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Research Article

STUDY ON RELATIONSHIP BETWEEN DOSHA PRAKRUTI AND HEART RATE VARIABILITY (HRV) IN GERIATRIC POPULATION: AN OBSERVATIONAL STUDY

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ABSTRACT

The scientific relationship between Dosha- Prakruti and Heart rate variability (HRV) is one of the most explored and relevant topics in the present scenario of dramatically increasing prevalence of cardiovascular diseases in the elderly population. It was an observational study and the sample size was 30 participants aged 45 years and above. The intervention consisted of aerobic exercise i.e. cycling and walking for 60 minutes three times a week for 8 weeks with follow-up at every fortnight. The efficacy parameters were change in heart rate variability using heart rate and RR interval before and after exercise in the specific Doshas as well as its impact on Modified Baecke Questionnaire and Lawton Broody Index. The study inferred that individuals with Vata Dosha are highly prone to develop increased heart rate variability (HRV) with highly significant statistical result on heart rate ($p > 0.0001$) and RR interval ($p > 0.0001$). The study underlines the propensity of developing sinus dysfunction and exercise is an important mode to stimulate the vagal tone for the healthy heart.

Keywords: Dosha; heart rate variability; Vata; Elderly

INTRODUCTION

Ayurveda is the system of medicine with a rationale logical foundation which has survived as a distinct preventive and therapeutic entity from antiquity to the present day of sophisticated medical innovations[1,2]. The modern scientific innovations have logically proved the basic tenets of Ayurveda in the maintenance and cure of human ailments. Dosha Prakruti is an important physiological parameter of Ayurveda, and its derangement in various diseases is basis the pathological process of disorders[3]. The scientific study about relationship between Dosha- Prakruti and heart rate variability (HRV) is one of the most explored and relevant topics in the present scenario of dramatically increasing prevalence of cardiovascular diseases in the elderly population[4,5].

The human body is a biological combination of the five elements: Ether, Air, Fire, Water and Earth. The combination of Ether and Air form Vata, Fire and Water form Pitta and Water and Earth form Kapha[6,7]. The balance of these Dosha determines the maintenance of health, whereas the imbalance of Dosha may result in failure of hemodynamic stability and health[8]. Since ancient times, Ayurvedic physicians have used various methods of examination to determine Doshas[9,10] such as observation of the body, body functions, reading of the pulse, examination of the eyes, memory, and behavioral habits such as religious observation and sleep and eating habits[10].

The variations in Tridosha are the basis for disease diagnosis and treatment in Ayurveda[11]. The Doshas are assessed by sensing the pulse manually with fingers which depends on skill of the physician[3]. Thus, imbalance in Tridosha also has impact on the health heart and blood vessels and this physiological change in cardiovascular system is more prominent in the elderly population aged 60 and above[7].

In a recent study it was found that ageing is an important risk factor in the development of cardiovascular changes[5]. Aging results in an increase in cardiovascular disease and a decrease in cardiac reserve at the same time that the repair processes designed to deal with these problems become less active/effective. 1) Structurally, the heart thickens and stiffens with age resulting in the increased imposition of a number of functional demands. 2) Functionally, aging causes significant functional deficits with exercise[4].

The relation between Doshas and heart rate variability (HRV) are highly intertwined with each other. Similarly, heart rate variability (HRV) and Nadi examination are also inter-related because the assessment of beat to beat variation is translated into the pulse examination [1]. Thus, Nadi examination or radial pulse assessment and beat to beat variation may studied for exploring Dosha changes in an individual[1,12].

Heart rate variability (HRV) is variation in beat to beat intervals of the heart[6]. Electrocardiographically, R wave represents the peak of QRS complex[13] and R to R duration is also called as RR interval; NN interval is used while assessing heart rate variability (HRV) to highlight the fact that processed beats are normal beats[6].

Heart rate variability (HRV) is an outcome of the impact of autonomic regulation on the heartbeat[1] and Doshas are also autonomous regulators of body physiology[1]. In recent years various scholars have extensively studied the impact of Doshas on heart rate variability (HRV). Thus, Travis and Wallace also tried to explore the possible association between autonomous

nervous system and Doshas[1,14].

Putting all these facts together, it may be inferred that ageing is linked with physiological changes in heart and vessels which is reflected by arterial stiffness. Similarly, the examination of pulse helps determine the Tridosha in individuals. Thus, an association may be proposed between Tridosha and pulse rate as well as RR interval which depict the physiological as well as pathological changes of the heart. Similarly, exercise has significant impact on the heart which is again measured by pulse rate. In conclusion, estimation heart rate variability (HRV) through pulse rate and RR interval on lines of Dosha classification of elderly persons may Yield crucial information about the individuals with maximum probability of having cardiovascular changes. Keeping this triangular conception, the present study was designed to measure the relation of Dosha-Prakruti in elderly using heart rate variability (HRV).

Methodology

The present study was carried out in Aadhar Hospital located at Parwati Gaon, Pune under Department of Sharir Kriya, College of Ayurveda, Bharati Vidyapeeth, Pune and Maharashtra from January 2019 to August, 2019. The trial was conducted after getting approval from ethical committee vides Letter No. BVDU/COA/46/2018-19. The voluntary written informed consent was sought from the trial participants before commencement of the trial. It was an observational study where in participants were evaluated for heart rate variability (HRV) before and after exercise. The sample size was 30 participants. The intervention consisted of aerobic exercise i.e. cycling and walking for 60 minutes three times a week for 8 weeks with follow- up at every fortnight.

Inclusion criteria was participants in the age group of 45 years and above of both sexes and exclusion criteria consisted of participants suffering from any systemic disorder; especially cardiac problems; pregnant and lactating women and non-compliance of study protocol for one visit.

The study parameters included determination of Doshaja Prakruti using Ayu Soft software in the target population15; calculating heart rate variability (HRV) using RR interval of ECG16; studying effect of exercise on heart rate variability (HRV) using Modified Baecke Questionnaire17 and effect of exercise on heart rate variability (HRV) using Lawton Broody Index18 in the study participants. The data on these parameters were collected before and after the trial.

RESULTS

Table 1: The demographic data

Basic variables	No. of patients	%
Gender		
Female	13	43.3
Male	17	56.7
Total	30	100.0
Age in years		
<50	6	20.0
50-60	19	63.3
61-70	5	16.7
Total	30	100.0
Present illness		
NAD	21	70.0
Yes	9	30.0
• Arthritis	3	10.0
• DM	2	6.7
• HTN	4	13.3

Table 2: Dosha distribution of participants studied

	No. of patients (n = 30)	%	Female (n = 13)	%	Male (n = 17)	%
Vata						
1-25	9	30.0	5	38.5	4	23.5
26-50	15	50.0	7	53.8	8	47.1
51-75	6	20.0	1	7.7	5	29.4
76-100	0	0.0	0	0.0	0	0.0
Pitta						
1-25	4	13.3	3	23.1	1	5.9
26-50	24	80.0	8	61.5	16	94.1
51-75	2	6.7	2	15.4	0	0.0
76-100	0	0.0	0	0.0	0	0.0
Kapha						
1-25	18	60.0	6	46.2	12	70.6
26-50	9	30.0	4	30.8	5	29.4
51-75	3	10.0	3	23.1	0	0.0
76-100	0	0.0	0	0.0	0	0.0

The study variables and their efficacy have been depicted in Tables 3, 4 and 5. Descriptive and inferential statistical analysis has been carried out in the present study presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%).

Table 3: Distribution of study variables

Variables	Baseline	After study	% difference
R-R interval			
<1	28 (93.3%)	18 (60%)	-33.3%
>1	2 (6.7%)	12 (40%)	33.3%
Total	30 (100%)	30 (100%)	-
Baecke Score			
1-5	9 (30%)	8 (26.7%)	-3.3%
5.1-10	21 (70%)	22 (73.3%)	3.3%
Total	30 (100%)	30 (100%)	-
Lawton Brody Score			
1	1 (3.3%)	0 (0%)	-3.3%
2	1 (3.3%)	5 (16.7%)	13.4%
3	6 (20%)	5 (16.7%)	-3.3%
4	9 (30%)	9 (30%)	0.0%
5 and more	13 (43.3%)	11 (36.7%)	-6.6%
Total	30 (100%)	30 (100%)	-

Significance was assessed at 5% level of significance. Student t test (two tailed, independent) was used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters.

Table 4: Comparison of study variables at pre and post assessment

	Before exercise	After exercise	Difference	95% CI	t value	P value
Pulse rate	76.20 ± 2.85	90.60 ± 4.90	-14.400	16.234 to -12.566	16.063	< 0.001**
R-R interval	0.75 ± 0.13	0.88 ± 0.22	-0.130	-0.224 to -0.036	-2.840	0.008**
Baecke Score	5.91 ± 1.48	5.74 ± 1.73	0.168	-0.268 to 0.603	0.787	0.438
Lawton Brody Score	4.17 ± 1.18	4.13 ± 1.50	0.033	-0.388 to 0.455	0.162	0.873

Student *t* test

The Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were used for the analysis of the data.

Variables	< 50%	> 50%	Total	P value
Vata				
Pulse rate				
Before Exercise	76.33 ± 3.05	75.67 ± 1.97	76.20 ± 2.85	0.616
After Exercise	90.33 ± 5.16	91.67 ± 3.88	90.60 ± 4.90	0.001**
R-R interval				
Before Exercise	0.76 ± 0.13	0.72 ± 0.12	0.75 ± 0.13	0.476
After Exercise	0.88 ± 0.23	0.90 ± 0.21	0.88 ± 0.22	0.001**
Pitta				
Pulse rate				
Before Exercise	76.14 ± 2.82	77.00 ± 4.24	76.20 ± 2.85	0.688
After Exercise	90.21 ± 4.82	96 ± 2.83	90.60 ± 4.90	0.108
R-R interval				
Before Exercise	0.75 ± 0.13	0.80 ± 0.14	0.75 ± 0.13	0.568
After Exercise	0.87 ± 0.22	1.05 ± 0.21	0.88 ± 0.22	0.263
Kapha				
Pulse rate				
Before Exercise	76.31 ± 2.87	75.50 ± 3.00	76.20 ± 2.85	0.606
After Exercise	90.62 ± 5.18	90.50 ± 3.00	90.60 ± 4.90	0.966
R-R interval				
Before Exercise	0.76 ± 0.13	0.70 ± 0.08	0.75 ± 0.13	0.401
After Exercise	0.90 ± 0.22	0.73 ± 0.10	0.88 ± 0.22	0.130

DISCUSSION

The present study was an observational study to evaluate the effect of aerobic exercise on heart rate variability (HRV) in various Dosha Prakruti. Before that, no trial has been conducted in the target population for establishing relation of Dosha with heart rate variability (HRV). Thus, it is a naïve research step in correlation and contemporary interpretation of Dosha, heart rate variability (HRV), and exercise in the designated population.

Regarding the age and gender, male constituted 57% and female were 43%. The data infers that male were more than the female. Consequently, the data may be extrapolated that male are more prone to develop the heart rate variability (HRV) related problems

as well due to ageing. The data is consistent with Andreas Voss *et al* who concluded that gender and age influences need to be considered when performing heart rate variability (HRV) studies[19]. He found that males in the age group of 65 years and above had less heart rate as compared to female indicating that they may be compromised of cardiac problems in the coming days of their life. Similar, Jindal R *et al* reported that age has differential influence on vagal function in individuals in the age group of 60 years and above with implications for cardiovascular disease risk[20].

Moreover, the data also inferred that the mean age of the participants was 64 years in both the gender. Maximum number of participants was in the age group of 66 to 70 years (Table 1) which shows that with ageing the vagal stimulation is constantly compromised as evidenced by various models of ageing in humans[1,21].

Regarding Dosha distribution of study participants, the dominance of Vata, Pitta and Kapha in the elderly population was maximally 50%, 80% and 30% in the bracket of 1-25%, 26-50% and 26-50% respectively on Ayu Soft proforma (Table 2). It inferred that overall; Pitta was dominant at the start of the trial. The data is not in conformity with that of Manohar *et al* who failed to show any Dosha imbalance in the study trial[1]. Similarly, in the evaluation of data on exercise in relation to HRV, Vata Dosha was found dominant. More prospective trials are needed to explore the Dosha imbalance in this regard.

Regarding present illness of the participants, it was observed that majority (70%) of the participants were free from any co-morbid conditions except 6 cases who had co-morbid conditions of diabetes mellitus and hypertension (Table 1). The data seems compromised as the participants with co-morbid conditions are the prime source of confounding and bias. Hence, it is primarily required to select a homogenous population free from confounders. Besides this, Manohar *et al* has tried to show the heart rate variability (HRV) and its relation with Dosha in various morbid conditions[1] but the study is miniature in condition as the single disease or health status focused prospective studies are need of the hour in Ayurveda.

Regarding pulse rate, there was an increment in pulse rate of 53.3% as compared to the baseline data after exercise. Maximum increase in pulse rate was noticed in the bracket of 90-99 beats as compared to 71-79 (Table 3). Aerobic exercise has multiple positive effects on health outcomes in healthy elderly individuals including increased cardiovascular performance[1,22]. Contrary to this, Hartaigh *et al* found that twelve months of moderate intensity aerobic training did not improve RPR among older adults[23]. Hence, more prospective trials are needed to prove the same.

Regarding RR interval, there was constant improvement as 93.3% (28) had RR interval <1 at baseline which increased to 60% (18) had it > 1 showing the strong indication of cardiac output (Table 3). The data is in constant with Manohar *et al*[1]. In a major prospective population-based study, it was observed that modest aerobic exercise throughout the aging process is potentially related with minimum ECG changes[24].

Thus, heart diseases such as arrhythmias are prevalent in aging population and are linked to increased electrophysiological and autonomic dysfunction in the heart[25]. Heart rate variability (HRV) is the indicator of cardiac electrophysiology and autonomic regulation including respiratory, baroreflex and circadian fluctuations indicative of healthier heart[26]. In the same context, increased heart rate variability (HRV) may exhibit abnormal sinus patterns with advancing age[27], but physical activity in the middle age is associated with more favorable heart rate variability (HRV) data which reflects the increased vagal modulation and reduced sympathetic activity of the heart[28].

Estimation of the Dosha imbalance is highly importance in Ayurvedic diagnosis and treatment of diseases. But the assessment is primarily subjective in nature with no valid tool. Examination of pulse is an important tool of Ayurvedic medicine used to seek the insights into Dosha with higher inter-variability.

The present trial has been focused on interpretation of Dosha imbalance and determination using sophisticated tools such as Ayu Soft proforma to overcome the inter-variability. On the other hand, clinical determination of Dosha imbalance is done through pulse examination which is against the risk of inter-variability. Thus, heart rate variability (HRV) has also served an indirect method of Dosha imbalance in the target population. For that, series of studies comparing heart rate variability (HRV) spectral analysis with clinical assessment of Dosha dynamics can predict doshic imbalance.

CONCLUSION

The clinical implication of this study is that recommending exercise in Vata Dosha individuals may better the heart health in the older adults and elderly. The limitations of the study are small sample size and single arm study. Hence, it is recommended for the future researchers to design a randomized controlled trial to establish the relation of heart rate variability (HRV) to Dosha in more scientific way.

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