptual and Scientific Background

3.1 Ayurvedic basis of Prakriti and Swar

Prakriti is described as the constitutional expression of the doshas and their qualities. In Dwandwaj Prakriti, two doshas predominate and may produce blended features. Classical descriptions link Vata with movement, dryness and variability; Pitta with heat, sharpness and intensity; and Kapha with stability, smoothness and heaviness. These qualities are also reflected in traditional descriptions of Swar.[1-7]

3.2 Acoustic basis of the selected parameters

Voice production depends on respiratory airflow, vocal-fold vibration and vocal-tract resonance. F0 represents the average vibratory rate and is perceived as pitch; Jitter measures cycle-to-cycle frequency variation; Shimmer measures amplitude variation; and NHR estimates inharmonic noise relative to harmonic energy.[8-14]

SPI reflects the balance of low- and high-frequency harmonic energy and is used as a supportive indicator of soft or breathy phonation. Because these measures are affected by recording and speaker-related variables, they should be interpreted as complementary objective data rather than isolated diagnostic markers.[10,14,15]

4. Aim and Objectives

Aim: To assess the association between voice characteristics and Sharir Prakriti using the Multidimensional Voice Profile module.

Primary objective: To assess the association between selected acoustic voice characteristics and Sharir Prakriti.

Secondary objectives: To identify specific vocal characteristics that may be associated with different Prakriti types and to explore the use of objective voice analysis in Ayurveda.

Hypothesis: The null hypothesis stated that there is no significant association between voice characteristics and Sharir Prakriti. The alternative hypothesis stated that there is a significant association between voice characteristics and Sharir Prakriti.

5. MATERIALS AND METHODS

5.1 Study design and setting

The study was an observational study conducted at Bharati Vidyapeeth (Deemed to be University) College of Ayurved and Hospital, Pune, and Bharati Vidyapeeth (Deemed to be University) School of Audiology and Speech Language Pathology, Pune. The literary component included Ayurveda Samhitas, modern textbooks and relevant published research. The observational component included Prakriti assessment followed by acoustic voice analysis.

5.2 Participants and eligibility

Healthy participants from Bharati Vidyapeeth (Deemed to be University) Ayurved College, Pune were enrolled. The inclusion criteria were: healthy individuals, age between 18 and 24 years, and both genders. This age group was selected because vocal characteristics are considered stable and fully matured during this period. Participants with diagnosed voice disorders such as dyspnoea, vocal nodules or other laryngeal conditions, significant neurological or respiratory illness, age outside the selected range, or confounding factors that could affect voice such as hydration disturbance, emotional stress, excessive caffeine intake or vocal training were excluded.

5.3 Sample size and Prakriti distribution

A total of 33 participants were enrolled and classified into six Dwandwaj Prakriti groups. The distribution was: Vata-Pitta (n = 5), Vata-Kapha (n = 6), Pitta-Vata (n = 5), Pitta-Kapha (n = 6), Kapha-Vata (n = 5) and Kapha-Pitta (n = 6). The study thus focused on combined doshic patterns rather than purely single dosha constitutions.

Prakriti group	Number of participants	Percentage of total sample
Vata-Pitta	5	15.15%
Vata-Kapha	6	18.18%
Pitta-Vata	5	15.15%
Pitta-Kapha	6	18.18%
Kapha-Vata	5	15.15%
Kapha-Pitta	6	18.18%
Total	33	100%

Table 1. Distribution of participants according to Dwandwaj Sharir Prakriti.

5.4 Ethical considerations
Ethical clearance was obtained from the Institutional Ethics Committee of Bharati Vidyapeeth (Deemed to be University) College of Ayurved. The study was registered with the Clinical Trial Registry of India under CTRI/2026/01/100436.[17]Written informed consent was obtained after explaining the purpose, procedure, potential benefits and risks of the study. Participants were informed of their right to refuse or withdraw without penalty. Confidentiality was maintained by replacing personal identifiers with numerical codes.

5.5 Prakriti assessment
Sharir Prakriti assessment was conducted using the CCRAS Prakriti Parikshan portal. The assessment categorized participants into Dwandwaj Prakriti groups, and the obtained percentage and classification were recorded for comparison with MDVP parameters. Standardized reporting of the assessment method is important in Prakriti-based research.[7]

5.6 Voice recording and MDVP assessment
The voice analysis was performed using the Multidimensional Voice Profile module. Each participant phonated the vowel /aa/ using the tone and intensity of everyday speech after a demonstration. Recordings were obtained in a quiet room for at least three seconds, with the microphone approximately 10 cm from the mouth. Three to five recordings were made and the best acoustic sample was selected for analysis.[10-13]

MDVP parameter	Full form / meaning	Interpretive relevance in this study
F0	Fundamental frequency; average value across extracted pitch periods	Represents pitch and vocal fold vibratory frequency
Jitter	Cycle-to-cycle frequency perturbation	Represents short-term instability of pitch
Shimmer	Cycle-to-cycle amplitude perturbation	Represents instability of vocal intensity/amplitude
NHR	Noise-to-Harmonic Ratio	Represents inharmonic noise relative to harmonic energy
SPI	Soft Phonation Index	Represents low-frequency to high-frequency harmonic energy balance and soft/breathy phonation

Table 2. Acoustic parameters analyzed by the Multidimensional Voice Profile module.

5.7 Statistical analysis
The data obtained from MDVP and Prakriti assessment were analyzed statistically. One-way analysis of variance (ANOVA) was used to compare mean acoustic voice parameters among the six Prakriti groups. A p-value below 0.05 was considered statistically significant. The results were interpreted both statistically and in relation to Ayurvedic voice descriptions.

6. RESULTS
The results are presented according to each acoustic voice parameter. The parameters were compared across the six Dwandwaj Prakriti groups. Significant findings were observed for F0, Jitter, Shimmer and NHR, whereas SPI did not reach statistical significance. The reported descriptive values are retained from the thesis results.

6.1 Fundamental frequency (F0)

Prakriti	N	Mean (Hz)	SD	Min	Max	Median	Range
Kapha Pitta	6	162.67	36.02	118.00	200.00	175.00	82.00
KaphaVata	5	190.20	13.16	168.00	200.00	193.00	32.00
Pitta Kapha	6	198.67	30.82	140.00	230.00	204.00	90.00
Pitta Vata	5	205.40	13.03	190.00	223.00	200.00	33.00
VataKapha	6	241.17	5.60	233.00	250.00	240.00	17.00
Vata Pitta	5	253.00	6.71	245.00	260.00	250.00	15.00
ANOVA		F = 13.014	p = 0.000	Significant			

Table 3. Descriptive statistics of fundamental frequency (F0) across Prakriti groups.
The mean F0 values showed a statistically significant difference among the Prakriti groups. The Vata-Pitta group exhibited the highest mean F0 at 253.00 +/- 6.71 Hz, followed by Vata-Kapha at 241.17 +/- 5.60 Hz. The lowest mean F0 was recorded in the Kapha-Pitta group at 162.67 +/- 36.02 Hz. This pattern indicates higher pitch tendency in Vata-dominant combinations and comparatively lower pitch tendency in Kapha-dominant combinations.

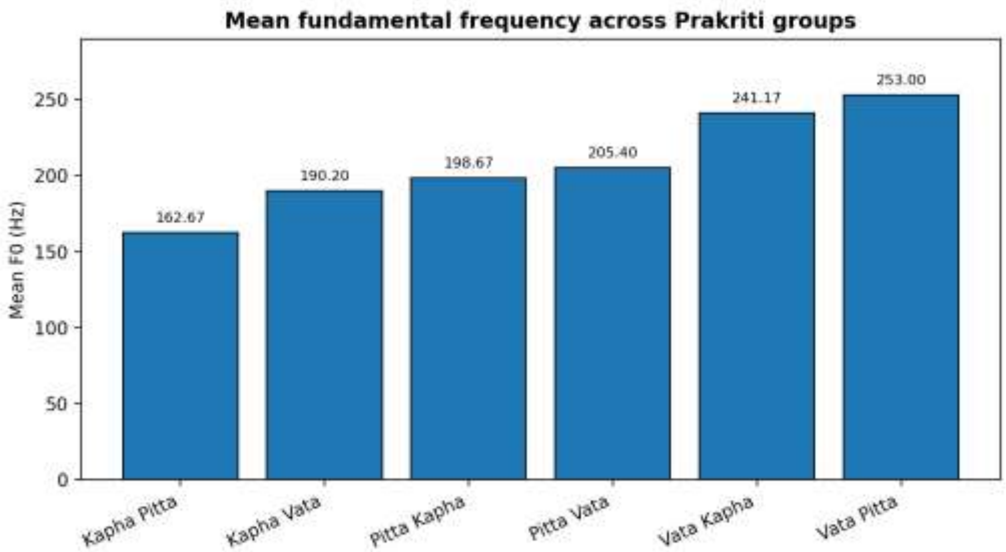

Figure 1. Mean F0 (Hz) across the six Dwandwaj Prakriti groups.

6.2 Jitter (%)

Prakriti	N	Mean (%)	SD	Min	Max	Median	Range
Kapha Pitta	6	0.66	0.32	0.44	1.29	0.52	0.86
KaphaVata	5	0.57	0.20	0.30	0.80	0.55	0.50
Pitta Kapha	6	0.84	0.37	0.42	1.31	0.82	0.89
Pitta Vata	5	0.70	0.46	0.20	1.19	0.65	0.99
VataKapha	6	1.06	0.55	0.46	2.00	1.00	1.54
Vata Pitta	5	1.66	0.62	1.00	2.30	2.00	1.30
ANOVA		F = 4.271	p = 0.005	Significant			

Table 4. Descriptive statistics of Jitter (%) across Prakriti groups.

Jitter showed significant variation across groups. The Vata-Pitta group had the highest mean Jitter value (1.66 +/- 0.62%), followed by Vata-Kapha (1.06 +/- 0.55%), while Kapha-Vata showed the lowest mean value (0.57 +/- 0.20%). Since Jitter represents pitch perturbation and cycle-to-cycle frequency variation, these findings support the observation that Vata dominance may be associated with relatively greater vocal instability.

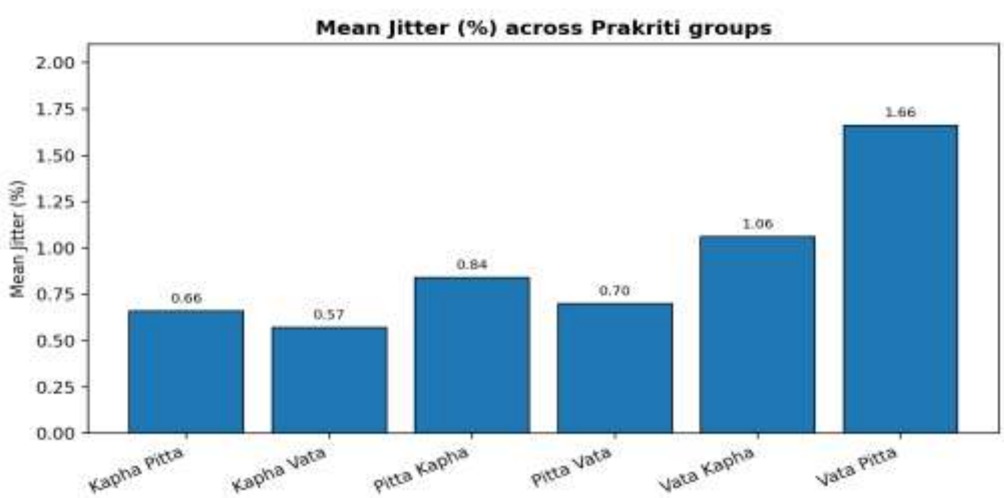

Figure 2. Mean Jitter (%) across the six Dwandwaj Prakriti groups.

6.3 Shimmer (%)

Prakriti	N	Mean (%)	SD	Min	Max	Median	Range
Kapha Pitta	6	2.04	0.23	1.87	2.50	2.00	0.63
KaphaVata	5	2.20	0.37	1.88	2.80	2.00	0.92

Prakriti	N	Mean (%)	SD	Min	Max	Median	Range
Pitta Kapha	6	3.04	0.30	2.50	3.34	3.10	0.84
Pitta Vata	5	3.20	0.28	3.00	3.60	3.00	0.60
VataKapha	6	2.92	0.60	2.30	4.00	2.85	1.70
Vata Pitta	5	2.56	0.26	2.40	3.00	2.40	0.60
ANOVA		F = 9.102	p = 0.000	Significant			

Table 5. Descriptive statistics of Shimmer (%) across Prakriti groups.

Shimmer also differed significantly across groups. The highest mean Shimmer value was observed in the Pitta-Vata group (3.20 +/- 0.28%), followed by Pitta-Kapha (3.04 +/- 0.30%). The lowest mean value was noted in the Kapha-Pitta group (2.04 +/- 0.23%). This suggests that amplitude perturbation may be more marked in Pitta-dominant combinations, particularly when associated with Vata.

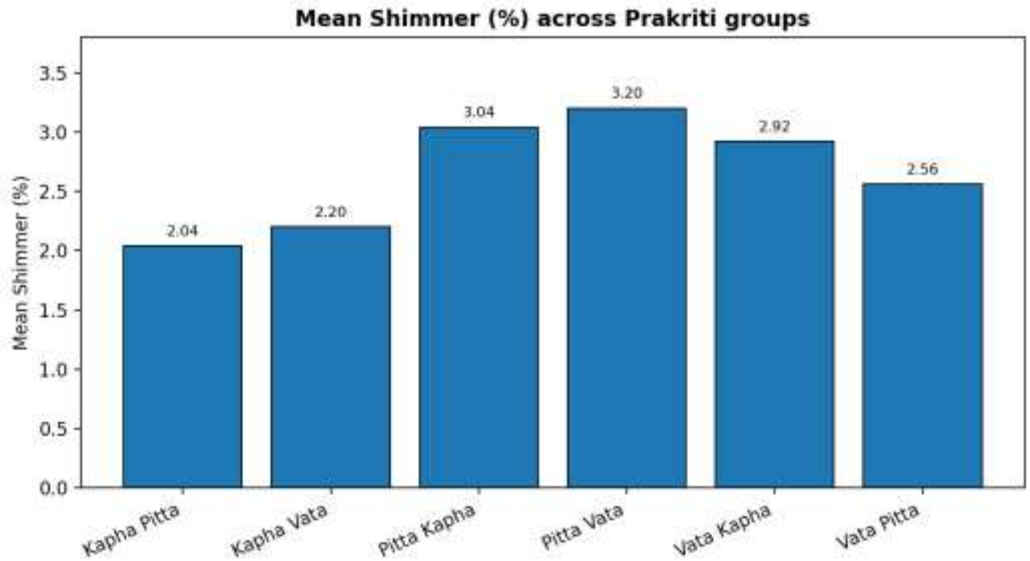

Figure 3. Mean Shimmer (%) across the six Dwandwaj Prakriti groups.

6.4 Noise-to-Harmonic Ratio (NHR)

Prakriti	N	Mean	SD	Min	Max	Median	Range
Kapha Pitta	6	0.09	0.02	0.06	0.12	0.10	0.06
KaphaVata	5	0.09	0.04	0.04	0.13	0.11	0.09
Pitta Kapha	6	0.12	0.01	0.10	0.13	0.12	0.03
Pitta Vata	5	0.12	0.02	0.11	0.15	0.12	0.04
VataKapha	6	0.25	0.32	0.09	0.90	0.13	0.81
Vata Pitta	5	0.96	0.50	0.09	1.30	1.20	1.21
ANOVA		F = 10.651	p = 0.000	Significant			

Table 6. Descriptive statistics of Noise-to-Harmonic Ratio across Prakriti groups.

NHR demonstrated statistically significant variation among the groups. The Vata-Pitta group showed the highest mean NHR (0.96 +/- 0.50), followed by Vata-Kapha (0.25 +/- 0.32). Kapha-Pitta and Kapha-Vata each showed the lowest mean NHR value of 0.09. Since NHR reflects the proportion of noise in the voice signal, the results suggest that Vata-dominant constitutions may show relatively more inharmonic or noisy components in the acoustic signal.

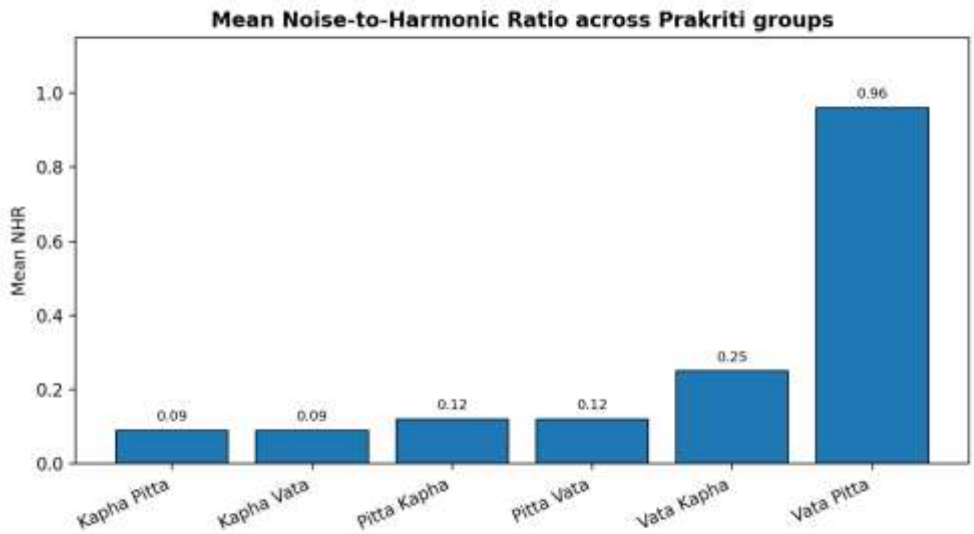

Figure 4. Mean Noise-to-Harmonic Ratio across the six Dwandwaj Prakriti groups.

6.5 Soft Phonation Index (SPI)

Prakriti	N	Mean	SD	Min	Max	Median	Range
Kapha Pitta	6	13.50	3.08	10.00	18.00	13.00	8.00
KaphaVata	5	11.89	3.17	8.00	16.00	11.44	8.00
Pitta Kapha	6	11.49	5.60	5.60	19.00	10.25	13.40
Pitta Vata	5	18.30	5.27	13.00	25.00	17.00	12.00
VataKapha	6	12.97	4.30	9.00	20.00	12.18	11.00
Vata Pitta	5	9.60	4.39	6.00	17.00	8.00	11.00
ANOVA		F = 2.258	p = 0.077	Not significant			

Table 7. Descriptive statistics of Soft Phonation Index across Prakriti groups.

The mean SPI values did not show a statistically significant difference among Prakriti groups. Although Pitta-Vata recorded the highest mean SPI (18.30 +/- 5.27) and Vata-Pitta recorded the lowest mean SPI (9.60 +/- 4.39), the difference did not reach statistical significance. Therefore, SPI should be interpreted cautiously as a supportive parameter rather than a definitive discriminator of Prakriti in this dataset.

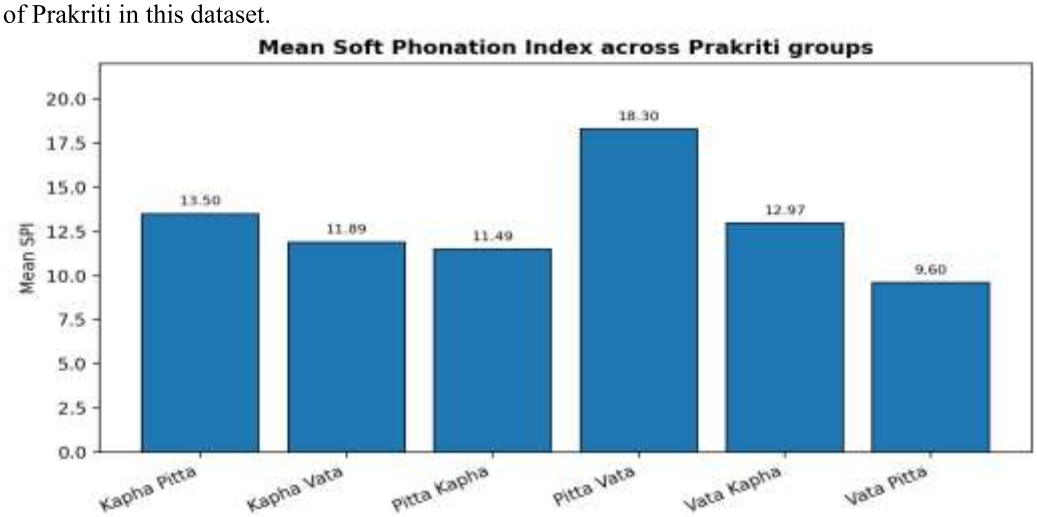

Figure 5. Mean Soft Phonation Index across the six Dwandwaj Prakriti groups.

6.6 Summary of significant MDVP trends

Parameter	Standard / reference value stated in thesis	Group with higher value	F-value	p-value	Result
F0 (Hz)	243.97	Vata-Pitta 253.00; Vata-Kapha 241.17	13.014	0.000	Significant

Parameter	Standard / reference value stated in thesis	Group with higher value	F-value	p-value	Result
Jitter (%)	0.63	Vata-Pitta 1.66; Vata-Kapha 1.06	4.271	0.005	Significant
NHR	0.11	Vata-Pitta 0.96; Vata-Kapha 0.25	10.651	0.000	Significant
Shimmer (%)	2.00	Pitta-Vata 3.20; Pitta-Kapha 3.04	9.102	0.000	Significant
SPI	7.53	Pitta-Vata 18.30; Kapha-Pitta 13.50	2.258	0.077	Not significant

Table 8. Comparative summary of MDVP parameters and statistical significance.

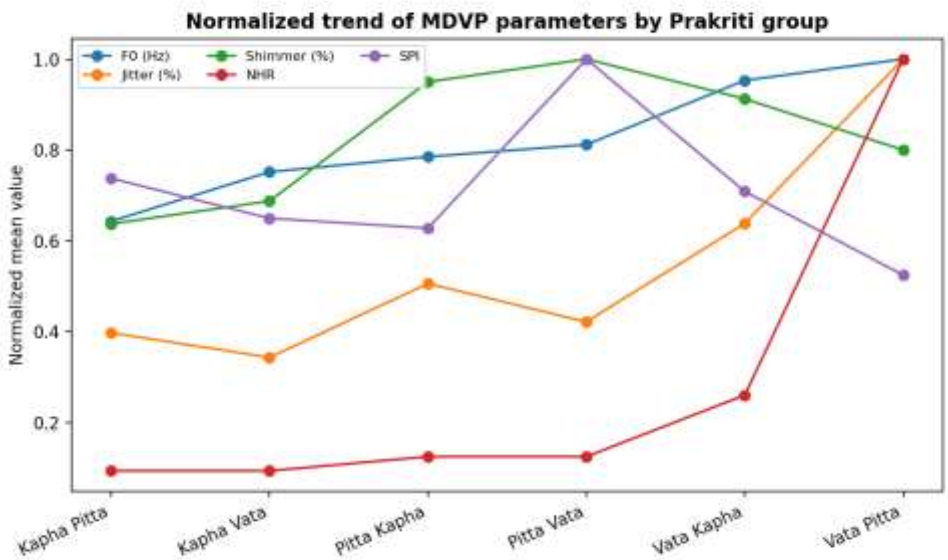

Figure 6. Normalized trend comparison of MDVP parameters across Prakriti groups.

6.7 Correlation of Ayurvedic voice characteristics with MDVP parameters

Ayurvedic voice characteristic	Meaning	Associated Prakriti / Dosha	Probable MDVP correlation
Ruksha	Rough, dry voice quality	Vata	Higher Jitter, higher Shimmer, higher NHR
Kshama	Weak or thin voice	Vata	Lower F0 with higher SPI
Chala	Fluctuating or unstable voice	Vata	Higher Jitter and variable F0
Pratata	Dispersed or irregularly spread sound	Vata	Higher Jitter and Shimmer
Sanna	Obstructed phonation	Vata	Higher NHR and altered SPI
Sakta	Constricted voice production	Vata	Increased perturbation measures
Jarjara	Dull or hollow resonance	Vata	Higher NHR and SPI
MriduUccharana	Soft and clear speech	Pitta	Moderate F0, lower Jitter and Shimmer
Prasanna	Pleasant and stable voice	Kapha	Normal F0, lower Jitter, lower Shimmer and lower NHR
Snigdha	Smooth and unctuous quality	Kapha	Lower perturbation measures

Table 9. Ayurvedic voice characteristics and their probable relation with MDVP parameters.

The MDVP findings showed a probable association with classical Ayurvedic voice descriptions. Higher perturbation measures can be interpreted as measurable reflections of rough, unstable or noisy voice qualities described in Vata dominance. Lower perturbation measures and more stable phonation are consistent with Prasanna and Snigdha voice qualities associated with

Kapha. Pitta-related Mridu Uccharana showed comparatively balanced parameters, although the Pitta-dominant groups showed higher Shimmer and SPI in this dataset.

7. DISCUSSION

F0, Jitter, Shimmer and NHR differed significantly among the six Dwandwaj Prakriti groups, whereas SPI did not. The selective pattern is important because it indicates that the association was not uniform across all acoustic measures.

Vata-Pitta showed the highest F0, Jitter and NHR, and Vata-Kapha showed the second-highest values. F0 is influenced by vocal-fold length, mass and tension, while Jitter and NHR reflect frequency instability and noise in the signal.[8-14]The observed pattern is therefore compatible with, but does not prove, the classical description of Vata-associated Swar as mobile, rough or irregular.

Pitta-Vata and Pitta-Kapha showed the highest Shimmer values. Because Shimmer represents cycle-to-cycle amplitude variation, the result suggests that amplitude instability may have a different Prakriti association from frequency instability. Kapha-dominant groups generally showed lower perturbation and noise values, which is consistent with the classical description of Kapha voice as smooth and stable.

SPI was highest in Pitta-Vata but the intergroup difference was not significant ($p = 0.077$). SPI has recognized interpretive limitations and should be treated as a supportive parameter rather than a definitive marker.[15]

8. CONCLUSION

This study found a probable association between Sharir Prakriti and selected MDVP voice parameters. Vata-dominant combinations showed higher F0, Jitter and NHR; Pitta-dominant combinations showed higher Shimmer; and Kapha-dominant combinations generally showed lower perturbation and noise values. SPI did not differ significantly among groups.

The results provide preliminary objective correlates for classical Swar descriptions but do not establish voice analysis as a diagnostic test for Prakriti. Larger, sex-stratified and methodologically standardized studies are needed before the findings can be generalized.

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