

EFFECT OF YOGA TRAINING ON RESTING METABOLIC RATE (RMR) AND BODY FAT METABOLISM IN THE CONTEXT OF BODY CONSTITUTION (*PRAKRITI*)

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ABSTRACT

Ayurveda describes human body constitution under the term *prakriti*. Each person is known to have specific capacity to regulate energy expenditure and metabolic efficiency. In present era, metabolic syndrome is the major global risk due to sedentary lifestyle and a lack of physical activity. The present study was planned to assess the effect of *yoga* intervention on resting metabolic rate, percent body fat and fat mass with respect to *prakriti*. After approval from the Institutional Ethical Committee (IEC), in a self - control study design, 60 residential healthy subjects of both genders between 18-45 years from GS College of *yoga* and cultural synthesis, *Kaivalyadhama*, Lonavla, were enrolled. Their *prakriti* baseline evaluation was done using a standardized and validated questionnaire. The pre-post non-invasive physiological testing included resting metabolic rate (RMR), percent body fat (BF%) and body fat (BF) using Body Composition Analyser (BCA) Maltron Bioscan-916. *Yoga* training was imparted for an hour twice daily for 120 days of duration. The *prakriti* analysis revealed 15 of *Vata-Pitta* (V-P) and 43 of *Pitta-Kapha* (P-K) group of individuals. Two subjects of *Vata-Kapha* (V-K) were excluded. The results of body composition in both groups indicated significant enhancement of RMR, as well as, decreased BF% and BF content after *yoga* practice. However, P-K group shows highly significant increase in RMR ($P < 0.0001$) and significant decrease in BF% ($P < 0.04$).

This study indicates the implication of *yoga* practice for prevention of metabolic disorders with respect to specific body constitutions.

Keywords: *prakriti*, *yoga*, RMR, BF%, BF

INTRODUCTION

Metabolism represents chemical process of living cell involving energy utilization and production. Resting metabolic rate (RMR) corresponds to major component of total daily energy expendi-

ture (TDEE) that accounts for 60-75% by calorie burning process to stabilize cellular energy dynamics¹. Low RMR is a major predisposing risk factor for obesity². In present era, obesity and abnormal body fat

distribution is one of the major contributors for epidemic global risk of metabolic syndrome (MS). This is mainly due to sedentary lifestyle, physical inactivity and ignorance³ leading to impaired regulation in energy utilization and storage. Further, MS can promote higher risk for development of atherosclerotic cardiovascular disease, type-2 diabetes and other health related complications³. Hence, there is a need for an early detection and progression of MS to overcome this risk in future life⁴. Worldwide estimation indicates that America, Europe and India stand at higher risk level to carry MS⁵. Impaired ideal health can be overcome by regular exercise and balanced diet⁶. It has been estimated that *yoga* or exercise can raise resting rates of energy expenditure or metabolism in addition to numerous effects on physiological functions such as improved blood flow, absorption of nutrients, weight loss etc⁷⁻⁹. This mode of action will further direct towards prevalence of metabolic disorders.

In ancient Indian medicinal system *Ayurveda*, science of exercise and its importance is clearly indicated to induce harmony between body, mind and spirit¹⁰. It considers each human body constitution from birth influenced with unique morphological and psycho-physiological make-up, described under the term *prakriti*¹¹. *Prakriti* analysis plays a vital role in regulation of optimum health through its dietary guidelines and lifestyle regimens¹². Several psycho-physiological parameters with exercise or *yoga* intervention have shown a strong association with specific body constitution (*Prakriti*)^{10, 13-15}. Further, the knowledge of one's own body type will influence in prevention and progression of metabolic syndrome¹⁶. Thus, the *yoga* intervention on metabolic profile, with reference to specific constitutional type, can

obviously help in a better prognosis and health.

MATERIALS AND METHODS

This is a self as control study design conducted on normal healthy 67 residential students of both genders between age group of 18 to 45 years, enrolled from Goverdhandas Seksaria College of *Yoga* and cultural synthesis of *Kaivalyadhama*, Lonavla. The subjects had uniform dietary intake as per yogic food menu. The health fitness examination was done by residential medical officer. There were 7 drop outs from the study. The study was initiated after an approval from Institutional ethical committee and a written consent of subjects were readily taken.

Assessment of *Prakriti*

Assessment of *prakriti* was done using a standardized and validated questionnaire, based on the descriptions from various *Ayurvedic* texts¹⁷. It comprises 37 objective questions related to physical characteristics, physiological habits and psychological make-up of an individual. Each question carries three options referring to each *dosha* namely *Vata* (V), *Pitta* (P) and *Kapha*(K). The dominance of specific *prakriti* of person is identified on the basis of responses given in each column of V, P, K followed by interview and physical examination by an *Ayurvedic* physician. The responses are computed to obtain final percent score. The percent score $\geq 50\%$ for particular *dosha* is considered as predominant *dosha*, while score between 25%-35% categorized as secondary *dosha* in *prakriti*. The volunteers were classified as three groups namely *Vata-Pitta*, *Pitta-Kapha* and *Vata-Kapha*. While designating *prakriti*, individuals of *Vata-Pitta* or *Pitta-Vata*, *Pitta-Kapha* or *Kapha-Pitta* and

Vata-kapha or *Kapha-Vata* were considered to be equivalent.

Physiological measurements:

The physiological testing includes resting metabolic rate (RMR), Percent body fat (BF %) and body fat (BF) measured through non-invasive method by using body composition analyser (BCA) Maltron Bio Scan 916, UK with an operating frequency of 50 kHz. The subjects were made to lie down in supine position with their arms and legs stretched apart. The data were collected by tetra polar electrode recording methods using two paired adhesive gel paper electrodes¹⁸. One pair of active gel paper electrodes are placed one below the other of third knuckle of middle finger and centrally opposite of palm surface, while other pair of electrodes are placed on foot at the union of second and third toe and on central portion of the same side. All electrodes are placed on right side of the body with cables as per user's manual^{18, 19}.

The physiological variables such as RMR, BF% and BF were statistically analysed using GraphPad InStat3.06 version statistical software. All values are given as mean \pm standard deviation. The comparative analysis between two groups is done by paired T-test.

Intervention:

The *yoga* training was imparted daily an hour twice a day for 120 days except Sun-

days and holidays. The *yoga* module was prepared as per the syllabus curriculum by senior *yoga* experts of *Kaivalyadhama yoga* institute, Lonavla. The module is described in appendix 1.

RESULTS/OBSERVATIONS

The analysis of *prakriti* scores revealed that among 60 volunteers, maximum number of people found to be of *Pitta-Kapha* (n=43) and *Vata-Pitta* (n=15) *prakriti*. The *Vata-Kapha* group is excluded because of too few values in this group (n=2).

The statistical analysis of physiological variables was as follows:

After *yoga* intervention, the change in terms of highly significant elevation in RMR, with decrease in BF% and BF is found in both *Vata- Pitta* (V-P) and *Pitta-Kapha* (P-K) group of individuals (Table 1, Figure 1-4). Similarly, in comparison of both pre and post *yoga* training, highly significant increase in RMR is found to be in P-K group compared to V-P group of individuals and in the same group, significant decrease in BF% is found after *yoga* training. However, there is no significant change in terms of BF between both groups (Table 2a & 2b, Figure 5-8).

Table 1: RMR, BF%, BF of healthy individuals initially and after 120 days of Yoga practice as per Prakriti

Parameters	Prakriti	Mean \pm SD		Paired t – Test t – value
		At 0 day	At 120 th day	
RMR	<i>Vata-Pitta</i>	1347 \pm 161	1454 \pm 178	12.71 P<0.0001*
	<i>Pitta-Kapha</i>	1470 \pm 160	1581 \pm 189	15.48 P<0.0001*
BF%	<i>Vata-Pitta</i>	33.97 \pm 4.98	18.10 \pm 3.77	12.50 P<0.0001*
	<i>Pitta-Kapha</i>	30.80 \pm 7.14	17.56 \pm 7.72	22.81 P<0.0001*
BF	<i>Vata-Pitta</i>	18.36 \pm 3.72	10.83 \pm 3.5	10.45 P<0.0001*
	<i>Pitta-Kapha</i>	18.80 \pm 5.69	10.64 \pm 5.01	14.98 P<0.0001*

(*- Highly significant)

Table2a: RMR, BF%, BF of healthy individuals before *Yoga* practice within comparison of *Prakriti*

Parameters	Mean ± SD at 0 day		Within <i>Prakriti</i> comparison, Paired Test, t – value
	<i>Vata-Pitta</i>	<i>Pitta-Kapha</i>	
RMR	1334 ± 161.7	1523 ± 172.6	5.001 P<0.0003*
BF%	33.97 ± 4.9	29.16 ± 7.3	1.974 P>0.05
BF	18.36 ± 1.03	18.18 ± 1.3	0.086 P>0.05

Table 2b: RMR, BF%, BF of healthy individuals after 120 days of *yoga* practice within comparison of *prakriti*

Parameters	Mean ± SD at 120 th day comparison within <i>Prakriti</i>		Within <i>Prakriti</i> comparison, Paired Test, t – value
	<i>Vata-Pitta</i>	<i>Pitta-Kapha</i>	
RMR	1444 ±174.4	1649.3± 200.8	3.82P<0.002*
BF%	19.84 ± 6.02	15.15 ± 6.4	2.26 P<0.04
BF	10.83 ± 3.5	9.12 ± 3.7	1.27 P>0.05

Figure 1-4: Pre and Post *Yoga* practice on Resting Metabolic Rate (RMR), percent Body Fat (BF %) and Body Fat (BF) as per *prakriti*.

Figure 1

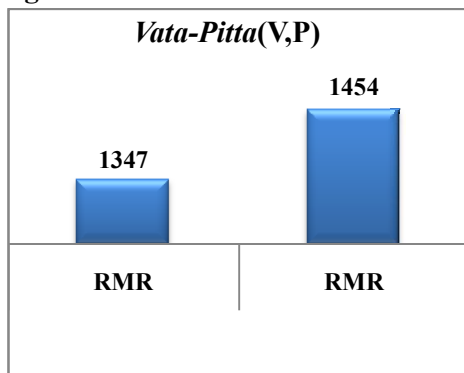


Figure 2

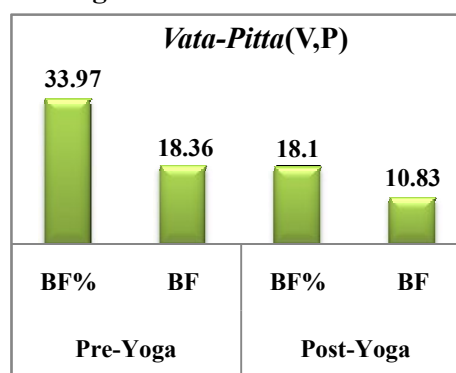


Figure 3

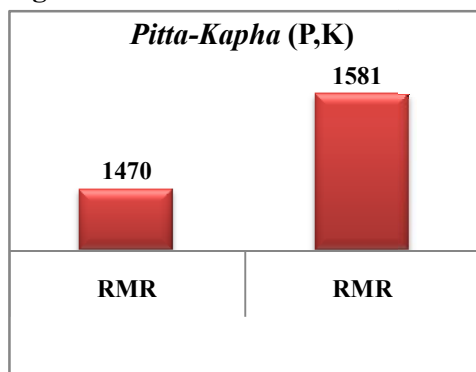


Figure 4

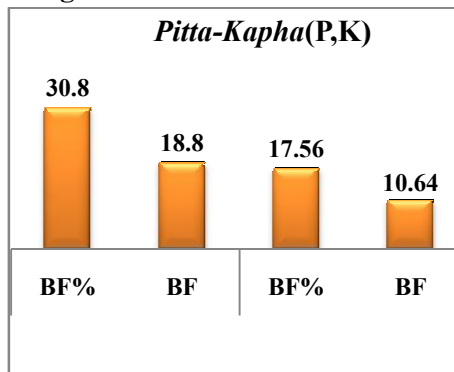


Figure 5-8: Pre and Post Yoga practice on RMR, BF% and BF within comparison of prakriti.

Figure 5

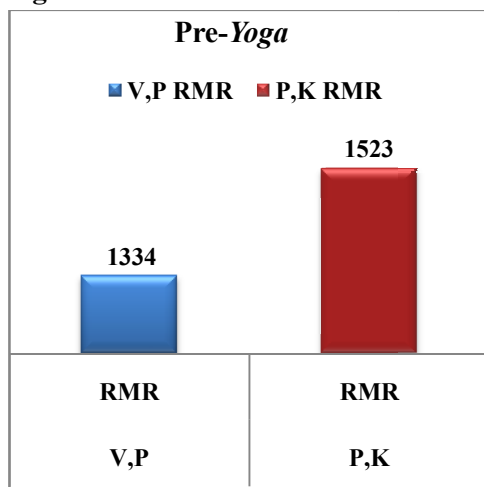


Figure 6

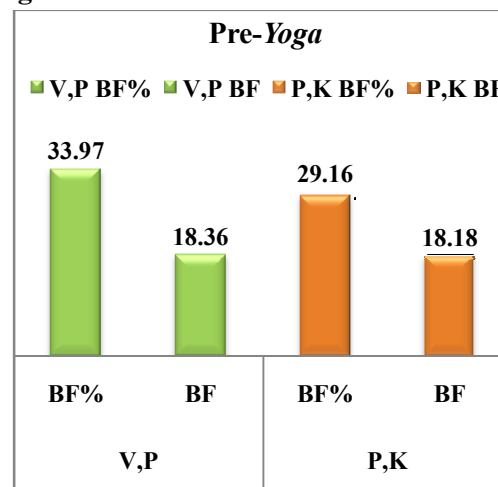


Figure 7

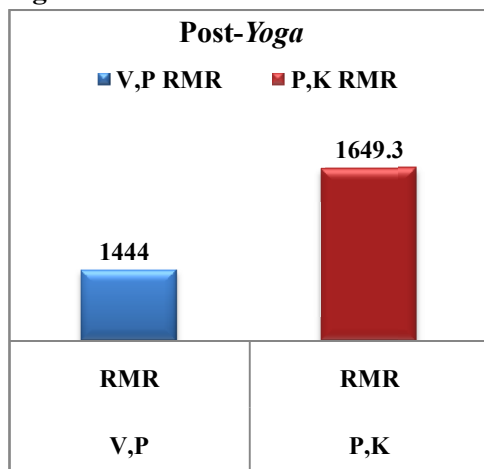
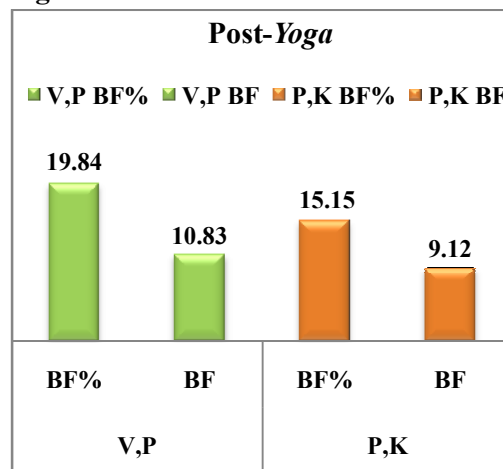


Figure 8



DISCUSSION AND CONCLUSION

In *Ayurveda*, *prakriti* represents biological specificity at cellular level²⁰. The constituents of *prakriti* (*tridosha*) namely *vata*, *pitta* and *kapha* are present in the entire body along with their respective functions¹¹. Besides single dominant *doshas*, *Prakriti* also exists in combination of two *doshas* or in a balanced combination that accounts for total of seven types. Since the *doshas* accounts for whole body metabolism, as well as, *yoga* practices are known to enhance resting metabolic rate⁹, reduces obesity²¹ etc., suggests the plausible role of *yoga* in modulating *dosha* mediated

metabolic activity. The RMR variation and *prakriti* share a common physiological and genetic basis²²⁻²⁴. Therefore, correlating RMR with *prakriti* was found to be viable in the study.

The results of the study amply indicate the subjects having baseline *prakriti* such as *Vata-Pitta* (V-P) and *Pitta-Kapha* (P-K) types practicing *yoga* could enhance metabolic activity as evident from highly significant increase in RMR ($P < 0.0001$). The reciprocal effect of *yoga* training towards reduction of fat content is also reflected from the significant decrease in fat mass (BF), percent body fat (BF%) ($P < 0.001$) in

both groups. The above results suggests that the *doshas* have a characteristic physiological functions, such as *vata* could be attributed to microcirculation of metabolites, *pitta* for metabolic function of the cell and *kapha* for fat storage²⁵. The enhanced RMR indicates the role of *pitta* that contributes for more heat production, higher basal metabolic rate (BMR) and energy consumption²⁶. This infers that *yoga* practice acts as catalyst to enhance metabolic activity in subjects having *pitta* dominant constitution. However, mobilization of fat towards enhanced metabolism due to *yoga* practice is well evident in K-P subjects, resulting into weight loss. It infers cumulative effect of *pitta dosha* with *yoga* practice mobilising *kapha* content as reflected from earlier studies^{27, 28}. Further, within group results shows significant decrease in BF % ($P < 0.04$) among P-K group, leading to inference that *yoga* training may have activated *pitta* constituent towards fat reduction. This suggests that in any physical activity, a balanced relationship exists between energy storage and expenditure²⁹, which, in this study, is evidently seen equivalent to the relationship between *kapha* with *pitta*. The present study is delimited to only two dual constitutional types namely V-P and P-K. However, further studies are recommended on subjects of V-K combinations, as well as, on single dominant constitutional types. It will shed more light on therapeutic effects of *yoga* in this direction.

The study concludes that *yoga* practice is more effective for selected *prakriti* types such as V-P and P-K so as to enhance RMR and fat metabolism. However, subjects of P-K *prakriti* type exhibits higher RMR magnitude and a significant decrease in body fat percent. *Yoga* practice thus can be used for prevention of metabolic disor-

ders with respect to specific body constitutions for which further research is warranted.

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Appendix 1: Yoga Module

ASANAS	<i>Shavasana, Shrishtasana, Pavanmuktasana, Naukasana, Viparitarikarani, Sarvangasana, Matsyasana, Halasana, Karnapidasana, Bhujangasana, Shalabhasana, Sarpasana, Dhanurasana, Vakrasana, Ardha-Matsyendrasana, Paschimatanasana, Supta Vajrasana, Yoga Mudra, Simhasana, Gomukhasana, Matsyendrasana, Mayurasana, Ushtrasana, Gorakshasana, Padma – Bakasana, Baddha – padmasana, Parvatasana, Janushrihasana, Siddhasana, Padmasana, Tolangulasana, Muktasana, Virasana, Guptasana, Sankatasana, Ut-tanamandukasana, Vrishabhasana</i>
PRANAYAMA	<i>Anuloma-viloma, Ujjayi, Shitali, Sitkari, Bhastrika, Bhramari, Suryabhedana, Chandrabhedana</i>
BANDHAS AND MUDRAS	<i>Jalandhara Bandha, Uddiyana Bandha, Jicha Bandha, Mula Bandha</i>
KRIYAS	<i>Jala Neti, Sutra Neti, Dhauti (Vamana, Danda, Vastra)</i>

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