Comparison of Cardiovascular Autonomic Function Status in Normal Healthy Individuals of Various Ayurveda Prakritis

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ABSTRACT

Introduction: An ancient form of traditional medicine, Ayurveda, is based upon the various forms of prakriti and has drawn scientific interest from medical professionals. Important scientific applications of discerning prakriti (body constitution) lie in predicting disease susceptibility of an individual, and deciding disease prognosis and treatment of choice for it. This calls for inventing a universally applicable, standardized tool for the analysis of Prakriti, which would be helpful to integrate Ayurvedic fundamentals with allopathic medicine.

Objectives: To assess and compare cardiovascular autonomic function status in normal healthy individuals of various Ayurveda Prakritis.

Methods: This cross sectional study was carried out on 79 randomly selected normal healthy subjects in the age group of 18-40 years with dual constitutional prakriti types (Dvandvaja Prakriti). Various cardiovascular autonomic function tests were assessed in all these subjects.

Results: Out of all the cardiovascular reflex tests, mean values for heart rate response to postural change (30:15 ratio) as well as heart rate response to deep breathing were found to be the highest in kapha dominant prakriti, though not statistically significant. Both these parameters denote parasympathetic activity. Whereas, the mean value for heart rate response to Valsalva maneuver, which indicates both sympathetic and parasympathetic activity, was found to be the highest in vata prakriti though not statistically significant. Of all the tests done to evaluate the heart rate variability, the mean value for normalized high frequency (HFnu) which signifies parasympathetic modulation was again found to be the highest in kapha dominant prakriti individuals, though not statistically significant.

Conclusion: Our study results are suggestive of a parasympathetic predominance in normal healthy individuals with prakriti of kapha as primary dosha.

Keywords: Dosha, Heart rate variability, Kapha, Pitta, Vata.

INTRODUCTION

Ayurveda, an ancient form of traditional medicine, is considered to be the discipline of life and has an integrated approach to health and disease. Unfortunately, though considered to be the cure for various diseases, due to lack of scientific validation, Ayurveda finds it daunting to hold ground.[1] But as seen in recent times, many medical professionals and researchers have shown a rising interest in this traditional practice of medicine. As stated by the World Health Organization, around 70-80% of the population around the globe has shown interest in using Ayurvedic medicines. But as seen in recent times, many medical professionals and researchers have shown a rising interest in this traditional practice of medicine. As stated by the World Health Organization, around 70-80% of the population around the globe has shown interest in using Ayurvedic medicines.

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traditional medicines in their healthcare.[2] However, requisite recognition for Ayurveda from the modern medical fraternity is forthcoming. Ayurveda comprises comprehension about physiological, pathological along with psychological facets of botanical, zoological and mineral sources, including all particulars regarding them. Since Ayurveda holistically approaches health and personalized medicine in contrary to the generalized approach of biomedicine, it is worth taking into account the epistemological differences between Ayurveda and biomedicine while framing evidence-based research protocols.[3]

The Ayurvedic core concept of health is determined by an individual’s uniqueness based on three Doshas, Vata, Pitta, and Kapha, which materialize as the salient mechanisms executing the maintenance of homeostasis in humans. Accordingly, humans can be classified as seven constitutional types (Prakritis), depending upon the dominion of any single or a blend of two or three Doshas. A balance between these doshas is health and any imbalance leads to disease.[4,5] One of the riveting applications of discerning prakriti is in predicting disease susceptibility of an individual in order to implement targeted preventive measures prior to the actual surfacing of the disease. It also decides the prognosis of disease and the choice of therapy in a disease. This calls for inventing an universally applicable, standardized tool for the analysis of prakriti, which would pave the way to incorporate Ayurvedic fundamentals in routine clinical practice for evidence-based medicine.[6] This requires amalgamation of the concepts of the ayurvedic and the allopathic medicine with an unbiased attitude.[7]

In Ayurveda, prakriti is determined by pulse examination and certain other ways, the accuracy of which depends on the experience of the Ayurvedic practitioner (Vaids) and is quite subjective. Prakriti-based evidence will have a high impact on personalized medicine. But there is scarcity of quantitative studies, for instance, those on the reliability of prakriti assessment.[8] Hence, in the past few years, there have been few studies trying to unravel the relation between different diseases and cardiovascular autonomic response tests in different prakritis. Also, little research has been done in a direction to interpret the three doshas in terms of heart rate variability (HRV) bands. Since dosha imbalance is associated with diseases and diseases are associated with HRV bands, there is a prospect of determining the relationship between the three doshas and HRV bands.[9] This interlinking between specific parameters of autonomic function and specific prakriti may pave the way towards detecting the probable tendency of an individual to develop specific diseases, which might facilitate an integrated approach towards disease prevention.

Therefore, the present study was undertaken in an attempt to evaluate the cardiovascular autonomic function in different prakritis by using modern cardiovascular autonomic function tests. Because of complex mechanisms involved in the functioning of the autonomic nervous system, a comprehensive evaluation with a number of tests needs to be done.

### Materials and Methods

This was a cross-sectional study done in Dr. D.Y. Patil Medical College, Pune in collaboration with Dr. D.Y. Patil Ayurveda College, Pune. Ethical committee clearance was taken before initiating the study. For this, initially, 150 healthy age and sex matched subjects were randomly selected from the teaching and non-teaching staff. Written informed consent was obtained from every individual.

#### Inclusion Criteria

Healthy males and females between 18 to 40 years.

#### Exclusion Criteria

- Patients having cardiovascular, respiratory, autoimmune or any other systemic disease; or taking any kind of medication.
- Patients having any form of addictions like alcohol, smoking, etc.
- Obese and underweight subjects.

This study was carried out in the morning hours between 9am to 10am without any preceded consumption of tea, coffee or food by the subjects. A socio-demographic proforma containing details like age, sex, height, weight, domicile and family details of all the subjects was filled up prior to the study. History taking and general examination of all the subjects was done. Height was measured in erect position using a stadiometer and weight was measured using a standardized weighing machine. Body mass index (BMI) in terms of kg/m² was deducted as the ratio of weight in kilograms to the square of height in meters. Resting pulse rate was recorded, and baseline blood pressure in supine position was measured by mercury sphygmomanometer. Methodology was explained to the subjects, with demonstration and trials given prior to the actual recordings.

The prakriti evaluation was done by a qualified Ayurvedic practitioner (Vaidya). A self-assessment questionnaire based on the specific physical, physiological, and psychological characteristics determining an individual’s prakriti was administered to all the subjects. Out of 150, the Ayurvedic practitioner selected 80 subjects fulfilling the norms to be allotted to dual constitution prakriti type (Dvandvaja Prakriti). They were further divided into six groups with their dual constitution represented by a combination of primary dominant dosha and secondary dominant dosha, i.e. kapha-pitta (KP), kapha-vata (KV), vata-kapha (VK), pitta-kapha (PK), pitta-vata (PV).[10] Of all the selected subjects, there was one subject who instead of revealing his history of hypothyroidism during the initial history taking, did so only during his autonomic function testing and therefore, was excluded. Thus, the actual sample size was 79.

Then, the cardiovascular autonomic function tests were performed consisting of cardiovascular reflex tests and evaluation of heart rate variability.[10] A rest of 10 minutes was given before starting the tests and a rest of 5 minutes was given in between each test. After rest, acquisition was obtained in ECG mode on Polyrite D machine (multichannel digitalized polygraph machine, model 2.4, Chandigarh,
India). Continuous Lead II ECG was recorded. Signals were automatically recorded by software. Analysis of HRV parameters was done by Fast Fourier Transformation (FFT). Thus, the following tests were performed:

A. Autonomic cardiovascular reflex tests: \cite{11,12}

1. Heart rate response to postural change (30:15 ratio): The heart rate was continuously monitored while the subject was supine. The subject then stood unaided while ECG was continuously recorded for a minimum of 45 seconds and the instant at starting to stand was marked. 30:15 ratio was noted by measuring the shortest RR interval at 15th beat and longest one at 30th beat after standing and ratio more than 1.04 was considered normal.

2. Heart rate response to deep breathing (Deep breathing difference: DBD): The subject took breaths at 6 breaths per minute (5 sec of inhalation and 5 sec of exhalation) for 3 cycles (30 sec) and the difference between the average of the largest accelerations while inspiration and the average of the largest decelerations while expiration was calculated. A value > 15 beats/minute was taken as normal, 11–14 beats/minute as borderline and < 10 beats/minute as abnormal.

3. Heart rate response to Valsalva maneuver (Valsalva Ratio): This was executed in the sitting position. The nose was clamped and the subject was told to blow into a tube against closed glottis while controlling the mercury column at 40 mmHg for 15 seconds. Thereafter, the clamp was released. ECG was taken during rest and the subsequent 40 heart beats. Valsalva ratio computed was noted down with a value of this ratio ≥ 1.21 taken as normal.

B) Evaluation of heart rate variability: \cite{10,13}

Frequency domain variables of normalized low-frequency (LF nu), normalized high-frequency (HF nu), and LFnu/HFnu ratio were recorded. Time domain variables of SDNN (standard deviation of all R-R intervals over the selected time intervals) and RMSSD (root mean square of successive differences between adjacent RR intervals) were also computed for each subject.

Statistical Analysis
This was done with the help of SPSS software ver.17. The mean of each parameter for different prakritis was calculated. Intergroup comparison was done with P value obtained by one-way ANOVA; which if less than 0.05 was considered statistically significant.

RESULTS

| Table 1: Age wise distribution of study subjects |
| --- |
| Age (years) | No. of subjects | Percentage |
| <20 | 4 | 5.06 |
| 21 – 30 | 37 | 46.83 |
| 31 – 40 | 38 | 48.1 |
| Total | 79 | 100 |

| Table 2: Prakriti wise distribution of subjects |
| --- |
| Prakriti | No of subjects | Percentage |
| KP | 34 | 43.0 |
| KV | 6 | 7.6 |
| PK | 14 | 17.7 |
| PV | 9 | 11.4 |
| VP | 8 | 10.1 |
| VK | 8 | 10.1 |
| Total | 79 | 100 |

Maximum individuals (50.6%) had Kapha dominant prakriti.

| Table 3: Comparison of Body mass index (BMI) in various prakritis. (Mean±SD) |
| --- |
| Prakriti | n | Mean | SD | F value | p value |
| KP | 34 | 24.18 | 2.86 | 2.74 | * 0.025 |
| KV | 6 | 21.71 | 1.37 | | |
| PK | 14 | 23.87 | 2.23 | | |
| PV | 9 | 22.34 | 2.76 | | |
| VP | 8 | 21.26 | 2.28 | | |
| VK | 8 | 22.71 | 2.34 | | |

BMI was found to be the highest in kapha-pitta (kapha dominant) prakriti, and it was statistically significant.

| Table 4: Comparison of 30:15 ratio, DBD and Valsalva Ratio (VR) in different prakritis. (Mean ± SD) |
| --- |
| Prakriti | 30:15 ratio | DBD | VR |
| | Mean | SD | F value | p value | Mean | SD | F value | p value |
| KP | 1.25 | 0.091 | 1.64 | 0.16 | 24.44 | 6.947 | 0.80 | 0.56 |
| KV | 1.38 | 0.211 | | | 27.33 | 9.288 | 1.35 | 0.16 |
| PK | 1.29 | 0.111 | | | 23.07 | 3.852 | 1.36 | 0.15 |
| PV | 1.29 | 0.078 | | | 25.78 | 7.242 | 1.35 | 0.15 |
| VP | 1.31 | 0.163 | | | 24.88 | 5.276 | 1.38 | 0.19 |
| VK | 1.29 | 0.077 | | | 21.63 | 2.200 | 1.38 | 0.09 |

Values for 30:15 ratio, DBD were the highest in kapha-vata (kapha dominant) prakriti though not statistically significant. There is no significant difference of VR according to prakriti in the study group as p>0.05.
prakriti, though not statistically significant (Table 4). Both these parameters denote parasympathetic predominance. Of all the tests done to evaluate the heart rate variability, the mean value for HF nu (which is modulated by the parasympathetic nervous system)\[13\] was again found to be the highest in kapha-vata (kapha dominant) prakriti individuals, though not statistically significant. Thus, the mean values of all the above three parameters are indicative that kapha prakriti individuals have parasympathetic predominance in terms of cardiovascular autonomic responses. These findings are similar to one of the studies done in the recent past.\[17\] With a gross assumption that VLF (very low frequency), LF and HF denote vata, pitta and kapha respectively; Travis FT et al found a substantial diagnostic agreement between the clinical (Ayurvedic) evaluation of gross dosha imbalance and HRV analysis.\[18\] Our study finding regarding the HFnu parameter that it may be indicative of kapha prakriti is corroborative with the finding of this previous preliminary study.

Our findings (Tables 4 to 6) also concur with those of Tripathi et al, who found that the basic cardiovascular responses did not vary significantly according to the dual prakritis, with an exception of a significant fall in the diastolic blood pressure immediately after isotonic exercise in Vata-Kapha individuals as compared to the Pitta-Kapha and Vata-Pitta individuals. Paralleling the three doshas of Kapha, Pitta and Vata with the immune, endocrine, and nervous mechanism, respectively; they concluded Pitta prakriti to be having some positive association with sympathetic activity.\[5\]

**Table 5:** Comparison of LF, HF and LF/HF ratio (normalized) in different prakritis

| Prakriti | LF nu | Mean | SD | F value | p value | HF nu | Mean | SD | F value | P value | LFnu/HFnu | Mean | SD | F value | p value |
|---------|-------|------|----|---------|---------|-------|------|----|---------|---------|-----------|------|----|---------|---------|
| KP      |       | 77.24| 7.27| 0.61    | 0.70    | 23.26 | 6.86| 0.41  | 0.84    | 3.63      | 1.16  | 0.90 | 0.49    |
| KV      |       | 74.58| 4.17|         |         | 25.32 | 2.84|       |         | 2.99      | 0.57  |
| PK      |       | 75.57| 7.13|         |         | 24.58 | 7.07|       |         | 3.46      | 1.53  |
| PV      |       | 74.83| 3.66|         |         | 24.09 | 3.66|       |         | 3.18      | 0.57  |
| VP      |       | 78.39| 4.95|         |         | 22.03 | 5.16|       |         | 3.79      | 1.19  |
| VK      |       | 75.34| 1.75|         |         | 25.08 | 1.55|       |         | 3.01      | 0.18  |

Value for LFnu was found to be the highest in vata prakriti though not statistically significant.
Value for HFnu was found to be the highest in kapha-vata (kapha dominant) prakriti though not statistically significant. There is no significant difference of LFnu/HFnu ratio according to prakriti as P>0.05.

**Table 6:** Comparison of SDNN and RMSSD in different prakritis.

| Prakriti | SDNN  | Mean | SD | F value | p value | RMSSD | Mean | SD | F value | p value |
|---------|-------|------|----|---------|---------|-------|------|----|---------|---------|
| KP      |       | 36.64| 13.20| 0.92    | 0.47    | 27.69 | 11.99| 1.38| 0.24    |
| KV      |       | 46.81| 22.69|         |         | 29.62 | 15.56|     |
| PK      |       | 38.02| 14.49|         |         | 28.03 | 18.74|     |
| PV      |       | 45.34| 19.02|         |         | 41.23 | 19.15|     |
| VP      |       | 37.79| 14.09|         |         | 26.53 | 16.29|     |
| VK      |       | 37.12| 1.49 |         |         | 30.38 | 4.29 |     |

There is no significant difference of SDNN supine and RMSSD supine according to prakriti as p>0.05.

**Discussion**

In the present study, only individuals with a prakriti of dual constitution (owing to the physiological dominion of two Doshas) were assessed to see if there was any possible association of the constitutional types with the outcomes of basic cardiovascular parameters. The age and sex distribution of the participants amongst the six groups was comparable. The perturbation in equilibrium of these doshas can give rise to disease depending upon the prakriti; a pitta prakriti person being more susceptible to peptic ulcers, skin diseases and hypertension, a vata prakriti person to joint aches, crackling joints and backache, whereas a kapha prakriti person to diabetes, obesity and atherosclerosis.\[14\] In order to maintain a healthy lifestyle, one needs to maintain a balance between various physiological characteristics.\[15\] As shown in table 2, maximum individuals (50.6%) had kapha dominant (i.e. kapha as primary dosha) prakriti. One of the former studies has mentioned that individuals having kapha as their predominant prakriti are more prone to gain weight and can face obesity related health complications, individuals of pitta prakriti are more inclined to suffer from ulcers and skin disorders, and individuals with vata prakriti are at high risk of developing chronic diseases.\[16\] Our study finding that the BMI of individuals with kapha prakriti was found to be the highest is consistent with this previous study (table 3).

Of all the cardiovascular reflex tests, the mean values for 30:15 ratio and DBD were found to be highest in kapha-vata prakriti, though not statistically significant (Table 4). Both these parameters denote parasympathetic predominance. Of all the tests done to evaluate the heart rate variability, the mean value for HF nu (which is modulated by the parasympathetic nervous system)\[13\] was again found to be the highest in kapha-vata (kapha dominant) prakriti individuals, though not statistically significant. Thus, the mean values of all the above three parameters are indicative that kapha prakriti individuals have parasympathetic predominance in terms of cardiovascular autonomic responses. These findings are similar to one of the studies done in the recent past.\[17\] With a gross assumption that VLF (very low frequency), LF and HF denote vata, pitta and kapha respectively; Travis FT et al found a substantial diagnostic agreement between the clinical (Ayurvedic) evaluation of gross dosha imbalance and HRV analysis.\[18\] Our study finding regarding the HFnu parameter that it may be indicative of kapha prakriti is corroborative with the finding of this previous preliminary study.

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The relationship between prakriti type and autonomic activity needs further exploration in ensuing research.\[5,19\]

This calls for future studies to validate HRV as a screening tool to assess prakriti or dosha imbalances. This may help in modulating the lifestyle of the individuals in order to prevent the disease rather than curing it.

**Strength of the study:** Our study may provide baseline data for future large scale studies on the diagnostic accuracy of HRV analysis in various prakritis/ doshas. It can also serve as reference data for studies involving both dual and extreme body constitutions.

**Limitations:** Only the individuals with a dual constitutional type of prakriti were taken into consideration excluding extreme constitutional types. Since this study was done with a limited sample size, it needs to be done using a larger sample size to get definitive results.

**Conclusion**

Our study results are indicative of a parasympathetic predominance in normal healthy individuals with prakriti of kapha as primary dosha. There may be a relation between prakriti type and autonomic activity, which needs to be further explored in ensuing research.

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