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Impact of Food Intake and Submaximal Exercise on Metabolic Response in Young Healthy Adults of Different Prakriti (Constitutions)

Dr. Priyanka B Kundaragi, Dr. Parwati P Patil, Dr. Padmashri S Kudachi.
Post Graduate, Department of Physiologhy, Jn Medical College, Belagavi-10
Professor and Head of the Department of Physiologhy, jn Medical College, Belagavi-10
Professor Department of Physiologhy, Jn Medical College, Belagavi-10

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ABSTRACT

Introduction

Prakriti is a lifelong dosha constitution formed at conception, influencing body, mind, and health. *Vata* shows dryness, lightness, and mobility; *Pitta* shows heat and sharpness; *Kapha* shows heaviness and softness. Each type is prone to related diseases. BMR, the body's basic energy need, varies by age, weight, and height, and rises after exercise in all Prakriti types. Vata controls movement, and proper exercise boosts BMR, fitness, and *dosha* balance when suited to one's *prakriti,* age, and season. A bicycle ergometer measures work done by the rider's muscles. VO_{2max}, defined by Hill and Lupton (1923) is the maximum oxygen uptake during intense exercise beyond which no further increase occurs, marking the limit of the cardiorespiratory system. Objective of the study: To study the impact of food intake on metabolic efficiency measured by Basal Metabolic Rate and VO_{2max} in different *Prakriti.* To study the impact of submaximal exercise on metabolic efficiency in different *Prakriti,* metabolic efficiency will be measured by basal metabolic rate. Methodology- A total of 99 Participants was included in the study. After taking written consent, based on preliminary assessment, participants were classified into three prakriti based on a questionnaire. Before having food,descriptive data, anthropometric parameters and basal heart rate was recorded. After food, history and quantity of food intake of each prakriti was asked and Basal metabolic rate and post prandial heart rate was recorded. All the participants were allowed to do bicycle ergometer in view of recording VO_{2max}. Post exercise metabolic rate was then recorded.Results- Amongst all 99participants *Kapha* prakriti had the highest mean BMR followed by *Pitta* and *Vata* prakriti had the lowest BMR amongst the three which relatively indicates slower basal metabolism rate.Vata prakriti individuals show superior cardiorespiratory fitness and oxygen utilization (highest VO_2 max), whereas *Kapha* has the lowest, with *Pitta* falling in between.Conclusion- *Kapha* shows the highest BMR but lowest VO_2 max. *Vata* shows the lowest BMR but highest VO_2 max. *Pitta* remains intermediate for both BMR and VO_2 max.

1. INTRODUCTION:

The depiction of genetic coding found in an individual's physical, physiological, psychological, social, and spiritual characteristics is known as *Prakriti.* It is helpful to comprehend Prakriti in order to avoid disease, diagnose conditions, create treatment programs, and predict future ailments. It outlines unique traits that are dictated by a specific and long-lasting *dosha* configuration in an individual. One or more combine at the time of conception, and the dominant dosha combination creates the *prakriti.* These can be manifested

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through *Dosha*-specific characteristics and represent the individual's *Doshika Prakriti*.[1]A *vata* dosha's characteristics include dryness (ruksha), lightness or lower specific gravity (laghu), coldness (sheeta), motility (chala), and minuteness (sukshma). Those with a *pitta dosha* have sneham (lubricant), drava (liquidity), hot (ushna), piercing (tikshan), and sheeta (cold in temperature), while those with a *kapha dosha* are weight (guru), soft (mrudu), and slippery (pichilla). Throughout their lives, people who are *Vataja Prakriti* are more likely to suffer from *Vataja* diseases (such as body aches, joint disorders, and neuromuscular problems); people who are *Pittaja Prakriti* are more likely to suffer from *Paittika* diseases (such as acid reflux, skin conditions, and inflammatory reactions) and people who are *Kaphaja Prakriti* are more likely to suffer from *Kaphaja* diseases (such as respiratory illnesses, worm infestations, and itching issues).[2]According to *Ayurveda* the three *doshas Vata* ,*Pitta* and *Kapha* regulate the body's functions, while modern science describes metabolic requirements through the Basal Metabolic Rate (BMR) which is the minimum caloric intake needed to sustain life when at rest. BMR constitutes approximately 50-60% of the total daily energy expenditure and is influenced by factors such as age, weight, height and level of physical activity. Engaging in exercise, particularly cardiovascular workouts can elevate BMR and enhance overall health. The BMR variations in individuals based on different Prakriti types before and after physical activity are noteworthy. Since *Vata* is associated with movement, *Pitta* with metabolism and *Kapha* with structure, their responses in terms of metabolism vary. It has been noted that BMR rises after exercise for all three Prakriti categories. Ayurveda suggests that exercise regimens should align with *Prakriti-Vata* benefits from light activities, *Pitta* From moderate levels and *Kapha* from more intense exercises such as jogging or aerobics ultimately aiding in balancing, strengthening , increasing endurance and promoting overall weel-being.[3,4,5] Per-Olof Astrand invented the first bicycle ergometer in the 1950s The term "ergometry" stems from the Greek words "ergon" (work), and "metron" (measurement), and may be translated rather literally as "work measurement". A bicycle ergometer is a bicycle fitted with mechanical devices to measure the amount of work done by the rider's muscles. Maximal oxygen uptake (VO_{2max}) was defined by Hill and Lupton in 1923 as the oxygen uptake attained during maximal exercise intensity that could not be increased despite further increases in exercise workload, thereby defining the limits of the cardio respiratory system.[6,7]

Aim

The current study will be conducted to examine the impact of various prakriti on metabolic response following food consumption and submaximal exercise. Prakriti is linked to metabolic rateand maximum oxygen intake. Our understanding of tailored health interventions based on various prakriti would be enhanced by this multidisciplinary research

Objective of the study:

- To study the impact of food intake on metabolic efficiency measured by Basal Metabolic Rate and VO_{2max} in different Prakriti.
- To study the impact of submaximal exercise on metabolic efficiency in different Prakriti, metabolic efficiency will be measured by basal metabolic rate.

Methodology-

1.Source of Data: Healthy young adults aged 18-25years Health science students studying in JNMC Belagavi.

2. **Study Design:** Comparative Cross-sectional study

3.Study Period: The study will be conducted over period of 12 months, beginning from January 2025 and ending in December 2025.

4. **Sample Size:** The sample size is calculated using G-power
software under F tests for Anova .

- Considering effect size to be 0.25, $\alpha = 0.05$ and $\beta = 0.95$
- number of groups = 3 (Vata, Pitta, Kapha)
- number of measurement = 2 (Pre-exercise and post- exercise)
- correlation among repeated measures = 0.5
- non sphericity correction = 1
- the total sample size is 66.
- By taking attrition as 10% we get 72, i.e., 24 in each group, For the sake of future validation, we are expanding each group to 33 students.

5.Sampling technique:

Convenience
Physiology lab, Department of Physiology, JNMC Belagavi

6.Inclusion Criteria:

1. Healthy young adults college students aged 18-25 years.
2. The study will include physiological tests for those who voluntarily consented to Prakriti Pariksha and exercise.

Note 3. Obesity is known to be prevalent among kapha prakriti hence all grades of BMI subjects included in study.

7.Exclusion Criteria:

1. Students with a history of Musculoskeletal

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disorders, Metabolic syndrome, Psychiatric medicines, Diabetes, Hypertensive, Thyroid disorders, Respiratory disorders, Neurological Disorders, Nutritional deficiency will be excluded.

Data collection procedure:

1. Recruitment and Informed Consent:

❖ Healthy young college students aged 18-25 years who give informed consent and willing to participate shall be enrolled in this study.

❖ Informed voluntary written consent will be taken and participant's prakriti evaluation will be done using a **Standardized CCRAS Prakriti questionnaire** will be enrolled.[8]

❖ Classification of study 99 participants in different Prakriti: *Vata* Pradhana Prakriti group, *Pitta* Pradhana Prakriti group and *Kapha* Pradhana Prakriti group.

❖ Each participant will complete a demographic form to collect data on age, gender, history, and lifestyle factors. All the young adults will be invited to the physiology lab, Dept. of Physiology JNMC Belagavi for the recording and assessment of various parameters and Prakriti assessment followed by giving pre-exercise instructions to the students to carryout bicycle ergometry.

❖ After the post lunch they will be called at 1:45pm and measured basal metabolic rate.

❖ After food, history and quantity of food intake of each prakriti was asked and post prandial heart rate was recorded.

❖ Bicycle ergometry procedure will be conducted in view of recording VO_{2max}.

❖ Post exercise metabolic rate was then recorded.

Baseline Data Collection:

l. Descriptive data of the young adult: Age, gender, history will be recorded for each Participants.

ll. Anthropometric Measurements:

❖ **Weight in kg**: Body weight will be measured (to the nearest 0.01 kg) with the subject standing still on the electronic weighing scale, feet about 15 cm apart, and weight equally distributed on each leg. Subjects will be instructed to wear minimum outerwear (as culturally appropriate) and no footwear while their weight will be measured.

❖ **Height (stature) in cms:** Height will be measured by a commercial stadiometer (to the nearest 0.1 cm) with the subject in an erect position against a vertical surface and the head positioned so that the top of the external auditory meatus is in level with inferior margin of the bony orbit. (Weight will be recorded with an accuracy of + 100gm).[9]

lll. Basal heart rate:

Will be noted as beats per minute by taking Radial artery pulse rate and counting for whole minute.

lV. BMR in Kcal:

Men =66.0+(13.7×body mass in kg) + (5.0×stature in cm) - (6.8×age in yrs)

Women=655+(9.6× body mass in kg) + (1.85× stature in cm) -(4.7×age in yrs).[10]

V. Bicycle Ergometer:

It is a safe, low-impact, and efficient cardiovascular exercise.It has a saddle, pedals and handlebars of some sort, just like a (stationary) bicycle**.** A bicycleequipped with mechanical devices to gauge

the amount of effort exerted by the rider's muscles is called an ergometer. (Anand agencies Pune)

Procedure:

- **Resting Pulse Rate:** The resting pulse rate of the subject will be recorded**.**
- **Warm-up:** The subject is given a warm-up ride for 1-2 minutes without any load.
- **Exercise:** The subject is asked to pedal the bicycle at a constant speed of 50 revolutions per minute with an initial load of 2 kilograms.
- **Pulse Rate Monitoring:** The pulse rate is measured using a pulse oximeter at the end of each minute during the exercise**.**
- **Duration:** The subject is required to continue the exercise for a minimum of 6 minutes**.**
- **Load Adjustment:** If the subject can maintain the exercise, the load is gradually increased by half a kilogram at a time.
- **Steady State:** The steady pulse rate achieved at the 5th and 6th minutes is noted. If the difference between these two readings is more than 5 beats per minute, the test is extended for 1-2 minutes until a steady state is reached.
- **Maximum Heart Rate:** The average pulse rate from the last 2 minutes is considered the maximum heart rate at that load.
- **VO_{2max} Estimation:** The **Astrand-Rhyming nomogram** is used to estimate VO_{2max}.
- **Age Correction:** An age correction factor is applied to the VO_{2max} score based on a table, resulting in the final VO_{2max} value in L/min**.**

VO_{2max} (ml/min/kg)= VO_{2max} (L/min) X 1000

Body weight

The main panel as shown in the figure contains the ON-OFF switch. It gives the durations in min, no of wheel revolutions & also the speed of pedaling. The control to increase or decrease load is present on the right handle bar. The increase/decrease in the load is indicated on the analog dial in the main panel.

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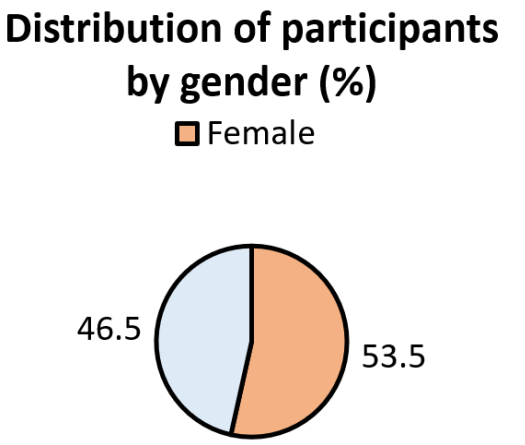
	Male	46	46.5
Total		**99**	

Gender distribution



Data analysis table And Result:

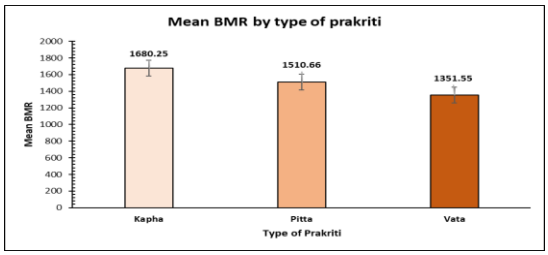
Table 1.

Variable		n	%
Gender	Female	53	53.5

Table -2. Descriptive statistics of selected variables

Variable	Type of Prakriti							
	Kapha (n =33)		Pitta(n =33)		Vata(n =33)		F value	p value
	Mean	SD	Mean	SD	Mean	SD		
Age	19.61	1.62	19.52	0.94	19.58	1.37	0.039	0.961
Height	163.82	10.07	163.61	6.5	159.21	9.05	2.967	0.056
Weight	74.18	11.38	58.48	5.92	47.3	6.15	89.131	0.001*
Basal Metabolic Rate	1680.25	218.2	1510.66	109.84	1351.55	123.51	35.7	0.001*
VO2 Max	41.57	6.14	45.95	6.49	53.27	7.57	25.24	0.001*
Sub-maximal Heart Rate	160.32	1.3	160.39	0.75	160.34	1.1	0.039	0.961

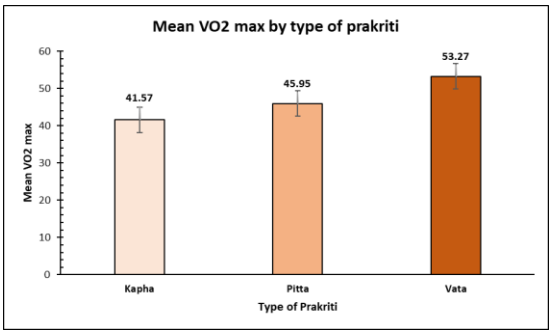
The table compares Kapha ,Pitta and Vata individuals (each group n= 33) on several physiological variables.ANOVA(F value and p-value) is used to test whether the differences between groups are statistically significant**.**The comparison of selected variables across Prakriti types shows no significant differences in age, height, and sub-maximal heart rate, indicating that these characteristics are similar among Kapha, Pitta, and Vata groups. Weight, BMR, and VO_2 max differ significantly (p = 0.001). Kapha individuals exhibit the highest weight and BMR, Pitta shows moderate values, and Vata has the lowest weight and BMR. In contrast, VO_2 max is highest in Vata, moderate in Pitta, and lowest in Kapha, reflecting differences in aerobic capacity. Overall, the findings align well with Ayurvedic descriptions of each Prakriti.



Kapha Prakriti — Highest BMR (1680.25 kcal/day),their larger body build and greater metabolic demand at rest contribute to this elevated caloric requirement**.**

Pitta Prakriti — Moderate BMR (1510.66 kcal/day),reflecting their naturally strong metabolism and efficient digestive capacity (agni).

Vata Prakriti — Lowest BMR (1351.55 kcal/day),consistent with their lighter body frame and lower baseline metabolic activity.



Vata Prakruti — (53.27 ml/kg/min)Vata individuals have a lean body, low fat percentage, quick movements, and efficient breathing. These factors reduce oxygen demand during exercise and improve oxygen delivery, giving them the highest VO_2 max.

Pitta Prakruti — (45.95 ml/kg/min)Pitta individuals possess strong metabolism, good muscle tone, balanced physique, and healthy cardiac output. These features support effective oxygen use and stable aerobic performance,

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resulting in a moderate VO_2 max

Kapha Prakruti — (41.57 ml/kg/min) Kapha individuals have a heavier build, higher body fat, and slower metabolism, which increase oxygen demand and reduce aerobic efficiency. This leads to the lowest VO_2 max among the three Prakrutis.

DISCUSSION:

Prakriti types differ in VO_2 max and BMR because of their innate physiological traits. Pitta people have a moderate aerobic capacity because of their robust metabolism and balanced physiology, whereas Vata people have the highest VO_2 max because of their lean physique and effective breathing. Due to their slower metabolism and bulkier physique, Kapha people have the lowest VO2 max. In a similar way, Kapha people have the highest resting metabolic rate (BMR) because of their larger bodies, Pitta people have a fairly high BMR because of their high metabolic activity, and Vata people have the lowest BMR because of their lighter bodies and reduced metabolic demands. These results imply that aerobic performance and metabolic rate are significantly influenced by Prakriti.

CONCLUSION:

In this study three varieties of Prakriti have significantly different VO_2 max. Because of their lean physique and effective breathing, Vata people have the highest VO_2 max; Pitta people have intermediate levels because of their balanced metabolism and well-toned muscles; and Kapha people have the lowest VO_2 max because of their slower metabolism and more body fat. These variations imply that Prakriti has a major impact on aerobic capacity and can direct individualised health and exercise plans.

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