

A Confirmatory Study of Relationships in Ayurveda: Deha Prakritis, Agnis, Koshtas, and their Association to Cardiovascular Risk Factors

Research Article

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Abstract

Background and Objectives: Ayurvedic theory proposes a person's mind-body type (*Deha Prakriti*) is related to the condition of their digestive system (*Agni*) and to the responsiveness of their alimentary canal (*Koshta*). However, these relationships have never been statistically verified. Evidence also suggests the condition of a person's digestive system and gut responsiveness are related to cardiovascular risk factors, but the relationships between them, too, have also not been statistically tested. **Methods:** One hundred and sixty patients underwent pulse diagnosis for general health assessment, including measurements of weight, Body Mass Index (BMI), blood pressure, and diet. **Results:** Results suggest each Deha Prakriti was related to its respective Agni and Koshta. For example, a Vata-dominant Deha Prakriti was correlated to Vishamagni and to Krura Koshta. Results also indicate Deha Prakriti, Agni, and Koshta were generally associated to weight, BMI, and diet, but not to hypertension, a finding also advanced by Ayurvedic theory. **Discussion:** These data suggest for the first time that Ayurvedic assessment of mind-body type and gastrointestinal conditions are related to each other and somewhat to cardiovascular risk factors, and provide confirmatory insights into fundamental Ayurvedic principles, a topic yet to be empirically examined despite its importance for health.

Key Words: *Ayurveda, Deha Prakriti, Agni, Koshta, cardiovascular risk factors.*

Introduction

A significant number of cardiovascular risk factors related to heart and circulatory disease conditions have been identified, including poor diet, weight, increased levels of cholesterol, and hypertension. Collectively, these factors can lead to stroke, congenital heart disease, rhythm disorders, subclinical atherosclerosis, coronary heart disease, heart failure, and peripheral artery disease (1). Indeed, cardiovascular disease (CVD) is one of the leading causes of death in the world. Consideration of the many different approaches of Ayurveda to CVD is the topic of an extensive corpus of research (2). In Ayurveda, the heart (*Hridaya*) is referred to as one of the *Trimarmas* (or three key points) in the human body and Ayurveda has emphasised that special care must be given to protection and health of the heart. Particular attention in Ayurveda to counter CVD has been given to the diagnosis of *Deha Prakritis*, *Agnis*, and *Koshtas*.

The three main types of pulse vibration (or *Dosha*) diagnosed in Ayurveda have been well documented. The *Doshas* are *Vata*, *Pitta*, and *Kapha*, and because the "heart is the root of all blood vessels, so the dosha(s) are transmitted by the blood vessels to the whole body" (3). Thus, while the vibratory qualities of *Vata*, *Pitta*, and *Kapha* can be felt throughout the body they are most dominant and readily discernible in the radial pulse using *Nadi-Vigyan* or pulse diagnosis.

The presence and diagnosis of the *Doshas* and their possible combinations in the body (such as *Vata-Pitta*, *Vata-Kapha*, *Pitta-Vata*, etc.) are referred to as the *Deha Prakriti* or constitutional nature of the individual body type. Collectively, *Vata*, *Pitta*, and *Kapha* are referred to as *Tridosha*, the threefold nature of the body (4). Bhalerao, Deshpande and Thatte have observed those with a *Vata*-dominant *Deha Prakriti* have lower body mass index (BMI), those with *Pitta*-dominant *Deha Prakriti* have a moderate BMI, and those with a *Kapha*-dominant constitution have higher BMI (5). According to Chintala and Bhagavathi, accurate diagnosis of a patient's *Deha Prakriti* "allows a physician to assess the condition of *Koshtha* (digestion system) (and) *Agni* (digestive capacity)" (6).

In addition to determining the *Deha Prakriti* of a patient, the Ayurvedic doctor can diagnose the status of a patient's digestive system using *Nadi-Vigyan*. In Ayurveda, particularly in the Vedic texts *Charak Samhita* and *Sushrut Samhita*, the digestive system is

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referred to as a 'digestive fire' or *Agni*, because it is the internal 'fire' of the body which converts food into energy by breaking down solids and liquids into nutrients. According to Poojary and Banu, "Agni is the sole cause for existence of life, and its extinction leads to death; its proper maintenance helps to live a long life, and its impairment gives rise to diseases" (7); elsewhere, an imbalance in Agni (or improper digestion, *Agnivaishamyā*) has been associated with neck and back pain (8). Ayurveda identifies four main types of Agni: *Vishamagni*; *Tikshnagni*; *Mandagni*; and *Samagni*, although Poojary and Banu cite a total of 13 Agnis (6), of which the four main types can be classed together as states of *Jatharagni*.

Vishamagni represents an unpredictable digestive system (the word 'Vishama' means irregular). In such a condition, a person can alternately feel satiated after eating a meal, with a feeling of being well nourished and satisfied, but at other times, can feel bloated, heavy, lethargic, and uncomfortable. In Ayurveda, *Vishamagni* is associated with an excess in Vata Dosha because, like the wind, it is unpredictable and causes symptoms such as feelings of bloat and gas, rumbling in the abdomen, often accompanied by constipation or alternate periods of constipation and loose stool (i.e., diarrhea): "Vishamagni is influenced by Vata dosha and hence is unpredictable in nature" (7).

Tikshnagni occurs when the digestive fire is burning too intensely and too quickly (the word 'Tikshna' means sharp). In such a condition, a person must eat on time or may become irritable, and is often hungry, even between meals. Such a person might be going to the toilet after every meal, particularly if the meal involves hot, spicy food or contains a lot of onion and garlic. When a person's Agni is too strong, their stomach secretes extra acid, causing hyperacidity and heartburn (a symptom of both acid reflux and gastroesophageal reflux disease), potentially leading to the formation of stomach ulcers. *Tikshnagni* is associated with an excess in Pitta Dosha because, like a raging fire, it is fast, strong, sharp, hot, and upwardly directed, and causes symptoms such as loose stool, heartburn, dyspepsia, loss of energy, and sharp appetite, and may be associated with dysentery: *Tikshnagni* is "influenced by Pitta dosha which is the cause of its intense nature" (7). According to Ohol, while traditional Ayurvedic texts do not specifically link all Doshas to their respective Agni, the ancient texts do say: "*tikshnagni* (intense digestive fire) (is associated with *pitta prakriti*" (9).

Mandagni which is influenced by Kapha (7), occurs when the digestive fire is low and weak, and hence metabolism and digestion are especially slow (the word 'Manda' means slow). In such a condition, irrespective of the amount of food one consumes, a person feels full for several hours after eating a meal. Hence, one's Agni digests the least amount of food in the greatest amount of time. Feelings of tiredness, lethargy, or even exhaustion, can accompany a large meal followed by an urge to sleep. *Mandagni* is associated with an excess in Kapha Dosha because, like the earth, it is heavy, slow, and dense, and causes

symptoms such as a tendency toward easy weight gain, low appetite, feelings of slow digestion, and sticky stool.

Samagni is the only one of the four types which is considered normal; "all others are considered as abnormal" (7). *Samagni* occurs when the digestive fire is even, steady, and without disturbance. In this condition, when a person eats a meal, s/he feels comfortable thereafter, with none of the aforementioned effects of bloat, gas, heartburn, lethargy, and so on. *Samagni* is associated with balance in all three Doshas and relates to the proper digestion and assimilation of food by the body, a condition which improves quality of the *Dhatu*s or bodily tissues. Symptoms of *Samagni* include no digestive discomfort after eating, radiant skin, shining eyes, and healthy daily bowel movements. In conclusion, Poojary and Banu maintain that in order "to avoid the disease manifestation and to retain the healthy state, one should always concentrate on (the) state of Agni and its management" (7).

Moreover, the accurate diagnosis of Agni is critical to maintaining cardiac health because direct links between the quality of one's digestive system and CVD and cardiovascular risk factors have been identified. For example, Ricciardelli et al. found evidence of an association between cardiac arrest and digestive problems in 828 Canadian public safety personnel (10); Svihus and Hervik documented the relationship between the digestion of starchy foods and CVD (11); and Soliman presented data which show the digestion of dietary fibre is associated with a decreased risk of CVD (12). Digestion of some fats is also associated weight (13) and poor digestion more generally is associated with depression, anxiety, and BMI (14).

The status of a patient's *Koshta* or gut responsiveness can be determined by Nadi-Vigyan but is diagnosed using *Prashana* or questioning the patient about important health topics, such how a patient feels, what symptoms they are experiencing, what is the direction of their symptoms or disease, what is the progression of their disease, whether they are sleeping well at night, what they eat, how they feel after eating, how much they exercise, and their outlook on life. According to Divyashree et al., "Koshta refers to the state of the abdomen or alimentary tract and is usually determined by the behaviour of the bowel habits" (15) and thus to the entire gastrointestinal system. Neck and back pain in women have also been associated with the patient's *Koshta* and possibly with an imbalance in Vata (8). The responsiveness of the alimentary tract is directly related to gut microbiome and the "complex interaction between the microbiome and immune systems may result in an inflammatory state", a topic of great interest in Ayurveda (16). Of particular interest to this paper is the observation that "Koshta varies according to *Prakriti*" (15).

In Charak Samhita and Sushrut Samhita, the gut response is referred to as 'Koshta' because the word relates to both the hollowness of the thoracic cavity as well as bowel movements as they relate to both Deha *Prakriti* and Agni. Ayurveda identifies three main types

of Koshta: *Krura Koshta*; *Mridu Koshta*; and *Madyama Koshta* (20). Divyashree et al. and Ragad and Gokhale maintain that one's Koshta varies according to the Doshas and hence one's Deha Prakriti (15,20). For example, *Krura Koshta* generally relates to Vata Dosha, *Mridu Koshta* relates to Pitta Dosha, and *Madhyama Koshta* relates to Kapha Dosha. When all three Koshtas are in equal proportion, one is said to experience a fourth type of gut response: *Sama Koshta* (15).

Krura Koshta occurs when Vata is dominant in the alimentary canal, which reduces the liquid content of the stool and results in elimination of hard stools (the word 'Krura' means harsh or disagreeable). *Krura Koshta* therefore causes difficulty in elimination (i.e., constipation). The *Laghu* (light) and *Ruksha* (dry) qualities of Vata reduce softness, stickiness, and oiliness of the stool, however these two qualities are required in harmony with others for proper elimination thereby preventing loose stools. In *Krura Koshta* the qualities of lightness and dryness are elevated.

Mridu Koshta occurs when Pitta is dominant in the alimentary canal, increasing the liquid content due to *Drava* (liquid), resulting in semi-solid discharge of fecal matter (the word 'Mridu' means soft). People with *Mridu Koshta* are more prone to loose or semi-solid

stools, increased frequency of defecation, and diarrhea. In *Mridu Koshta* the qualities of heat and looseness are elevated.

Madhyama Koshta occurs when Kapha is dominant in the alimentary canal, resulting in the passage of soft and solid stools, which is desirable and ideal (the word 'Madhyama' means middle or central). The optimum level of Kapha keeps both Vata and Pitta under control and prevents loose and hard stools. When Kapha qualities are excessive in the alimentary canal, increased mucus content is observed in the stool. *Sama Koshta* occurs when all three qualities of Koshta are present in the alimentary canal and are thus in balance.

The accurate diagnosis of a patient's Koshta is critical to maintaining cardiac health because direct links between the condition of one's gut responsiveness and CVD have been identified. For example, Ryan et al. found gut responsiveness both accelerates and attenuates the occurrence of CVD (17); Boulangé et al. showed that modulation of the 100 trillion gut microbiota in the alimentary canal is related to obesity and metabolic disease (18); and Serino et al. provided evidence that the putative role of gut microbiota dysbiosis-induced CVD, such as atherosclerosis, are common comorbidities of metabolic dysfunction (19).

Table 1: Properties of Deha Prakriti, Agni and Koshta and their proposed synchronous relationships

		Vata Dominant > Vishmagni > Krura Koshta	Pitta Dominant > Tikshnagni > Mridu Koshta	Kapha Dominant > Mandagni > Madhyama Koshta	Tridosha > Samagni > Sama Koshta
Deha Prakriti	Name	Vata-Pitta; Vata-Kapha	Pitta-Vata; Pitta-Kapha	Kapha-Vata; Kapha-Pitta	Vata-Pitta-Kapha
	Property	Takative, quick in initiating actions, quick in likes and dislikes, quick to understand and quick to forget; intolerance to cold, often feeling cold, shivering and stiffness	Sharp physical strength; moderate learning and memory; strong digestive power; intake of food and drink in large quantities	Strength, energy, peace and longevity; slow in initiating action and slow to get irritated	Balanced and even state of the body; state of equilibrium is endowed with good qualities of all three types of Prakriti
Agni	Name	Vishmagni	Tikshagni	Mandagni	Samagni
	Property	Unpredictable and irregular digestion; intake of food and drink in large quantities; irregular appetite; hypermetabolism	Fast, strong, sharp, hot and upwardly directed digestion; sharp and sudden appetite	Low and weak digestion; tendency to feel heavy after meals; steady appetite; hypometabolism	All three Agnis in equal proportions; balanced and even state of metabolism and digestion; proper assimilation of digested food; no digestive discomfort
Koshta	Name	Krura Koshta	Mridu Koshta	Madhyama Koshta	Sama Koshta
	Property	Lightness, roughness and dryness; infrequent bowel clearance; small quantity of stool; random discoloration of stool; slow defecation time; no urgency and requires straining	Heat and looseness; medium quantity of stool; no discoloration of stool; quick defecation time; occasional feeling of satisfaction after bowel clearance; marked urgency	Softness and solidity; medium quantity of stool; random discoloration of stool; requires straining; feeling of satisfaction after bowel clearance; moderate urgency	All three Koshtas in equal proportion

As graphically represented in Table 1, Ayurvedic theory thus states parallel associations generally exist between Vata Dosha > Vishamagni > Krura Koshta, between Pitta Dosha > Tikshnagni > Mridu Koshta, and between Kapha Dosha > Mandagni > Madhyama Koshta (7,15,20). While the work of Divyashree et al. goes some of the way to verifying these predictions (15), to these authors’ knowledge such associations have not been empirically verified with a large sample, hence the need for the present study.

The process of confirming the relationship of mind-body type, digestion, and gut responsiveness to cardiovascular risk factors begins by asking the following three research questions: RQ 1) Do the Deha Prakritis, Agnis, and Koshtas statistically relate to each other; RQ 2) Do cardiovascular risk factors of weight, BMI, and hypertension differ when categorised according to Deha Prakriti, Agni, and Koshta; and RQ 3) Do Deha Prakritis, Agnis, and Koshtas relate to cardiovascular risk factors of weight, BMI, hypertension, and diet?

A unique element of this research was its diagnostic use of Maharishi Ayur-Veda, a restoration of the complete knowledge and experience of Ayurveda by Maharishi Mahesh Yogi (21). The three main contributors with Maharishi in this restorative process were: Dr V. M. Divedi, a leading authority in *Rasayanas*; Raj Vaidya Brihaspathi Dev Triguna, a leading authority in diagnosing any forthcoming and existing disorder or disease by feeling the pulse (*Nadi-Vigyan*) (22); and Dr Balraj Maharishi, a leading authority on *Dravyaguna*, the identification and utilisation of medicinal plants (23). The stated goal of Maharishi Ayur-Veda is to revive the system (of Ayurveda) in its comprehensive and integrated form—with the help of leading Vaidyas of our time, and in accordance with the classical texts. Most especially, Maharishi’s intent was to restore the role of consciousness to its central position—both theoretically and through practical techniques (24).

Thus, Maharishi’s two main contributions to the restoration of Ayurveda can be summarised as: 1) his identification that the source of Ayurveda is the field of pure consciousness, *Atma*, the unbounded, unified state of intelligence underlying all physical creation; and 2) as part of his restoration and systematic reorganisation of the 40 aspects of Veda and the Vedic Literature, Maharishi was able to relocate the place of Ayurveda within the totality of Vedic knowledge, and thereby reorganise and illuminate its various components, creating what is now known as Maharishi Ayur-Veda. For his efforts in Ayurveda, in 2016 the Government of India declared Maharishi a “Master of AYUSH”.

Materials and Methods

Clinical Setting:

The study was carried out with patients attending the Maharishi Ayur-Veda Integrative Health Centre on the campus of Maharishi International University (MIU) in Fairfield, Iowa, during 2018-2019. The Centre offers multi-modality, holistic health care and education according to the principles and practices of Maharishi

Ayur-Veda through a collaboration with the faculty of MIU’s College of Integrative Medicine. Data collection was approved by MIU’s Committee for the Protection of Human Subjects and conducted according to its guidelines on clinical research.

Research Design and Procedure: The study employed a two-stage, observational design.

Stage 1: after meeting the inclusion criteria, patients completed a questionnaire to provide demographic, lifestyle (including diet), and health-related information. In Stage 1, two measures were taken by a nurse: a) blood pressure using a manual sphygmomanometer (SP) was taken three times between interval rests of one to two minutes with the average systolic and diastolic reading; and b) patient’s height and weight. Both measures were recorded *sub rosa*.

Stage 2: after resting in a prone position for ten minutes, a Maharishi Ayur-Veda expert diagnosed Deha Prakriti and Agni without speaking to the patient using Maharishi Nadi-Vigyan or examination of the pulse (i.e., Sparshana, a description of this how diagnostic technique was performed is explained in separate published research (30)); the patient’s Koshta was determined by questioning the patient (i.e., Prashana, including the following questions: Do you have any problems with digestion; how do you feel after eating; do you suffer from abdominal pain; if so, when does it occur and how intense is it; do you ever suffer from indigestion or upset stomach, hyperacidity or acid reflux, etc.). Findings from these sources of evidence were recorded *sub rosa*. (Note, in this study, diagnoses were conducted by Vaidya Dr Manohar Palakurthi. Vaidya Manohar, Ph.D., is the only Vaidya trained by all three Vaidyas cited above, and has served as a consultant in diet, digestion, and nutrition on numerous tours of the U.S., South Korea, Europe, Canada, and Japan, where he has trained physicians in the practice of Maharishi Ayur-Veda.)

Table 2: Patient demographic data at Stage 1

Demographic Variable	Number of Patients	Percentage of Total
Gender		
Female	94	58%
Male	66	42%
Age		
20-29	10	6%
30-39	10	6%
40-49	11	7%
50-59	25	16%
60-69	62	39%
70-79	42	26%
Ethnicity		
Caucasian	153	96%
African American	4	2%
Asian	3	2%
Level of Education		
High School Graduate	27	17%
University/College Graduate	106	66%
Post-Graduate	17	11%
Doctorate	10	6%

Socio-economic Level		
High Income	20	12%
Middle Income	105	66%
Low Income	35	22%
Occupation		
Agriculture	6	4%
Service	86	54%
Business	27	17%
Other	41	25%
Body Mass Index		
Underweight	32	20%
Normal Weight	48	30%
Overweight	66	41%
Obese	14	9%
Hypertension		
Normal	115	72%
Elevated	14	9%
Grade 1	24	15%
Grade 2	7	4%
Sedentariness		
Sedentary Lifestyle	128	80%
Non-sedentary Lifestyle	32	20%
Diet		
Non-vegetarian	127	80%
Vegetarian	33	20%

On the basis of a), hypertension was rated as: 130/80mmg = normal; 130-139/80-89mmg = elevated; 140-159/90-99mmg = Grade 1 hypertension; and 160-179/100-109mmg = Grade 2 hypertension, using guidelines provided by Williams et al. (25). On the basis of b), the patient's BMI was calculated using the following standard formula (26): kg/m^2 , where kg was the patient's weight in kilograms and m^2 was their height in metres squared; BMI was recorded *sub rosa* by the nurse according to the following classification: <18.5 kg/m^2 (underweight); 18.5-25 kg/m^2 (normal weight); 25-30 kg/m^2 (overweight); and >30 kg/m^2 (obese).

Participants

One hundred and sixty individuals (M age = 60.0 years, SD = 14.4) participated in this study and were selected using non-probability opportunity sampling based on the following five inclusion criteria: 1) patient was between 20 and 80 years of age, irrespective of gender, religion, race, or socioeconomic status; 2) patient was visiting the Centre for the first time; 3) patient had no known history of cardiovascular risk factors, such as stress or insomnia; 4) patient had no known history of hypertension; and 5) patient was unknown to the Ayurvedic diagnostician at the time of the study. Ninety-four patients were females (M age = 58.1 years, SD = 15.2) and 66 were males (M age = 63.0 years, SD = 12.7), with the largest age group of 60-69 years (39%). At the time of testing, all patients provided informed consent to be included in the study. Table 2 presents patient demographic data at Stage 1 for gender, age, ethnicity, level of education, socio-economic level, occupation, sedentariness, BMI, hypertension, and diet.

In this study, as shown in Table 2, 20% of patients were underweight, 30% were normal weight, and 50% were either overweight or obese, reflecting the

U.S. national average. Average weight at Stage 1 was 149 lbs (67.7 kg, SD = 28.5) and average BMI was within normal limits, although on the high end of the normal range at 24 kg/m^2 (SD = 4.4) but below U.S. national averages (27). Seventy-two percent of patients had normal blood pressure, 9% had elevated blood pressure, and 19% had either Grade 1 or Grade 2 hypertension, also reflecting the national average (i.e., 28% of patients in the sample had hypertension, slightly less than the 34% for adults of this average age in the U.S. so afflicted (27)). Eighty percent of patients self-reported a sedentary lifestyle and 80% were non-vegetarian.

Reliability and Validity

The reliability and validity of diagnoses using the methods of *Sparshana* for determining a patient's Deha Prakriti and Agni, and Prashana for determining a patient's Koshta, have only tentatively been empirically determined. For example, Kurande et al. found low levels of inter-rater reliability in multiple doctors who examined the pulse (*Nadi*), tongue (*Jivha*), and Deha Prakriti of healthy subjects (28), but Kurande et al. found moderate and substantial test-retest reliability when one doctor diagnosed physiologic imbalances and Deha Prakriti (29).

Earlier research provided evidence that the inter-diagnoses of hypertension using Maharishi Nadi-Vigyan and the manual SP were near perfect, indicating a high degree of reliability (30). Nevertheless, reliability and validity to determine consistency and trustworthiness of measurement are generally not mentioned in the research literature on Nadi-Vigyan (3,31). It can therefore be concluded that further reliability and validity testing of Maharishi Nadi-Vigyan is required. The reliability and validity of the manual SP to accurately measure blood pressure, including its ability to accurately measure variables such as handgrip strength of Parkinson's patients (32) and upper body strength of stroke victims (33), are well established.

Data Analysis

For statistical purposes, diagnoses of Deha Prakriti were recorded as 'Yes' = 1 or 'No' = 0. This means that a patient's score could be either '1' if diagnosed, for example, as Vata-Pitta constitution or '0' if a patient was diagnosed as not Vata-Pitta constitution. Each patient therefore was scored with a '1' for constitution on one of the following possible seven Deha Prakriti and '0' on all others. The same recording convention was used for a patient's Agni and Koshta classification. Thus, raw data for Deha Prakriti, Agni and Koshta were nominal (or dichotomous). Weight and BMI were scored at standard numerical intervals (and were therefore interval variables). Systolic BP (to determine hypertension) was scored as: normal blood pressure = 1; elevated blood pressure = 2; Grade 1 hypertension = 3; and or Grade 2 hypertension = 4 (and was an interval variable). Diet was recorded as vegetarian = 1 or non-vegetarian = 0 and was a dichotomous variable.

Two types of correlational analyses were performed to answer RQs 1 and 3: 1) point biserial coefficients (r_{pb}) for correlations between dichotomous variables and interval variables (i.e., for correlations between Deha Prakriti, Agni, Koshta, and diet on the one hand and weight, BMI and systolic BP on the other); and 2) mean square contingency coefficients (ϕ) for correlations between dichotomous variables (i.e., between Deha Prakriti, Agni, Koshta, and diet).

In addition to standard descriptive statistics to answer RQ 2, multivariate analyses of variance (MANOVA) were conducted to determine if statistically significant differences existed between the three diagnostic dimensions used in this study—Deha Prakriti, Agni, and Koshta according to weight, BMI, hypertension, and diet. These variables were verified *post hoc* using Tukey’s (Q) pairwise honestly significant differences (HSDs). All measures were statistically analysed using SPSS 26 and tested at the two-tailed level for greater than 95% level of confidence ($p < .05$).

Observations and Results

A descriptive summary of patient diagnostic data, along with average weight, BMI, and systolic blood pressure with standard deviations, are provided in Table 3.

Table 3: Descriptive data for Deha Prakriti, Agni, and Koshta by number, percentage, average weight, BMI, and systolic blood pressure

Diagnostic Variable	Number of Patients	Percent age of Total	Weight (lbs) (SD)	BMI (kg/m ²) (SD)	Systolic BP (mmg) (SD)
Deha Prakriti					
Vata-Pitta	24	15%	122.0 (14.5)	19.6 (1.7)	122 (15.1)
Vata-Kapha	0	0%			
Pitta-Vata	37	23%	146.6 (22.3)	22.6 (2.4)	124 (18.6)
Pitta-Kapha	64	40%			
Kapha-Vata	0	0%	176.3 (29.8)	27.4 (4.2)	127 (24.9)
Kapha-Pitta	35	22%			
Vata-Pitta-Kapha	0	0%	—	—	—
Agni					
Vishamagni	89	56%	141.3 (27.2)	22.3 (3.3)	125 (14.6)
Tikshnagni	33	20.5%	146.5 (23.4)	22.9 (3.4)	116 (13.3)
Mandagni	33	20.5%	174.8 (22.5)	26.8 (5.2)	133 (20.4)
Samagni	5	3%	141.9 (20.9)	21.4 (1.2)	115 (11.6)

Koshta					
Krura	24	15%	124.8 (15.9)	19.7 (1.7)	121 (15.1)
Mridu	97	61%	151.7 (27.2)	23.7 (3.8)	123 (18.5)
Madhyama	39	24%	159.4 (30.0)	24.4 (3.2)	126 (19.3)
Sama Koshta	0	0%	—	—	—

Twenty-four patients (15%) were diagnosed as having a predominantly Vata constitution, 101 patients (63%) a predominantly Pitta constitution, and 35 patients (22%) a predominantly Kapha constitution. No patient presented as having either a Vata-Kapha or Kapha-Vata constitution, each of which are considered less common given their dissimilar characteristics. This phenomenon has previously been observed by Bhalerao, Deshpande and Thatte (5). Similarly, no patient presented as having a Tridoshic constitution. Eighty-nine patients (56%) were diagnosed as Vishamagni, 33 patients (20.5%) as Tikshnagni, 33 patients (20.5%) as Mandagni, and five patients (3%) as Samagni. Twenty-four patients (15%) were diagnosed as Krura Koshta, 97 patients (61%) as Mridu Koshta, and 39 patients (24%) as Madhyama Koshta; no patient presented as Sama Koshta.

Table 4 presents data to answer RQ 1. Consistent with Ayurvedic theory that each Deha Prakriti is associated with its parallel Agni and Koshta, the study found that Vata-dominant Deha Prakritis were statistically associated with both Vishamagni and Krura Koshta. Vishamagni also correlated to Krura Koshta. Similarly, Pitta-dominant Deha Prakritis were associated with both Tikshnagni and Mridu Koshta, but Tikshnagni was not statistically associated with Mridu Koshta. Kapha-dominant Deha Prakritis were associated with Mandagni and Madhyama Koshta, but Mandagni was not statistically associated with Madhyama Koshta.

Table 4: Mean square contingency correlation coefficients of Deha Prakritis, Agnis, and Koshtas

Deha Prakriti	Agni	Koshta
Vata Dominant ($n = 24$)	Vishamagni ($n = 89$)	Krura ($n = 24$)
$\phi = .31, p = .00007$		$\phi = .28, p = .008$
$\phi = .80, p < .00001$		
Pitta Dominant ($n = 101$)	Tikshnagni ($n = 33$)	Mridu ($n = 97$)
$\phi = .23, p = .002$		$\phi = 0.0, NS$
$\phi = .21, p = .002$		
Kapha Dominant ($n = 34$)	Mandagni ($n = 33$)	Madhyama ($n = 39$)
$\phi = .48, p < .00001$		$\phi = .13, NS$
$\phi = .48, p < .00001$		

To answer RQ 2, analysis indicated there was a statistically significant difference between patient

weight according to Deha Prakriti ($F = 40.8, p < .00001$), with Tukey's HSDs between all Deha Prakritis confirming the difference (e.g., between Vata-dominant Deha Prakriti and Pitta-dominant Deha Prakriti, between Pitta-dominant Deha Prakriti and Kapha-dominant Deha Prakriti, and between Vata-dominant Deha Prakriti and Kapha-dominant Deha Prakriti).

As shown in Table 5, analysis also indicated there was a significant difference between BMI when categorised according to Deha Prakriti ($F = 60.7, p < .00001$), with Tukey's HSDs confirming the difference between all Deha Prakritis (e.g., between Vata-dominant Deha Prakriti and Pitta-dominant Deha Prakriti, between Pitta-dominant Deha Prakriti and Kapha-dominant Deha Prakriti, and between Vata-dominant Deha Prakriti and Kapha-dominant Deha Prakriti). No significant difference was found between hypertension levels when categorised according to Deha Prakriti ($F = 2.2, p = NS$).

Analysis indicated there was a statistically significant difference between patient weight when categorised according to Agni ($F = 21.5, p < .00001$), with Tukey's pairwise HSDs between Vishamagni and Mandagni, and Tikshnagni and Mandagni, but not between Vishamagni and Tikshnagni. Analysis also indicated there was a significant difference between BMI according to Agni ($F = 22.3, p < .00001$), with Tukey's HSDs confirming the difference between Vishamagni and Mandagni, and Tikshnagni and Mandagni, but not between Vishamagni and Tikshnagni. Analysis indicated there was a statistically significant difference between patient hypertension according to Agni ($F = 10.2, p = .00007$), with Tukey's HSDs confirming the difference between Vishamagni and Tikshnagni, Vishamagni and Mandagni, and Tikshnagni and Mandagni. Note, due to the low number of patients diagnosed with Samagni, these few data points were thought to be statistically unreliable and thus were not included in this analysis.

Analysis indicated there was a statistically significant difference between patient weight when categorised according to Koshta ($F = 13.3, p < .00001$), with Tukey's HSDs confirming the difference between Krura Koshta and Mridu Koshta, and Mridu Koshta and Madhyama Koshta, but not between Krura Koshta and Madhyama Koshta. Analysis also indicated there was a significant difference between BMI according to Koshta ($F = 16.2, p < .00001$), with Tukey's HSDs confirming the difference between Krura Koshta and Mridu Koshta, and between Mridu Koshta and Madhyama Koshta, but not between Krura Koshta and Madhyama Koshta. Analysis indicated there was a statistically significant difference between patient hypertension according to Agni ($F = 4.6, p = .01$), with Tukey's HSDs confirming the difference between Krura Koshta and Mridu Koshta, but not between Mridu Koshta and Madhyama Koshta or Krura Koshta and Madhyama Koshta.

Table 5: Multivariate analyses of variance of cardiovascular risk factors according to Deha Prakritis, Agnis, and Koshtas

Cardiovascular Risk Factor	Vata-Dominant Deha Prakriti	Pitta-Dominant Deha	Kapha-Dominant Deha Prakriti
Weight	$Q = 24.5, p = .00003$		$Q = 29.7, p < .00001$
	$Q = 54.3, p < .00001$		
BMI	$Q = 6.5, p = .00002$		$Q = 10.4, p < .00001$
	$Q = 16.9, p < .00001$		
Hypertension	$Q = 1.3, p = .62$		$Q = 3.3, p = .06$
	$Q = 1.9, p = .35$		
	Vishamagni (n = 89)	Tikshnagni (n = 33)	Mandagni (n = 33)
Weight	$Q = .78, p = .94$		$Q = 7.3, p < .00001$
	$Q = 8.6, p < .00001$		
BMI	$Q = .68, p = .96$		$Q = 7.6, p < .00001$
	$Q = 8.7, p < .00001$		
Hypertension	$Q = 3.4, p = .04$		$Q = 3.8, p = .02$
	$Q = 7.1, p < .00001$		
	Krura (n = 24)	Mridu (n = 97)	Madhyama (n = 39)
Weight	$Q = 6.3, p = .0005$		$Q = 8.1, p < .00001$
	$Q = 1.8, p = .41$		
BMI	$Q = 7.3, p = .0005$		$Q = 8.6, p < .00001$
	$Q = 1.3, p = .64$		
Hypertension	$Q = .99, p = .76$		$Q = 4.2, p = .009$
	$Q = 3.2, p = .06$		

Tables 6, 7, and 8 present the correlational data to answer RQ3. Consistent with Ayurvedic theory, Table 6 shows Vata Prakriti was inversely correlated to weight (i.e., patients with higher weight were less likely to have a Vata-dominant Deha Prakriti) and Kapha-dominant Deha Prakriti was positively correlated to weight (i.e., patients with higher weight were more likely to have a Kapha Prakriti). Exactly the same pattern was observed for Vata-dominant Deha Prakriti and Kapha-dominant Deha Prakriti constitutions and their association to BMI. Table 6 also shows that patients with higher BMI were less likely to have a Pitta constitution. Both Vata-dominant Deha Prakriti and Kapha-dominant Deha Prakriti were correlated to diet, but not Pitta-dominant Deha Prakriti; hypertension was unrelated to a patient's Deha Prakriti.

Table 6: Point biserial and mean square contingency correlation coefficients between Deha Prakritis and weight, BMI, hypertension, and diet

Variable	Vata-Dominant Deha Prakriti (n = 24)	Pitta-Dominant Deha Prakriti (n = 101)	Kapha-Dominant Deha Prakriti (n = 34)
Weight	$r_{pb} = -.40, p < 0.00001$	$r_{pb} = -.12, p = NS$	$r_{pb} = .50, p < 0.00001$
BMI	$r_{pb} = -.40, p = 0.00001$	$r_{pb} = -.19, p = 0.01$	$r_{pb} = .59, p < 0.00001$
Hypertension	$r_{pb} = -.12, p = NS$	$r_{pb} = 0.0, p = NS$	$r_{pb} = .11, p = NS$
Diet	$\phi = -.25, p = 0.001$	$\phi = 0.0, p = NS$	$\phi = -.23, p = 0.001$

Due to there being only five patients diagnosed with Samagni, results for patients with a balanced digestion have not been included in these data. Table 7 shows that Vishamagni was inversely correlated to weight (i.e., patients with an unpredictable digestive system were less likely to have higher weight) and Mandagni was positively correlated to weight (i.e., patients with an especially slow metabolism and digestion were more likely to have a higher weight). Exactly the same pattern of association was observed for Vishamagni and Mandagni and BMI.

Table 7: Point biserial and mean square contingency correlation coefficients between Agnis and age, weight, BMI, hypertension, and diet

Variable	Vishamagni (n = 89)	Tikshnagni (n = 33)	Mandagni (n = 33)
Weight	$r_{pb} = -.32,$ $p = 0.00004$	$r_{pb} = 0.0,$ $p = NS$	$r_{pb} = .46,$ $p < 0.00001$
BMI	$r_{pb} = -.33,$ $p = 0.00001$	$r_{pb} = 0.0,$ $p = NS$	$r_{pb} = .50,$ $p < 0.00001$
Hypertension	$r_{pb} = 0.0,$ $p = NS$	$r_{pb} = -.26,$ $p = 0.0007$	$r_{pb} = .27,$ $p = 0.0004$
Diet	$\phi = -.16,$ $p = 0.03$	$\phi = 0.0,$ $p = NS$	$\phi = -.23,$ $p = 0.001$

Table 7 also shows that Tikshnagni was inversely correlated to hypertension (i.e., patients with an intense and quick digestive system were less likely to have hypertension) and Mandagni was positively correlated to hypertension (i.e., patients with a slow metabolism and digestion were more likely to have hypertension). Vishamagni and Mandagni were both negatively correlated to diet, meaning that a non-vegetarian diet was likely associated with an unpredictable digestive system and slow metabolism, but diet was unrelated to incidence of the intense and quicker digestive system of Tikshnagni.

Table 8 shows that Krura Koshta was inversely correlated to weight (i.e., patients with elevated dryness of stools were less likely to have higher weight) and Madhyama Koshta was positively correlated to weight (i.e., patients with soft stools were more likely to have higher weight), although the latter correlation, while statistically significant, was weak. A similar trend was observed for Krura Koshta and BMI, but both Madhyama Koshta and Mridu Koshta were only marginally correlated to BMI.

Table 8: Point biserial and mean square contingency correlation coefficients between Koshtas and weight, BMI, hypertension, and diet.

Variable	Krura Koshta (n = 24)	Mridu Koshta (n = 97)	Madhyama Koshta (n = 39)
Weight	$r_{pb} = -.36,$ $p < 0.00001$	$r_{pb} = 0.0,$ $p = NS$	$r_{pb} = .18,$ $p = 0.01$
BMI	$r_{pb} = -.40,$ $p < 0.00001$	$r_{pb} = .15,$ $p = 0.05$	$r_{pb} = .15,$ $p = 0.04$
Hypertension	$r_{pb} = 0.0,$ $p = NS$	$r_{pb} = 0.0,$ $p = NS$	$r_{pb} = .15,$ $p = 0.04$
Diet	$\phi = -.29,$ $p = 0.0001$	$\phi = .11,$ $p = NS$	$\phi = 0.0,$ $p = NS$

Table 8 also shows that Madhyama Koshta was marginally correlated to hypertension (i.e., patients with soft stools were more likely to have hypertension), although such a phenomenon was not evidenced for either Krura Koshta or Mridu Koshta, where zero correlations were observed. Diet was negatively correlated to Krura Koshta, but was not correlated to either Mridu Koshta or Madhyama Koshta.

Discussion

The results of this confirmatory study largely confirm Ayurvedic theory about Deha Prakritis, Agnis, and Koshtas, and further explain their association with cardiovascular risk factors. The descriptive data in Table 2 show patients with a Kapha-dominant Deha Prakriti weigh more than those with a Pitta-dominant Deha Prakriti, and those with a Pitta-dominant Deha Prakriti weigh more than those with a Vata-dominant Deha Prakriti, confirming a foundational Ayurvedic principle. This same observation applies to BMI, as also confirmed in Table 2, where BMI is higher in Kapha-dominant Deha Prakriti than either Vata- or Pitta-dominant Deha Prakriti. Of note, too, is the descriptive data on Agnis, which support the theory, for example, that the presence of an aroused Mandagni would be expected to associate with, and therefore parallel, higher weight and BMI of patients, as was the case in this sample.

Of interest also is the Ayurvedic principle that patients with any Deha Prakriti, Agni, or Koshta may be prone to hypertension, and this too is mostly borne from the data in Table 5, although the clear descriptive differences in hypertension according to Agni shown in Table 3 are somewhat pronounced, they are also largely consistent with research from other contexts (10,11,12).

Table 4 provides evidence that Deha Prakritis, Agnis, and Koshtas may represent parallel conditions in the body, thereby tentatively answering RQ1 in the affirmative. Indeed, in this study all Deha Prakritis related to their respective Agnis and Koshtas. Thus, we conclude that a dominance of Vata in the body is a reliable predictor of an erratic digestive system and the qualities of lightness and dryness in the alimentary canal; a dominance of Pitta in the body is a reliable predictor of a digestive fire that is burning more intensely and quickly accompanied by increased liquid in the alimentary canal; and a dominance of Kapha in the body is a reliable predictor of slower and weaker metabolism and digestion and increased mucus in the alimentary canal. However, some of these results are on the weaker end of statistical strength, and some Agnis did not correlate to some Koshtas.

The MANOVA and Tukey's HSD data answer RQ 2 in the affirmative, showing Ayurvedic diagnoses of Deha Prakriti, Agni, and Koshta are statistically different and therefore do not represent identical phenomena in the body. While not all diagnostic characteristics were different (e.g., Vishamagni and Tikshnagni were not different when measured by BMI, Mridu Koshta and Madhyama Koshta were not different when measured by BMI, and no difference was found between hypertension according to Koshta), most data

indicate the three possible dominant Deha Prakritis, three Agnis, and three Koshtas represent different diagnostic measures. This is important given the observed relationships of these dimensions to CVD.

Data in Tables 6, 7, and 8 also mostly support the proposition that Deha Prakritis, Agnis, and Koshtas are related to weight, BMI, hypertension, and diet, thereby answering RQ 3 generally in the affirmative. For example, Table 6 shows that a Vata-dominant constitution is inversely associated with both weight and BMI, and a Kapha-dominant constitution is positively associated with weight and BMI, findings consistent with Ayurvedic theory. Data in Table 7 on Agnis also support the principle that the presence of an aroused Mandagni would be associated with weight and BMI of patients.

The findings in Table 8, showing that Krura Koshta was inversely correlated to weight and BMI and Madhyama Koshta was positively correlated to weight and BMI, is similarly consistent with foundational principles of Ayurveda. The finding that increased Krura Koshta was associated with a non-vegetarian diet is also consistent with the principle that less digestible food is related to harder stools and a tendency toward constipation.

Nevertheless, there are methodological limitations with this research and results cannot be generalised to a wider adult population. First, the working sample was self-selected, not randomly selected, and therefore may not reflect the general U.S. population. Second, the sample was negatively skewed (-1.22) toward an older age group (but was not so skewed for weight, BMI, or hypertension, with an average skewness = .85) thereby possibly adversely affecting the confidence level of findings. Third, the sample was somewhat biased toward women and thus the findings may not reflect the makeup of the general U.S. population. Finally, the cross-sectional design did not assess the directionality of associations, nor consider spurious associations, reversed causality, or reciprocal influence. Consequently, future research would contribute to an understanding about directionality of predictor variables.

Despite these limitations, several preliminary and tentative conclusions can reasonably be drawn from this confirmatory study. **Conclusion #1:** these findings are generally consistent with Ayurvedic theory, which states a parallel association exists between Vata > Vishamagni > Krura Koshta, between Pitta > Tikshnagni > Mridu Koshta, and between Kapha > Mandagni > Madhyama Koshta. **Conclusion #2:** diagnoses of Deha Prakriti, Agni, and Koshta using traditional Ayurvedic techniques of Sparshana and Prashana measure discrete physiologic factors (i.e., they are different from one another, which is important in both the conceptualisation of variables as well as in measuring their relationship to each other). **Conclusion #3:** Deha Prakritis, Agnis, and Koshtas mostly relate statistically (although often quite weakly) to some cardiovascular risk factors, although not hypertension. To our knowledge, these are the first empirical data to

provisionally confirm these associations using statistical analysis, making the present study important.

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