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Original Article

Variations in the functions of *Pitta Dosha* as per gender and *Prakriti*

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ABSTRACT

The *Tridosha* theory, which is the cornerstone of *Ayurvedic* physiology governs all the functions of human body and mind. *Tridosha* are responsible in determining one's *Prakriti* and their functional status may vary in both gender of different *Prakriti*. No research work is available to assess the functions of *Dosha* by objective parameters. Therefore, this study was planned to find out the variation in functional status of different types of *Pitta*, using certain objective parameters, in 201 young healthy volunteers of both gender belonging to different *Prakriti.* Serum level of triglycerides, cholesterol, total protein and glucose level were estimated for *Pachaka Pitta* and hemoglobin concentration for *Ranjaka Pitta,* visual acuity for *Alochaka Pitta,* memory and reaction time for *Sadhaka Pitta* and RGB value for *Bhrajaka Pitta* were measured .Except the functioning of *Bhrajaka Pitta*, variation in functional status of all type of *Pitta* was not the same in different *Prakriti* of both gender. However these findings were not significant which may have occurred due to small sample size and homogenous population. Thus we propose the consideration of sex differences while planning and evaluating the studies that are based on *Prakriti*.

Keywords *Tridosha, Prakriti, Pitta*, reaction time, RGB

INTRODUCTION

The concept of *Prakriti* or psychosomatic constitution is one of the central tenet of *Ayurveda*. Researchers are showing their keen interest in acquiring further insights in the domain of *Prakriti* by evaluating the possible correlations between *Prakriti* and certain genes like HLA-DRB1 (Patwardhan et al., 2011), CYP2C19 (Ghodke et al., 2011), EGLN1 (Aggarwala et al., 2010), SNP (Govindaraj et al., 2015), incidences of diseases (Mahalle et al., 2012), immuno phenotyping (Rotti et al., 2014), Ayurgenomics (Prasher et al., 2014) or Ayurneutrogenomics (Banerjee et al., 2014) and so on. In most of published research work on *Prakriti*, participants of both genders have not been included separately for the valuation of objective parameters. It is a well-known fact that estrogen and testosterone hormones play different role in metabolic activities of the body which ultimately leads to the variations as per sex. For example estrogen has an inhibitory effect on erythropoietin while androgen has stimulatory effect (Jain et al., 2010). Similarly levels of cholesterol, triglycerides vary in different phases of menstrual cycle [NIH]. These effects may produce some ambiguity in data if not analyzed as per gender. To avoid the effect of confounding factor Govindraj et al., 2015 has conducted a study excluding the female participants. We have intended to study the functions of *Pitta Dosha* as per gender and *Prakriti* as no such work is available in relation to functions of *Dosha as per Prakriti.* To evaluate this, certain objective parameters were taken for each types of *Pitta Dosha* depending on their prime functions. *Pitta Dosha* being in normalcy is responsible for the functions like good vision, good digestion, normal temperature, hunger, thirst, bodily softness, luster, happiness and intelligence (*Charak Samhita Sutrasthana 18/51*) but on abnormality results in various types of disease. (*Charaka Samhita Sutrasthana* 17/116). Five types of *Pitta Dosha* are mentioned in *Sushruta Samhita*, *Ashtanga Hridaya* and *Ashtanga Sangraha* i.e. *Pachaka, Ranjaka, Sadhaka, Alochaka and Bhrajaka Pitta* (*Ashtanga Hridaya Sutrasthana 12/10, Ashtanga Sangraha Sutrasthana 20/3, Sushruta Samhita Sutrasthana* 15/4). While *Acharaya Charak* has not mentioned different types of *Pitta*, but their functions are mentioned under the general functions of *Pitta*. (*Charaka Samhita Sutrasthana* 12/11) *Pachaka Pitta* residing in between *Aamashaya* and *Pakvashaya* helps in digestion of the food ingested and separates the nutrient fraction and undigested part or waste products (*Sushruta Samhita Sutrasthana* 21/10). *Ranjaka Pitta* is responsible for imparting color to *Rasa Dhatu*. (*Sushruta Samhita Sutrasthana* 21/10, 14/4). Indu, the commentator of *Ashtanga Sangraha* has revealed that the fraction of *Rakta Dhatu* produced from *Rasa Dhatu* is colored by the action of *Ranjaka Pitta* (*Sangraha Sutrasthana Ashtanga* 20/3). All the factors involved in erythropoiesis can be considered under *Ranjaka Pitta* (Agrawal et al., 2016). *Alochaka Pitta* governs the phenomenon of vision (*Sushruta Samhita Sutrasthana* 21/10). It may include all the enzymes which are involved in the chemical reaction taking place in eye during visualization of any object. *Sadhaka Pitta* controls the higher mental functions like *Buddhi* (Discrimination), *Medha*(intelligence), *Abhiman* (pride), *Utsaha*(enthusiasm) (*Ashtanga Hridaya Sutrasthana* 12/13, *Ashtanga Sangraha Sutrasthana* 20/3, *Sushruta Samhita Sutrasthana* 21/10) and *Smriti* (memory) (*Indu* on *Ashtanga Sangraha Sutrasthana* 20/3). *Bhrajaka Pitta* imparts luster to the complexion of the skin and helps in absorption of medicaments used in the form of massage, irrigation, tub bath and ointment (*Sushruta Samhita Sutrasthana* 21/10).

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MATERIAL AND METHODS

Study design
This is a cross sectional study which was approved from the ethical committee of Institute of medical sciences, BHU, Varanasi vide letter no. ECR/526/Inst/UP/2014 dated 31-01-2014.

Sampling method
Healthy participants of age group 20 - 35 years were selected through purposive sampling method, from the student community of Banaras Hindu University pursuing the course of BAMS, BDS, MD (Ay), PhD after obtaining their written consent. The subjects who were not clinically healthy and not willing to participate in the study were excluded.

Sample size
Initially 210 subjects were registered for the study, out of which 9 subjects were excluded as they were not fulfilling the inclusion criteria, out of which two students were dropped out during the course of study, three students were excluded as they were having almost equal percentages of three *Dosha* in *Prakriti* assessment and five students were excluded because they were not clinically healthy. Finally 201 subjects were selected out of which 115 subjects were females and 86 were males.

Assessment of *Prakriti*
Prakriti assessment was done by using reliable and validated proforma designed by (Tripathi et al., 2016). *Ekdoshaja Prakriti* was assigned on the basis of following criteria:

a. Most dominant *Dosha* having score more than 40%.
b. There should be difference of at least 7% between primary and secondary *Dosha*.

Finally out of 86 male subjects 14, 26, and 46 were of *Vata*, *Pitta* and *Kapha Prakriti* respectively while out of 115 female participants 19, 34, and 62 were of *Vata*, *Pitta* and *Kapha Prakriti* respectively. Subjects not having the score as per above criteria were excluded from the study.

Selection of objective parameters
Considering the function of each type of *Pitta Dosha*, certain objective parameters were selected. *Pachaka Pitta* is responsible for digestion of all sorts of food. As analysis of direct functions of digestive enzyme is too tedious, the metabolizing function of *Dhatvagni* was assessed through estimating the serum level of cholesterol, triglycerides, total protein and glucose. Functional status of *Ranjaka Pitta* was determined by the hemoglobin concentration, to assess its *Raga* (red coloration) and *Ranjana* of *Rasa Dhatu*. Reaction time for auditory and visual stimuli and short term and long term memory were assessed to check the *Utsaha*(enthusiasm) and *Smriti* (memory) function of *Sadhaka Pitta*. Visual acuity was judged for the visualization function of *Alochaka Pitta*. RGB values of facial photographs were calculated for the evaluation of the function of *Bhrajaka Pitta* as it gives coloration and complexion to the skin. Subjective assessment of skin color may result in bias and uncertainty in data thus to avoid this the objective assessment of skin color was done through the RGB color models in which different colors are defined by the combination of red, green and blue primary colors (Erik, 2001).

Recording the objective parameters
Following methods were employed for the assessment of these objective parameters:

1. 5 ml of venous blood was withdrawn in between 3-5 pm. Serum was immediately separated by centrifuging it at 3000 rpm for 5-6 min. Serum was stored in deep fridge at -40 degree centigrade.Colorimeter was used for the estimation of biochemical parameters with the help of Autospan liquid gold reagent kits which works on the principle of end enzymatic test.
2. Hemoglobin concentration was estimated through Sahli's Hemoglobinometer (Ghai, 2013).
3. Visual acuity was tested by using Snellen's chart (Ghai, 2013).
4. Average reaction time for auditory and visual stimuli was measured through digital reaction time apparatus.
5. Long term and short term memory of all the subjects were assessed by using manual for human memory and experimental procedure on long term memory (LTM) and short term memory (STM) by Dr. B.B. Asthana. In this test certain words were presented to each participants, (16 pairs for long term and 24 for short term memory) followed by interpolated task (2 min for long term and 3, 6, and 9 seconds for short term) thereafter recalling of words. The average numbers of correct recall and time taken was obtained.
6. RGB values of facial photographs were calculated by using software MATLAB R2014a with the help of department of computer science, IIT, BHU. For this purpose facial photographs of all the volunteers were taken in biochemistry laboratory of Kriya Sharir department in fixed illumination, from a fixed distance of 2.5 feet and fixed optical zoom of 2x, without spectacles if any. Male subjects were asked to come clean shaved and all the subjects were asked not to use any cosmetics one week prior to photographs.

Statistical Analysis
Statistical analysis was carried out by using SPSS (Statistical Package for Social Sciences), Version 16.0. Two way ANOVA was applied by taking *Prakriti* and gender as two factors. Significance of main effect and interaction of *Prakriti* and gender was tested. Data was presented as Mean ± SD. *p* value of less than 0.05 was considered statistically significant. Non-parametric test Kruskell - Wallis was applied to find correlation of *Prakriti* with average time taken to recall words by memory test.

RESULTS

The mean hemoglobin concentration was higher in male subjects than female subjects in all *Prakriti* individuals. On inter *Prakriti* comparison it was observed that mean value of hemoglobin concentration was highest in *Pitta Prakriti* individuals of both gender and was lowest in female subjects of *Kapha Prakriti* and male subjects of *Vata Prakriti*. On applying two way ANOVA, difference in hemoglobin concentration as per *Prakriti* and as per gender vary significantly ($p<0.001$ for both as per gender and as per *Prakriti*), but do not vary significantly on interaction between *Prakriti* and gender (Table 1).

The mean of protein concentration varies significantly as per *Prakriti* but does not vary significantly as per sex and on interaction between as per *Prakriti* and as per sex, on applying two way ANOVA. However it was more in female subjects of all three *Prakriti* than male subjects and it was highest in *Kapha Prakriti* and lowest in *Vata Prakriti* of both sex (Table 1).

The mean value of cholesterol concentration was higher in

Table 1. Showing the mean and SD of Hemoglobin, Protein, Triglycerides, Cholesterol and Glucose concentration as per gender and *Prakriti*

Hemoglobin and Biochemical parameters	**Mean ± S.D**						**TWO WAY ANOVA as per *Prakriti*/ gender/ interaction between gender and *Prakriti***
	***Vata Prakriti* (n = 33)**		***Pitta Prakriti* (n = 60)**		***Kapha Prakriti* (n = 108)**		
	Male (n = 14)	**Female (n = 19)**	**Male (n = 26)**	**Female (n = 34)**	**Male (n = 46)**	**Female (n = 62)**	
Hemoglobin (gm/dl)	13.47 ± 1.61	12.15 ± 0.927	14.95 ± 0.815	12.89 ± 1.036	14.23 ± 1.101	12.13 ± 1.041	F = 13.800, $p < 0.001$ (P) F = 114.573, $p < 0.001$ (G) F = 1.732, $p = 0.180$ (I)
Protein (gm/dl)	8.45 ± 2.485	8.55 ± 1.80	8.53 ± 2.136	9.15 ± 2.09	9.32 ± 1.888	9.57 ± 2.32	F = 3.083, $p = 0.0489$ (P) F = 0.884, $p = 0.348$ (G) F = 0.207, $p = 0.813$ (I)
Cholesterol (mg/dl)	133.12 ± 19.449	127.3 3± 15.464	130.26 ± 27.106	127.17 ± 26.52	147.95 ± 24.21	151.60 ± 25.83	F = 17.091, $p < 0.001$ (P) F = 0.197, $p = 0.658$ (G) F = 0.628, $p = 0.534$ (I)
Triglycerides (mg/dl)	111.23 ± 28.62	126.39 ± 30.07	118.53 ± 37.171	115.95 ± 35.43	126.84 ± 34.358	121.05 ± 32.60	F = 0.839, $p = 0.433$ (P) F = 0.177, $p = 0.675$ (G) F = 1.210, $p = 0.300$ (I)
Glucose (mg/dl)	107.74 ± 27.242	108.11 ± 20.57	106.07 ± 21.667	111.64 ± 25.39	116.46 ± 29.260	117.71 ± 25.60	F = 2.748, $p = 0.067$ (P) F = 0.347, $p = 0.556$ (G) F = 0.161, $p = 0.851$ (I)

*P refers to *Prakriti*, *G refers for gender,* I interaction between *Prakriti* and gender

male subjects of *Vata* and *Pitta Prakriti*, while in *Kapha Prakriti* it was higher in female subjects. On applying two way ANOVA, it was found statistically significant as per *Prakriti* but not as per gender and on interaction between *Prakriti* and gender (Table 1).

The mean value of triglyceride concentration was higher in male subjects of *Pitta Prakriti* while in female subjects of *Vata Prakriti*. It was found more in male subjects than female subjects in *Pitta* and *Kapha Prakriti*. Two Way ANOVA reveals that this value does not vary significantly as per *Prakriti*, as per gender and on interaction between *Prakriti* and gender (Table 1).

The mean value of glucose concentration did not vary significantly as per gender, as per *Prakriti* and also on interaction between *Prakriti* and gender. However glucose concentration was higher in female subjects of all the three *Prakriti* group. Its mean value was highest in *Kapha Prakriti* of both gender and lowest in *Pitta Prakriti* of male subject and *Vata Prakriti* of female subject (Table 1).

The mean of red, green and blue values was highest in *Pitta Prakriti* and lowest in *Vata Prakriti* in both gender. On gender wise comparison it was higher in males except in *Vata Prakriti*. On applying two way ANOVA, red, green and blue values vary significantly as per *Prakriti* ($p < 0.001$ for red and green, $p = 0.004$ for blue), while on interaction between *Prakriti* and gender, and as per gender, red value does not vary significantly but green ($p = 0.015$ as per gender, $p = 0.010$ on interaction between *Prakriti* and gender) and blue ($p < 0.015$ as per gender, $p = 0.047$ on interaction between *Prakriti* and gender) value varies (Table 2).

In all the *Prakriti* groups, females have taken more time to respond visual stimuli. *Kapha Prakriti* individuals have taken

Table 2. Showing the mean and SD of RGB values as per gender and *Prakriti*

RGB value	Mean ± S.D.						TWO WAY ANOVA as per *Prakriti*/ gender/ interaction between gender and *Prakriti*
	Vata Prakriti (n = 33)		*Pitta Prakriti* (n = 60)		*Kapha Prakriti* (n = 108)		
	Male (n= 14)	Female (n=19)	Male (n=26)	Female (n = 34)	Male (n = 46)	Female (n = 62)	
Red	134.28 ± 8.004	135.69 ± 7.413	142.96 ± 8.740	139.54 ± 5.320	142.97 ± 6.213	139.35 ± 5.98	F = 11.816, $p < 0.001$ (P) F = 3.127, $p = 0.079$ (G) F = 1.883, $p = 0.153$ (I)
Green	127.99 ± 6.866	130.66 ± 6.13	138.23 ± 9.430	133.00 ± 5.300	137.05 ± 6.605	131.76 ± 6.19	F = 9.747, $p < 0.001$ (P) F = 5.985, $p = 0.015$ (G) F = 4.729, $p = 0.010$ (I)
Blue	120.89 ± 6.996	120.92 ± 5.144	129.18 ± 8.671	123.72 ± 6.663	128.02 ± 8.462	120.54 ± 7.298	F = 5.735, $p = 0.004$ (P) F = 12.950, $p < 0.001$ (G) F = 3.113, $p = 0.047$ (I)

*P refers to *Prakriti*, *G refers for gender,* I interaction between *Prakriti* and gender

least time and *Pitta Prakriti* individuals of both gender has taken more time to respond to visual and auditory stimuli. On applying two way ANOVA, it does not vary significantly (Table 3).

Male subjects of *Vata Prakriti* had recalled more number of words than females by long term memory test, while male subjects of all three *Prakriti* had recalled more number of words by short term memory test. On applying two way ANOVA , words recalled by long term memory test vary significantly on interaction between gender and *Prakriti* ($p = 0.018$), while words recalled by short term memory vary significantly as per *Prakriti* ($p = 0.001$) and as per gender ($p = 0.011$), (Table 4).

Male subjects of *Kapha Prakriti* and female subjects of *Vata Prakriti* had taken more time to recall words by long term memory test while subjects of *Vata Prakriti* of both gender had taken more time to recall words by short term memory test. These value on inter *Prakriti* comparison were significant in female subjects. ($p = 0.007$ for LTMART, $p = 0.038$ for STMART). On gender wise analysis *Vata Prakriti* male subjects have taken less time than female subjects to recall the words by long term memory test while male subjects of *Kapha Prakriti* have taken more time to recall words by short term memory test (Table 5).

The percentage of emmetropia was more in *Pitta Prakriti* among female subjects and in *Kapha Prakriti* among male subjects while incidence of myopia was more in *Vata Prakriti* individuals of both gender. The percentage of myopia was more and emmetropia was less in male subjects than female subjects except in *Kapha Prakriti* (Table 6).

DISCUSSION

Hemoglobin concentration was found higher in males than females in all *Prakriti* individuals. Similar findings have been also reported by the study of Gunawat et al., (2014). Testosterone level in male stimulates erythropoiesis taking place in bone marrow while estrogen depresses the erythropoietin response to hypoxia resulting in lower hemoglobin concentration in females than males (Jain, 2010).

Table 3. Showing the mean and SD of reaction time (visual and auditory) as per gender and *Prakriti*

Reaction time (in seconds)	Mean ± S.D.						TWO WAY ANOVA as per *Prakriti*/ gender/ interaction between gender and *Prakriti*
	Vata Prakriti (n = 33)		*Pitta Prakriti* (n = 60)		*Kapha Prakriti* (n = 108)		
	Male (n = 14)	Female (n =19)	Male (n = 26)	Female (n = 34)	Male (n = 46)	Female (n = 62)	
Reaction time (visual)	0.7198 ± 0.149	0.7187 ± 0.133	0.7258 ± 0.239	0.7261 ± 0.177	0.6714 ± 0.188	0.6997 ± 0.183	F = 1.034, $p = 0.358$ (P) F = 0.095, $p = 0.758$ (G) F = 0.144, $p = 0.866$ (I)
Reaction time (auditory)	0.9583 ± 0.251	0.9611 ± 0.378	0.8983 ± 0.424	1.007 ± 0.440	0.8785 ± 0.318	0.9543 ± 0.575	F = 0.188, $p = 0.829$ (P) F = 0.768, $p = 0.382$ (G) F = 0.148, $p = 0.862$ (I)

Table 4. Showing mean and SD of long term and short term memory recalls (LTMR, STMR) as per gender and *Prakriti*.

Memory	MEAN±S.D.						TWO WAY ANOVA as per p*rakriti*/ gender/ interaction between gender and *Prakriti*
	Vata Prakriti (n = 33)		*Pitta Prakriti* (n = 60)		*Kapha Prakriti* (n = 108)		
	Male (n = 14)	Female (n = 19)	Male (n = 26)	Female (n = 34)	Male (n = 46)	Female (n = 62)	
LTMR	14.14 ± 1.61	12.73 ± 2.745	13.88 ± 2.14	14.76 ± 1.478	13.97 ± 1.769	14.22 ± 1.633	F = 2.469, p = 0.087 (P) F = 0.100, p = 0.753 (G) F = 4.079, p = 0.018 (I)
STMR	18.78 ± 3.423	16.00 ± 3.944	20.23 ± 3.08	19.91± 2.538	19.71 ± 3.264	18.87 ± 3.29	F = 7.249, p = 0.001 (P) F = 6.526, p = 0.011 (G) F = 1.593, p = 0.206 (I)

On inter *Prakriti* comparison in both male and female subjects it was more in *Pitta Prakriti*, while lower in *Vata Prakriti* among male subjects and *Kapha Prakriti* in female subjects. Higher level of hemoglobin concentration in *Pitta Prakriti* suggests the good functioning of *Ranjaka Pitta* in them as *Ranjaka Pitta* is responsible for the coloration of *Rasa Dhatu* (*Sushruta Samhita Sutrasthana* 21/10, 14/4).

Glucose concentration in female subjects of all *Prakriti* groups was more as compared to male subjects. K. Faerch et.al.,(2010) have concluded in their study that men had higher FPG and HbA1c levels than women, and women had higher 2hPG levels than men. Tarnopolsky MA (2001) has also stated that carbohydrate metabolism differs gender wise and female utilizes less carbohydrates than lipids. Our findings are supported by these studies. On inter *Prakriti* comparison glucose concentration was least in male subjects of *Pitta Prakriti* and female subject of *Vata Prakriti*, however it was more in *Kapha Prakriti* of both gender.

The cholesterol concentration was less in *Pitta Prakriti* while more in subjects of *Kapha Prakriti* in both male and female and the triglycerides concentration was again less in female subjects of *Pitta* and more in *Vata Prakriti*. But for the males, it was lower in *Vata Prakriti* and higher in *Kapha Prakriti*. Cholesterol and triglycerides concentration was high in male subjects as compared to females except in *Kapha Prakriti*. Significantly higher level of triglycerides and cholesterol in *Kapha Prakriti* subjects has been also reported by Prasher et al (2008). An article of Vera Bittner, MD, MSPH

Table 5. Showing average time taken to recall words by long term and short term memory test (LTMART, STMART) as per gender and *Prakriti*

Average recall time (in seconds)	Male (n = 86)			Female (n = 115)		
	Vata Prakriti (n = 14)	*Pitta Prakriti* (n = 26)	*Kapha Prakriti* (n = 46)	*Vata Prakriti* (n = 19)	*Pitta Prakriti* (n = 34)	*Kapha Prakriti* (n = 62)
LTMART	2.56 ± 1.692	2.20 ± 1.579	2.56 ± 1.716	3.62 ± 2.160	2.13 ± 1.98	2.09 ± 1.575
STMART	1.93 ± 1.092	1.78 ± 0.922	1.84 ± 1.164	2.84 ± 1.845	1.80 ± 1.57	1.82 ± 1.14
	χ^2 = 0.775, p = 0.679 for LTMART			χ^2 = 9.948 , p = 0.007 for LTMART		
	χ^2 = 0.05, p = 0.973 for STMART			χ^2 = 6.558, p = 0.038 for STMART		

Table 6. Showing the visual acuity of subjects as per gender and *Prakriti*

Visual Acuity	Males (n = 86)			Females (n = 115)		
	***Vata Prakriti* (n = 14)**	***Pitta Prakriti* (n = 26)**	***Kapha prakriti* (n =4 6)**	***Vata Prakriti* (n = 19)**	***Pitta Prakriti* (n = 34)**	***Kapha Prakriti* (n = 62)**
Emmetropia	4 (28.6%)	15 (57.7%)	32 (69.6%)	7 (36.8%)	20 (58.8%)	26 (41.9%)
Myopia	10 (71.4%)	11 (42.3%)	14 (30.4%)	12 (63.2%)	14 (41.2%)	3 (58.1%)
	$\chi^2 = 7.514$, $p = 0.023$			$\chi 2 = 3.303$, $p = 0.192$		

Faculty and Disclosures on Impact of Gender and Life Cycle on Triglyceride Levels has reported that male had higher level of TG than female. It has been reported that women's cholesterol and triglycerides level vary in accordance with menstrual cycle, and they have lower level of triglycerides and cholesterol when estrogen level is at peak [NIH]. It may be the one of the cause for not obtaining uniform findings. Protein concentration in females was more in all *Prakriti* group than male subjects. It was less in *Vata Prakriti* and more in *Kapha Prakriti*. These four biochemical parameters were higher in *Kapha Prakriti* in both gender, which indicates that they are slow metabolizers (Ghodke et al., 2011) and thus it can be assumed that function of *Pachaka Pitta* was exhibited less in *Kapha Prakriti* of both gender. However the minimum level was not constant in *Pitta* and *Vata Prakriti* of both genders, so it is difficult to infer the variations in functioning of *Pachaka Pitta* as per *Prakriti* of both gender.

No significant variation was seen in reaction time for visual and auditory stimuli as per sex but reaction time for both of these stimuli was found more in females (Except for visual stimuli in female subjects) and less in males, which is justified by the description that males have faster reaction time as compared to females (Robert J Konsiski) Same findings have been also reported by Jain et al., (2015). On inter *Prakriti* comparison it was more in *Pitta Prakriti* in both sex and less in *Kapha Prakriti* except male subject of *Vata Prakriti* who had more reaction time for visual stimuli. This variation in data may had occurred due to the fact that reaction time varies in female with different phases of menstrual cycle, due to variations in level of sex hormones in them. (Kumar et al., 2013) Thus it can be said that, *Utsaaha* function of *Sadhaka Pitta* was exhibited more in males than females, and more in *Kapha Prakriti* of both gender.

On inter *Prakriti* comparison for short term memory test *Pitta Prakriti* subjects of both gender had recalled more number of words and taken less time, thus possessing good memory. In long term memory test, *Vata Prakriti* females have least memory because they had recalled minimum number of words and had taken more time. In other *Prakriti* group variation was seen in number of words recalled and time taken to recall the words. As the memory is the function of *Sadhaka Pitta* (*Indu on Ashtanga Sangraha Sutrasthana 20/3*), it can be supposed that it was exhibited more in female subjects of *Pitta Prakriti* and least in *Vata Prakriti*, while in males complete inference cannot be drawn due to variability in findings of long term memory test, which may have occurred due to small sample size or as the study population are of same age group, having same intellectual level.

The frequency of emmetropia and myopia do not vary significantly gender wise. On inter *Prakriti* comparison, it was observed that frequency of emmetropia was more in male subjects of *Kapha Prakriti* and in female subjects of *Pitta Prakriti*. In the same way frequency of myopia was more in *Vata Prakriti* of both gender. It indicates that *Alochana* (visualization) function of *Alochaka Pitta* was exhibited more in male subjects of *Kapha Prakriti* and female subjects of *Pitta Prakriti*, it was exhibited least in *Vata Prakriti* of both male and female subjects. *Vata Prakriti* subjects have dry and lusterless eyes (*Ashtanga Sangraha Sharirasthana* 8/6, *Ashtanga Hridaya Sharirasthana* 3/8) which may affect their visual acuity (Miki et al., 2013) and thus showing the minimal functioning of *Alochaka Pitta* in them.

RGB value was found more in *Pitta Prakriti* and less in *Vata Prakriti* of both gender on inter *Prakriti* comparison as per gender. It indicates that function of *Bhrajaka Pitta* was exhibited more in *Pitta Prakriti* and least in *Vata Prakriti* of both sex as it is responsible for the complexion and luster (*Sushruta Samhita Sutrasthana* 21/10). On gender wise comparison *Vata Prakriti* females had higher RGB values than males but in *Kapha* and *Pitta Prakriti* it was higher in male subjects. This variation may had occurred due to influence of female sex hormones, which may fluctuate the RGB values (David et al., 2013).

CONCLUSION

From above discussion it can be perceived that the findings of these parameters were not same in both gender on inter *Prakriti* comparison. Mean value of hemoglobin concentration was more in *Pitta Prakriti* of both gender but less in *Kapha Prakriti* of female and *Vata Prakriti* of male subject. Visual acuity was better in females of *Kapha Prakriti* but in males of *Pitta Prakriti*, it was least in *Vata Prakriti* of both sex. Mean value of biochemical parameters was more in *Kapha Prakriti* of both sex except female subjects of *Vata Prakriti* had more triglycerides than other *Prakriti* individuals. Cholesterol was least in *Pitta Prakriti* while Protein was least in *Vata Prakriti* subjects of both gender. Mean value of glucose was least in *Pitta Prakriti* and triglycerides in *Vata Prakriti* of male subjects but in female subjects opposite was seen. The memory function of *Sadhaka Pitta* was exhibited least in *Vata Prakriti* female subjects, but other findings like its maximum exhibition in particular *Prakriti* and male subjects cannot be inferred due to

inconsistency in number of words recalled and time taken. *Utsaaha* function of *Sadhaka Pitta* was exhibited more in *Kapha Prakriti* of both gender and was least in *Pitta Prakriti* female subjects, for male subjects cannot be deduced due to again inconsistent findings. Mean value of RGB was maximum in *Pitta* and minimum in *Vata Prakriti*, thus it can be said that it was exhibited more in *Pitta Prakriti* and least in *Vata Prakriti* subjects of both gender. From above it can be concluded that function of *Bhrajaka Pitta* and *Alochaka Pitta* was least in *Vata Prakriti* and function of *Ranjaka Pitta* was highest in *Pitta Prakriti* of both gender. For other parameters, result was not uniform for both gender, especially for *Sadhaka Pitta* and *Pachaka Pitta* there was too much variability as per *Prakriti* and gender. However these findings were neither statistically nor clinically significant. Indeed from the mean value, we can hypothesize that difference of gender have impact on findings of various parameters as per *Prakriti*. Some the parameters like hemoglobin and biochemical parameters vary physiologically in both gender, which may influence the findings as per *Prakriti* especially when we want to define some reference range for determination of *Prakriti*. So we propose to include female and male participants separately while conducting *Prakriti* related researches. However this study, in spite of homogenous populations, was affected by the various confounding factors like the factors which may affect the individual digestion and metabolism capacity, phases of menstrual cycle in female. Thus in future if such studies are planned, parameters should be analyzed differently as per gender, such parameters should be selected which are least affected by the confounding factors and especially in female subjects, different phases of menstrual cycle should be considered to get more reliable findings.

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CONFLICT OF INTEREST

There is no conflict of interest to declare.

REFERENCES

Aggarwal S, Negi S, Jha P, Singh PK, Stobdan T, Pasha MA, Ghosh S, Agrawal A; Indian Genome Variation Consortium, Prasher B, Mukerji M. EGLN1 involvement in high-altitude adaptation revealed through genetic analysis of extremeconstitution types defined in Ayurveda. Proc Natl Acad Sci U S A. 2010;44:18961-18966.

Agrawal S, Verma V, Gehlot S. Ayurvedic perspectives on physiology of blood (Rasa-Rakta Dhatu) and its applied aspects. Int J Ayurveda & Med Sc. 2016;1:70-76.

Banerjee S, Debnath P, Debnath PK. Ayurnutrigenomics: Ayurveda inspired personalized nutrition from inception to evidence. J Tradit Complement Med. 2015;5: 228-233.

Ghai CL. Textbook of practical physiology (8th edition). (India, New Delhi: Jaypee brothers medical publishers), 2013.

Ghodke Y, Joshi K, Patwardhan B. Traditional Medicine to Modern Pharmacogenomics: Ayurveda Prakriti Type and CYP2C19 Gene Polymorphism Associated with the Metabolic Variability. Evid Based Complement Alternat Med. 2011;2011:249528.

Govindaraj P, Nizamuddin S, Sharath A, Jyothi V, Rotti H, Raval R, Nayak J, Bhat BK, Prasanna BV, Shintre P, Sule M, Joshi KS, Dedge AP, Bharadwaj R, Gangadharan GG, Nair S, Gopinath PM, Patwardhan B, Kondaiah P, Satyamoorthy K, Valiathan MV, Thangaraj K. Genome-wide analysis correlates Ayurveda Prakriti. Sci Rep. 2015; 5:15786.

Gunawat CP, Gehlot S. Variation in haematological parameters in different Dhatu Sara individuals as per sex. Int J Res Ayurveda Pharm. 2015;6:598-601.

Hjelmas E. Face Detection: A Survey. Computer Vision and Image Understanding 2001;83:236-274.

Jain A, Bansal R, Kumar A, Singh KD. A comparative study of visual and auditory reaction times on the basis of gender and physical activity levels of medical first year students. Int J Appl Basic Med Res. 2015;5:124-127.

Jain AK. Textbook of physiology. Reprint edition. (India, New Delhi: Avichal publishing company), p 70, 2010.

Kumar S, Mufti M, Kisan R. Variation of Reaction Time in Different Phases of Menstrual Cycle. J Clin Diagn Res. 2013;7:1604-1605.

Mahalle NP, Kulkarni MV, Pendse NM, Naik SS. Association of constitutional type of Ayurveda with cardiovascular riskfactors, inflammatory markers and insulin resistance. J Ayurveda Integr Med. 2012;3:150-157.

Murthy Shrikanth KR (editor). Ashtanga Sangraha of Vagbhatta. Vol. 1. 7th ed. (India, Varanasi: Chaukhambha Orientalia), 2003.

Murthy Shrikanth KR (editor). Sushruta Samhita of Sushruta. Vol. 1. Reprint ed. (India, Varanasi: ChaukhambhaOrientalia), 2008.

Murthy Shrikantha KR (editor). AshtangaHridaya of Vagbhatta. Vol. 1. 10th ed. (India, Varanasi: Chowkhambha Krishnadas Academy), 2014.

NIH. Women's cholesterol levels vary with phase of menstrual cycle. Available at: https://www.nih.gov/news-events/news-releases/womens-cholesterol-levels-vary-phase-menstrual-cycle. (accessed on 08th November 2017).

Patwardhan B, Joshi K, Chopra A.Classification of Human Population Based on HLA Gene Polymorphism and the Concept of Prakriti in Ayurveda.. The journal of alternative and complementary medicine 2011;2:349-353.

Prasher B, Negi S, Aggarwal S, Mandal AK, Sethi TP, Deshmukh SR, Purohit SG, Sengupta S, Khanna S, Mohammad F, Garg G, Brahmachari SK; Indian Genome Variation Consortium, Mukerji M. Whole genome expression and biochemical correlates of extreme constitutional types defined in Ayurveda. J Transl Med. 2008;6:48.

Prasher B, Varma B, Kumar A, Khuntia KB, Pandey R, Narang A, Tiwari P, Kutum R, Guin D, Kukreti R, Dash D; TRISUTRA

Ayurgenomics Consortium, Mukerji M. Ayurgenomics for stratified medicine: TRISUTRA consortium initiative across ethnically and geographically diverse Indian populations. J Ethnopharmacol. 2014;197:274-293.

Puts DA, Bailey DH, Cárdenas RA, Burriss RP, Welling LL, Wheatley JR, Dawood K. Women's attractiveness changes with estradiol and progesterone across the ovulatory cycle. Horm Behav. 2013; 63:13-19.

Rotti H, Guruprasad KP, Nayak J, Kabekkodu SP, Kukreja H, Mallya S, Nayak J, Bhradwaj RC, Gangadharan GG, Prasanna BV, Raval R, Kamath A, Gopinath PM, Kondaiah P, Satyamoorthy K. Immunophenotyping of normal individuals classified on the basis of human doshaprakriti. J Ayurveda Integr Med. 2014;5:43-49.

Sharma RK(editor). Charak Samhita of Agnivesha. Vol. 1. reprint ed. (India, Varanasi: Chowkhambha Sanskrita Sansthana), 2014.

Tarnopolsky MA, Ruby BC. Sex differences in carbohydrate metabolism. Curr Opin Clin Nutr Metab Care. 2001;4:521-526.

Times MR. A Literature Review on Reaction Time by Robert J. Kosinski Clemson University. Available at: http://homepage.univie.ac.at/andreas.franz.reichelt/intro2cogsci2/data/literature_review_reaction_time.pdf. (accessed on 31st October 2017).

Travis FT, Wallace RK. Dosha brain types: A neural model of individual differences. J Ayurveda Integr Med. 2015;6:280-285.

Tripathi PK, Gehlot S. A Physio-Anatomical Study of Prakriti. Available at: http://www.lulu.com/ca/fr/shop/piyush-kumar-tripathi-and-sangeeta-gehlot/a-physio-anatomical-study-of-prakriti/paperback/product-23213334.html. (accessed on 08th November 2017).

Uchino M, Schaumberg DA. Dry eye disease: Impact on quality of life and vision. Curr Ophthalmol Rep. 2013;1:51-57.

Vera B. Impact of Gender and Life Cycle on Triglyceride Levels. Available at: http://www.medscape.org/viewarticle/569070. (accessed on 31st October 2017).