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Development of a clinically useful tool for Prakriti assessment

Research Article

Abhilash M[1]*, Sudhikumar K B[2]

1. Assistant Professor, Department of Kriya Sharir, Government Ayurveda College, Tripunithura, Kerala,
2. Professor, Kerala University of Health Sciences, School of Research in Ayurveda, Tripunithura, Kerala.

Abstract

Introduction: Prakriti assessment is of fundamental importance for research and standardization of clinical practice. The available tools for prakriti assessment are not intended to be used in a clinical setting, which demands a short and clinically flexible one. Methods: 3 selected tools were compared with a newly developed questionnaire. These were administered first in 100 healthy volunteers. Agreement analysis between these tools were done. The validation process was completed by running the new tool together with TNMC questionnaire in 150 more individuals who have some *doshavriddhi*. The results were discussed in an FGD involving clinicians and faculties. Results: The new tool has shown fair agreement with Ayusoft (kappa 0.434 and Spearman correlation 0.506) and TNMC (kappa 0.429 and Spearman correlation 0.454) questionnaires. And it showed week agreement with self-assessment tool (kappa 0.214 and Spearman correlation 0.407). Meanwhile self-assessment tool has poor agreement with both Ayusoft (kappa 0.172 and Spearman correlation 0.279) and TNMC (kappa 0.175 and Spearman correlation 0.244). Reliability was tested in a total of 250 individuals and a Cronbach's alpha of 0.524 was obtained. Factor analysis was also done. In this total dataset, the new tool showed better agreement with TNMC questionnaire (kappa 0.581 and Spearman correlation 0.442). Conclusion: These results show that the new tool has potency to be run in large scale to study more variability among patients. This will add to the standardization of Ayurvedic diagnostic, prognostic and therapeutic fields.

Key Words: *Prakriti*, Tool, Agreement Analysis, Clinical assessment, Validity, Reliability.

Introduction

Understanding and assessment of Prakriti is inevitable part of Ayurvedic theory, education and practice. Also, the standardization of diagnostic, therapeutic and prophylactic sectors of Ayurveda demand the use of prakriti assessment and application to near perfection for extracting the maximum output of Ayurvedic management strategies. For this purpose, the need of the hour is a simple but powerful tool for prakriti assessment, which has maximum clinical efficiency. Hence this study was planned to device a new tool for prakriti assessment which renders valid and reliable result while assessing the prakriti and also can be used in various diseases. Then only, the actual purpose of prakriti assessment and subsequent decision making in Ayurvedic parlance can be achieved. The core Ayurvedic perspective of personalized medicine can be thus made fruitful by extending the assessment of individual characteristics contributed by the different *guna* factors and then negating the *dosha* variations created by the co-existing disease.

*** Corresponding Author:**

Abhilash M

Assistant Professor, Department of Kriya Sharir,
Government Ayurveda College,
Tripunithura -682301,
Kerala, India
Email Id: abhilash@ayurvedacollege.ac.in

Many works have been done and articles been published on the principles and practice of prakriti assessment. On reviewing them, we can experience the scope and utility of this area. Various tools in the form of questionnaires and softwares have been tested for their reliability and validity. Reliability is of prime importance and poor to substantial levels of reliability have been recorded for prakriti assessment. (1) Three questionnaires having different answering options were having good test-retest reliability according to numerical scores, but highly variable reliability according to discrete Ayurveda diagnosis. Internal consistency pertaining to individual constitutions within one questionnaire was poor for all three primary *doshas*, but especially for *kapha*. (2)

Several extensive works have been done in the area of standardization and assessment of prakriti. TRISUTRA consortium initiative is an integrative approach involving identification of molecular correlates of Prakriti as predictive and prognostic markers of disease as well as therapeutic response. (3) A comprehensive prakriti assessment model has been developed by CCRAS (Central Council for Research in Ayurvedic Sciences) and is being used for large scale testing in healthy volunteers. (4) Each question or parameter in a tool is important from a holistic point of view and ultimately it can contribute to strength or weakness of the tool. Since the Prakriti-based research work is still in its infantile stage, the evaluation of the full questionnaire/tool that they used to assess Prakriti

along with the weightage they assigned to each item is important and has to be incorporated in the publications. (5)

Several genomic studies have also been conducted coupled with prakriti assessment. Principal component analysis (PCA) of 52 single nucleotide polymorphisms (SNPs) classified 262 individuals into their respective groups (*Vata, Pitta* and *Kapha*) irrespective of their ancestry, which represent its power in categorization. It was further validated using findings with 297 Indian population samples with known ancestry. (6) Exploration of the association between various Prakriti subtypes and other biological variables influencing a target phenotype is another promising area. Eventually, this may help in establishing the concept of "personalized medicine" in Ayurveda in its true sense. (7) Several Artificial Intelligence (AI) techniques are also being employed here. The experimental result shows that ensemble learning methods clearly surpasses conventional methods indicating that advances in boosting algorithms could give machine learning a leading future. (8) Thus, if conceptually and practically efficient tool is available for prakriti assessment, machine learning can be employed for majority of further works.

From theory to practice, it needs some rethinking in the application level. With an emphasis on Ayurvedic practice in Delhi Government Health Institutions, a descriptive study was conducted and it has highlighted the need to apply the patient-centric approach, which is the cornerstone of the Ayurvedic medical system. (9) The real strengths of Ayurveda are in the areas of health promotion, preventive, predictive and personalized medicine and they should be focussed on, instead of the present emphasis on therapeutics seems similar to practice of modern medicine. (10)

Still, the assessment of individual variations in the form of prakriti is difficult when compared to assessment of disease variations in the form of *vikriti*. A diagnostic reliability study of 30 patients and 4 Ayurvedic experts was conducted, nested in a randomized controlled trial. Patients were diagnosed in a sequential order by all experts utilizing a semi structured patient history form. A nominal group technique as consensus procedure was performed to reach agreement on the items to be diagnosed. While high percentages of agreement for main diagnostic entities and the final Ayurveda diagnosis (95% consensus agreement on main diagnosis) could be observed, this was not reflected in the corresponding kappa values, which largely yielded fair-to-poor inter-rater agreement kappas for central diagnostic aspects such as prakriti and *agni* (k values between 0 and 0.4). Notably, agreement on disease-related entities was better than that on constitutional entities. (11) Another study showed the diabetic *Vata Prakriti* is a genetically susceptible group as it has a tendency to get affected by increased DNA damage, which could help in creating personalized management of diabetes among individual Prakriti. (12) There is a big area of scope for collaborative research between Ayurveda and other traditional medicines of Asia to enhance and streamline their inherent strengths of personalised medicine. (13)

A newly devised tool was good in reaching a consensus in reference to *Vata* and *Pitta* expressions, whereas it is notable to make a convincing correlation between observations made for *Kapha* group. Besides indicating the deficits related to the construct of the tool under study, it also indicates the intricate complexity associated with observations made in reference to *Kapha* features compared to *Vata* and *Pitta*. So, *Kapha* features are required to be designed more carefully to make their better appreciation by every observer, and therefore to reach a better agreement. (14) People with *Kapha* as the most dominant *dosha* showed a tendency to have either a higher parasympathetic activity or a lower sympathetic activity with respect to their cardiovascular reactivity in comparison to the individuals with *Pitta* or *Vata* as the most dominant *Dosha*. (15) The intrinsic activities of *doshas* have also been studied. The function of *Ranjaka, Bhrajaka* and *Sadhaka Pitta* was found better in *Pitta Prakriti* individuals followed by *Kapha Prakriti* and least in *Vata Prakriti* individuals. As mean values of hemoglobin, Short Term Memory and Long-Term Memory were highest in *Pitta Prakriti* and lowest in *Vata Prakriti* individuals. (16)

Prakriti assessment performed intuitively by the ayurvedic physician was having good correlation with Ayusoft measurements, thereby providing an effective and quantitative instrument to assess the prakriti of individuals. (17) Thus, the clinical adaptation of prakriti assessment using the understanding of *tridosha* theory has to be considered seriously while moving further to the area of personalized medicine. (18-22)

Methodology

The primary objectives of this study were,

- To develop a valid and reliable tool for prakriti assessment.
- To determine the prakriti of healthy volunteers and patients.

Secondary objective was,

- To provide database for the development of a clinical friendly software to determine prakriti.

The main drawback of the available questionnaires and softwares is that all of them are time consuming and hence cannot be administered in a clinical setting. Also, they do not consider the pathological changes in the assessment parameters so that they are rendered defective to be used in a clinical condition. Hence, a new tool developed based on the practicality and clinical friendliness was administered together with the other 3 tools namely,

1. Ayusoft - the software developed by C-DAC Pune. (23)
2. Questionnaire developed by Topiwala National Medical College (TNMC), Mumbai. (24)
3. Self-assessment questionnaire developed by Dr. Kishor Patwardhan et al. (25)

Assuming 8-10 parameters in the final scale, the initial sample size for agreement analysis was

calculated as 100. Again, adding 3 *dosha* wise divisions to each item, the final sample size was calculated as 250 based upon the sample size criteria for health measurement scales. (26)

The new tool was developed taking the clinical-friendly questions from the available questionnaires and analysing these questions in the light of *gunas* responsible. Another advantage of taking *gunas* into consideration is that it makes easy to find out the *dwidoshaja* traits which practically accounts for almost 95% of the population as per clinician's opinion. Content validity of these questions were done taking opinion from 10 experts. (Table 1), The weightage based upon this expert opinion was added in the final analysis. Since the items are not new and they were only modifications of the available tools, Focus Group Discussion was deferred to the final step to summarize the findings and for clinical cross-checking. The tools were run in 100 healthy volunteers and the data obtained were statistically analysed. Agreement analysis between all these tools were done.

Table 1: Content Validity – *Guna* wise characteristics

Characteristic	*Guna* responsible					
	Guru	***Laghu***	***Snigdha***	***Rooksha***	***Ushna***	***Seeta***
Vataprakriti						
Talkative		9		5		
Irrelevant talks		8		8		1
Appetite severe at times, diminished at times		5		3		5
Comprehension & Memory – Grasps easily, forgets easily		6		4		1
Prefer sweet		6		4		1
Dry skin				10		4
Round, lusterless eyes				6		1
Wakes up from sleep intermittently		8		4		
Few friends		2		5		5
Prefers hot		1		1		8
Prefers sour		2		3		7
Prefers salt		3		3		6
Pittaprakriti						
Speaks harshly when angry		2	1		6	
Intolerance to hunger		3			9	
Becomes support for the dependents		1	5		2	
Strong appetite and digestive capacity		4	3		8	
Moderate sleep		4	2		2	
Profuse sweating		4			7	
Eyes turns red easily		2			7	
Curious in new matters and ideas		2	5		5	
Prefers cold		2			7	
Prefers sweet		6	1		7	
Prefers bitter		4	1		7	
Kaphaprakriti						
Wide and elongated eyes	4		4			2
Generally reduced appetite	2		2			7
Hunger can be tolerated	4		2			4
Deep sleep	5		4			5
Grasps slowly but good memory	6		3			3
Smooth skin	1		7			2
Plenty of eye lashes	4		3			3
Relevant & Soft spoken	4		6			3
Strong friendship	3		7			3
Moist skin			6			1
Prefers hot	2					8
Prefers bitter	6		5			3
Prefers pungent	5		7			5
Prefers astringent	1		8			2

Again, the new clinical friendly tool developed for prakriti assessment was run in 150 more individuals who have some *doshavriddhi,* together with TNMC questionnaire. Due to Covid19 pandemic, this assessment could be done as online only and hence the questionnaire was converted into google forms.

https://docs.google.com/forms/d/e/1FAIpQLSdiVwDv6Pn045McLQiF4rA-OER9P2KOTtORUzWocD5WFa-VjQ/viewform?usp=sf_link

The data obtained were tabulated and the final score for the new tool was attributed based upon the *guna* factors common in the *dwidoshaja* status; so that it directly renders the *dwidoshaja* results. The individual scores of *vata, pitta* and *kapha* as well as that of *vatapitta, vatakapha* and *pittakapha* were noted. Considering the scores from these calculations, final diagnosis of prakriti was done.

Reliability was tested in this total of 250 individuals and the results were summarised. These

results and their interpretations were discussed in an FGD to streamline the clinical needs and to increase the usefulness of the tool.

Results

Most of the participants of the study were students and hence belong to the group of 20-30 age group (Fig. 1). Since the study was conducted in Govt Ayurveda College, Tripunithura and mainly among the UG and PG students, most of the participants (85.6%) were females.

The new tool has shown fair agreement with Ayusoft (kappa 0.434 and Spearman correlation 0.506) and TNMC (kappa 0.429 and Spearman correlation 0.454) questionnaires. And it showed week agreement with Kishor Patwardhan's tool (kappa 0.214 and Spearman correlation 0.407) (Table 2). Meanwhile Kishor Patwardhan's tool has poor agreement with both Ayusoft (kappa 0.172 and Spearman correlation 0.279) and TNMC (kappa 0.175 and Spearman correlation 0.244). Ayusoft and TNMC have the best agreement between them (kappa 0.576 and Spearman correlation 0.516) (Table 3).

Figure 1. Age wise distribution of participants. X-axis – Age; Y-axis – Number of participants

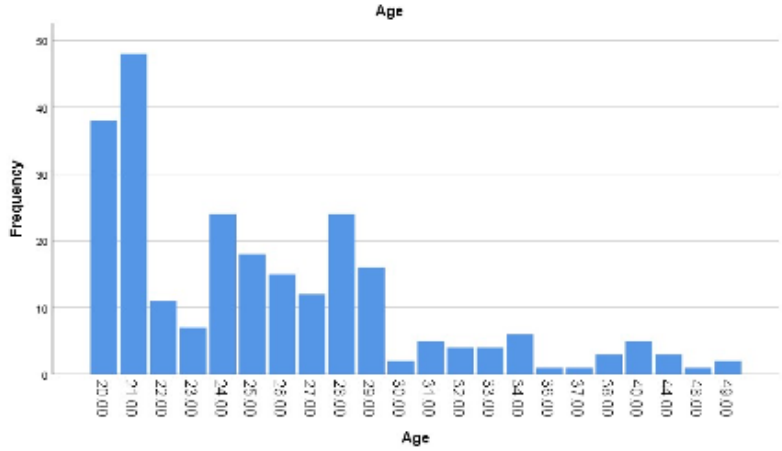


Table 2. Agreement between new tool and other tools

		Prakriti Ayusoft / TNMC / Self						
		VP	**VK**	**PK**	**V**	**P**	**K**	**S**
New Prakriti	**VP**	17 / 15 /12	5/ 5/ 10	1/ 1/ 3	2/ 3/ 0	0/ 1/ 0	1/ 1/ 0	0 /0/ 1
	VK	0 /0/ 1	1/ 1/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
	PK	9/ 3/ 8	5/ 9/ 18	51/ 52/ 37	0/ 1/ 2	2/ 3/ 0	2/ 2/ 4	2/ 1/ 2
	P	0/ 0/ 1	0/ 0/ 0	1/ 1/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
	K	0/ 0 /0	0/ 0/ 0	1/ 1/ 1	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0	0/ 0/ 0
Total	**26 /18/ 22**	11/ 15/ 28	54/ 55/ 41	2/ 4/ 2	2/ 4/ 0	3/ 3/ 4	2/ 1/ 3	
Spearman Correlation		**0.506 / 0.454 / 0.407**						
Kappa		**0.434 / 0.429 / 0.214**						

Table 3. Agreement between other tools

Prakrit Ayusoft vs Prakriti self-assessment								
		Prakriti self						Total
		VP	VK	PK	V	K	S	
Prakriti ayusoft	VP	9	11	4	0	0	2	26
	VK	4	2	4	1	0	0	11
	PK	6	14	30	1	3	0	54
	V	2	0	0	0	0	0	2
	P	1	1	0	0	0	0	2
	K	0	0	2	0	1	0	3
	S	0	0	1	0	0	1	2
Total		22	28	41	2	4	3	100
Prakrit TNMC vs Prakriti self-assessment								
		Prakriti self						Total
		VP	VK	PK	V	K	S	
Prakriti TNMC	VP	6	8	3	0	0	1	18
	VK	6	4	3	2	0	0	15
	PK	6	14	31	0	3	1	55
	V	2	0	2	0	0	0	4
	P	2	1	1	0	0	0	4
	K	0	1	1	0	1	0	3
	S	0	0	0	0	0	1	1
Total		22	28	41	2	4	3	100

Prakrit TNMC vs Prakriti Ayusoft									
		Prakriti ayusoft							Total
		VP	VK	PK	V	P	K	S	
Prakriti TNMC	VP	15	2	1	0	0	0	0	18
	VK	1	6	6	0	1	1	0	15
	PK	6	3	46	0	0	0	0	55
	V	2	0	0	2	0	0	0	4
	P	1	0	1	0	1	0	1	4
	K	1	0	0	0	0	2	0	3
	S	0	0	0	0	0	0	1	1
Total		26	11	54	2	2	3	2	100

Face validity and content validity

The face validity of the tool was directly tested form the clinicians who are used to look for prakriti wise differences in patients. The content validity of the new tool was determined by getting feedback from 10 experts regarding the *guna* wise weightage for the individual items in the tool.

Criterion validity

Criterion validity was obtained by comparing with other standard tools like Ayusoft, TNMC and self-assessment questionnaire. The fair agreement with Ayusoft and TNMC shows that it has good criterion validity.

Construct validity

Feedback was taken from the clinicians regarding the factors under consideration for prakriti assessment and the impact of various *gunas* on them (Fig. 2). Inputs from FGD were also used for this purpose. Further, reliability testing separately based upon individual *doshas* were also done. (Table 4)

Figure 2. Construct of prakriti and its components. Prakriti divided into 3 phases – evolution, expression and influence of disease

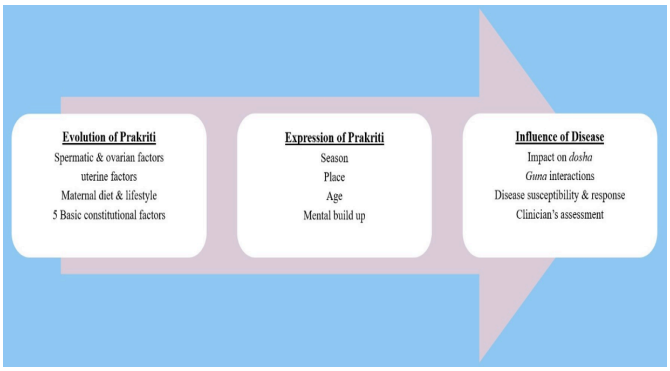


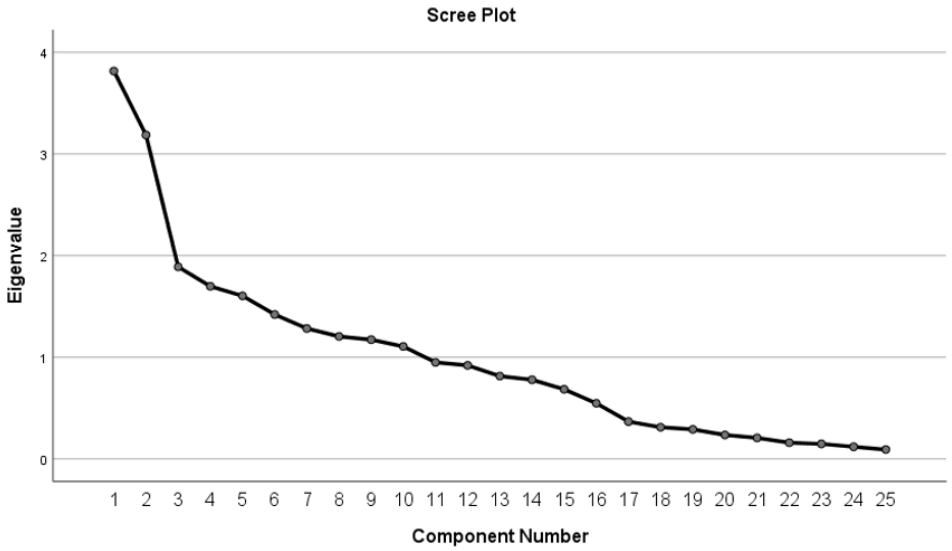
Table 4. Reliability testing based upon individual *doshas*

Item Statistics				Cronbach's Alpha
Kapha	**Mean**	**Std. Deviation**	**N**	
Smooth skin	2.10	0.877	250	**0.603**
Eye wide	1.88	0.917	250	
Soft spoken	2.19	0.878	250	
Appetite less	1.74	0.902	250	
Sleep sound	2.02	0.942	250	
Memory good	1.92	0.877	250	
Astringent	1.39	1.267	250	
Strong friend	2.08	0.958	250	
Pitta				
Sweating	1.86	0.905	250	**0.519**
Eye red	1.57	0.829	250	
Talk rough	1.74	0.905	250	
Appetite strong	1.84	0.920	250	
Sleep moderate	1.86	0.913	250	
Innovative	2.09	0.942	250	
Sweet	1.60	1.138	250	
Bitter	1.15	1.258	250	
Friend support	2.28	0.906	250	
Vata				
Dry skin	1.71	0.840	250	**0.540**
Eye lustreless	1.76	0.882	250	
Talkative	1.79	0.887	250	
Appetite varied	1.79	0.905	250	
Sleep disturbed	1.56	0.830	250	
Easy grasp and forget	1.86	0.929	250	
Hot	1.55	1.165	250	
Sweet	1.60	1.138	250	
Few friend	1.42	0.747	250	

Factor Analysis and Internal Consistency

Bartlett's test of sphericity shows significant variation among the recorded data with degree of freedom 300. Still, KMO measure of 0.462 shows it has to be tested in a larger sample. Factor analysis was also done. 7 factors were identified in the scree plot (Fig. 3). Factor loading also supports this finding by showing the *dosha* wise as well as *dwidoshaja* characteristics loaded under different factors, even though it has to be confirmed with a larger sample. (Table 5).

Figure 3 – Scree Plot



X-axis – component number; Y-axis – eigen value; 7 factors clearly identified

Table 5. Factor loading

Rotated Component Matrix[a]										
	Component									
	1	2	3	4	5	6	7	8	9	10
Dry skin	0.026	0.129	-0.179	0.074	-0.019	-0.136	0.081	-0.042	-0.889	-0.031
Sweating	0.045	0.286	-0.157	0.148	0.037	-0.294	0.195	-0.144	0.556	0.034
Smooth skin	0.074	0.150	0.446	-0.079	0.110	0.366	-0.114	0.252	0.426	0.218
Eye lustreless	0.052	-0.052	0.047	-0.068	-0.167	-0.766	0.122	-0.037	-0.103	0.306
Eye red	-0.097	0.575	-0.162	0.172	0.065	-0.124	-0.367	0.143	0.254	-0.173
Eye wide	0.107	-0.027	0.080	0.043	-0.029	0.844	0.148	-0.127	-0.055	0.154
Talkative	-0.041	0.186	-0.713	-0.039	0.030	0.039	0.099	0.024	-0.119	0.300
Talk rough	0.135	0.598	0.022	0.349	0.051	-0.079	0.253	0.013	0.077	0.189
Soft spoken	0.112	0.019	0.818	-0.066	0.094	0.089	-0.174	0.000	0.005	-0.004
Appetite varied	-0.099	0.067	-0.387	0.153	-0.616	-0.007	-0.141	0.286	0.013	0.261
Appetite strong	0.070	0.145	0.115	-0.028	0.205	0.066	0.025	-0.892	0.007	-0.012
Appetite less	0.100	0.255	0.341	0.075	0.438	-0.021	0.165	0.639	0.011	0.041
Sleep disturbed	0.165	0.448	-0.341	0.048	-0.116	0.134	0.219	0.216	0.160	-0.312
Sleep moderate	0.078	0.135	0.145	0.869	0.045	0.031	0.061	-0.010	-0.044	0.269
Sleep sound	-0.047	-0.010	0.260	-0.767	0.112	-0.094	-0.077	-0.099	-0.031	0.357
Easy grasp and forget	0.036	0.113	-0.092	0.220	0.032	-0.001	0.806	0.090	0.058	0.111
Innovative	0.036	0.729	-0.091	-0.119	0.100	0.083	0.035	-0.150	-0.099	0.179
Memory good	0.126	-0.033	0.414	0.107	0.131	-0.017	-0.662	0.066	0.082	0.125
Hot	-0.867	0.057	-0.107	-0.014	-0.040	-0.088	0.058	-0.002	-0.039	0.113
Sweet	-0.895	0.022	-0.060	-0.045	-0.051	0.038	0.029	0.033	-0.013	0.038
Bitter	0.517	0.542	0.221	0.159	-0.034	0.047	0.078	0.053	-0.076	0.243
astringent	0.747	0.333	-0.062	0.035	0.180	0.015	0.073	-0.008	-0.032	0.169
Few friend	0.015	0.164	-0.191	0.041	0.037	-0.042	0.046	0.045	0.093	0.730
Friend support	0.031	0.444	0.353	0.115	-0.628	-0.019	0.279	-0.023	-0.086	-0.158
Strong friend	0.192	0.270	0.073	0.077	0.724	0.128	-0.064	-0.002	0.038	0.111
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.										
a. Rotation converged in 13 iterations.										

Reliability was tested in this total of 250 individuals and a Cronbach's alpha of 0.524 was obtained (Table 6). In this total dataset, the new tool showed better agreement with TNMC questionnaire (kappa 0.581 and Spearman correlation 0.442) (Table 7). The lesser scores of kappa and KMO coefficient can be attributed to the construct of Prakriti, which has many dimensions and the aspects which are clinically relevant only being considered in this study.

Table 6. Internal Consistency of the new tool

Item-Total Statistics					
	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item Total Correlation**	**Squared Multiple Correlation**	**Cronbach's Alpha if Item Deleted**
Dry skin	45.70	47.187	-0.028	0.583	0.537
Sweating	45.55	44.418	0.193	0.463	0.508
Smooth skin	45.32	44.403	0.205	0.643	0.506
Eye lustreless	45.65	47.084	-0.024	0.487	0.537
Eye red	45.84	44.746	0.194	0.385	0.508
Eye wide	45.53	46.363	0.030	0.490	0.531
Talkative	45.62	46.205	0.048	0.583	0.528
Talk rough	45.67	40.409	0.551	0.601	0.455
Soft spoken	45.22	45.949	0.072	0.684	0.524
Appetite varied	45.63	47.291	-0.043	0.696	0.540
Appetite strong	45.56	46.425	0.024	0.722	0.531
Appetite less	45.67	43.649	0.261	0.733	0.498
Sleep disturbed	45.85	45.006	0.168	0.598	0.512
Sleep moderate	45.55	43.168	0.298	0.693	0.493
Sleep sound	45.39	47.714	-0.079	0.692	0.546
Easy grasp and forget	45.55	44.192	0.204	0.586	0.506
Innovative	45.31	41.135	0.460	0.592	0.467
Memory good	45.49	46.904	-0.008	0.600	0.535
Hot	45.86	48.850	-0.162	0.579	0.568
Sweet	45.81	49.880	-0.224	0.637	0.576
Bitter	46.27	37.841	0.528	0.572	0.436
Astringent	46.02	40.371	0.347	0.614	0.475
Few friend	45.99	44.044	0.299	0.544	0.497
Friend support	45.13	44.277	0.205	0.631	0.506
Strong friend	45.33	42.583	0.326	0.678	0.487
Prakriti new	44.76	45.258	0.090	0.391	0.523
Cronbach's Alpha = 0.524					

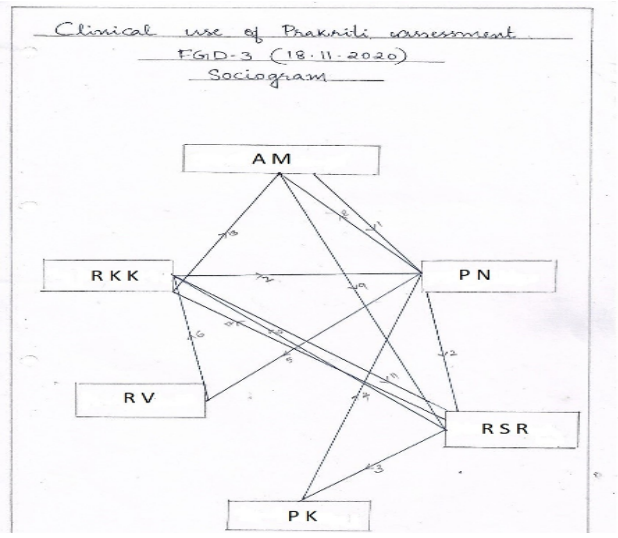
Table 7. Total Agreement between new tool and TNMC questionnaire

Prakriti new * prakriti TNMC Crosstabulation									
Count									
		Prakriti TNMC							Total
		VP	VK	PK	V	P	K	S	
Prakriti new	VP	30	5	11	2	2	0	3	53
	VK	1	5	1	0	0	0	0	7
	PK	8	3	162	1	0	3	1	178
	V	0	0	1	2	0	0	0	3
	P	1	1	1	0	3	0	0	6
	K	2	0	1	0	0	0	0	3
Total		42	14	177	5	5	3	4	250
Spearman Correlation 0.442									
Kappa 0.581									

FGD findings

A Focus Group Discussion was conducted among the clinicians and academicians (Fig. 4). The recording was transcribed and translated. After open coding, axial coding and selective coding, 4 themes were identified from the FGD. The general pattern of the practice of prakriti; the variations in understanding and assessment; the general uses in clinical practice as well as the issues in the clinical assessment of prakriti were highlighted in the FGD (Table 8). The characteristics added in the new tool were re-identified as the clinically relevant findings of prakriti from the FGD. The importance of identifying the *dwidoshaja* traits were also highlighted. (Fig. 5)

Figure 4: Sociogram – FGD on clinical use of Prakriti assessment (18-11-2020)



AM – Moderator; RKK – Participant 1; RV - Participant 2; PK - Participant 3; RSR - Participant 4; PN - Participant 5

Figure 5: The word cloud representation of discussions in FGD

Table 8. Themes and subthemes in FGD

Themes	Practice	Variation	Uses	Issues
Sub-themes	No systematic assessment; Rough assessment only	Difference in opinion of Acharyas regarding the weightage	To know disease susceptibility	*Prakriti* and *vikriti* demarcation
	Confused with *dosha* assessment	In understanding (physician's)	To determine prognosis	Long-standing *vikriti* can interfere with their *prakriti*.
	Key role of *pitta* and *agni;* hence *pitta (VP, PK)* and *non-pitta* (VK) can be considered clinically	In assessment (weightage for *dosha* expression)	For choice of medicine and dosage	*Pitta* is often missed
	Indirectly from *koshta*	Patient might have forgotten their *koshta* condition because of chronicity of their disease.	For choice of *Pathya*	Unable to explain clinically
	Direct observations of height, skin, eyes, *satmya* etc	There may be changes according to the *vikriti*.	For clinical feedback	Failure to recall by patients

Discussion

This study findings indicate that prakriti assessment has to be incorporated as an integral part of clinical examination in Ayurveda to achieve the proclaimed status of personalized medicine. (18) The available tools do not have perfect agreement with each other. (2) Also, they cannot be directly subjected to clinical testing to find out whether they actually addressed the construct of prakriti or not. Under these circumstances, it can be highlighted that the new tool developed in this study can be the best option to be subjected to clinical testing in a big sample and to see whether it can withstand the internal variations in the organization and expression of prakriti.

The fair agreement of the new tool with Ayusoft and TNMC shows that it has good concurrent validity. The self-assessment tool developed by Kishor Patwardhan et al can be seen as differing from all the other tools, mainly due to the change in pattern of assessment. Still, compared to Ayusoft and TNMC, the new tool has better agreement with self-assessment tool, owing to its efficiency in recording the subject's own feelings also. Some of the parameters, which creates doubt in the minds of those filling the forms may have great influence in the final outcome of the assessment. (20-22) It can be conclusively stated that no such factors are considered in the new tool and thus it is very less susceptible to faulty assessment and result.

Another advantage of this tool is that it can be used as self-assessment tool as well as physician administered tool with slight changes in the outlook. Also, it can be easily converted into software or mobile application without much modifications. (8) It can be filled within 5-7 minutes in both physician administered and self-administered modes. The direct linking with the dominant *guna* of the combination of *doshas* makes the clinical adaptation to maximum efficiency, which can also be cross checked in different disease conditions. This was highlighted in the FGD and various links connecting the clinical importance of prakriti assessment were narrated.

Conclusion

These results show that the new tool has potency to be run in large scale to study more variability

among patients suffering from different diseases and to test the treatment response accordingly to confirm the findings. This will add to the standardization of Ayurvedic diagnostic, prognostic and therapeutic fields.

Limitations

- The study was more focussed on the 20-30 age group since it was done mainly in healthy volunteers in Govt Ayurveda College, Tripunithura
- The second phase of administration of the tool in 150 *doshavriddhi* states could be done as online only due to the Covid19 pandemic.

Suggestions

- Follow up study can be planned taking specific disease conditions into consideration.
- Software development and mobile app designing can be done based upon this tool
- Using the electronic media, a data bank of prakriti characteristics and clinical features can be developed and further big data analysis can be planned.

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Statement of Ethics

IRB approval for the study was obtained from the institutional committee for ethics in Govt Ayurveda College, Tripunithura (Ref: 03/KS-PJ-KUHS/IEC/2018 dated 25-04-2018 and revalidated as 39-03/KS-PJ-KUHS/IEC/2019 dated 11-04-2019). An informed consent form expressing the consent to share their *Prakriti* details for the study was developed and it was translated into local language, Malayalam. The duly filled consent form was obtained from all the participants. Verbal consent was taken from the participants of online Focus Group Discussion on 'clinical use of Prakriti Assessment' conducted in google meet platform on 18-11-2020.

Data availability statement

All data generated or analyzed during this study are included in this article and its supplementary material files. Further enquiries can be directed to the corresponding author.

Author disclosure statement

No conflict of interest between the authors to disclose.

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Annexure – New tool for prakriti assessment

Grading: 0-Absent; 1-Doubtful; 2-Evident; 3-Clearly evident							
Sl. No.	**Feature**	**Vata**	**Grade**	**Pitta**	**Grade**	**Kapha**	**Grade**
1	Skin	*Dry*	A1	Profuse sweating type	B1	*Moist /smooth*	C1
2	Eyes	*Round, Lusterless (unclear)*	A2	Turns red easily	B2	*Wide and elongated with plenty of eye lashes*	C2
3	Sound/ speech	Talkative, irrelevant talks	A3	Rough when angry	B3	Relevant & Soft spoken	C3
4	Appetite	Severe at times, diminished at times	A4	Strong appetite and digestive capacity, Intolerance to hunger	B4	Generally reduced appetite, hunger can be tolerated	C4
5	Sleep	Wakes up intermittently	A5	Moderate sleep	B5	Deep sleep	C5
6	Memory/ intellect	Grasps easily, forgets easily	A6	Curious in new matters and ideas	B6	Grasps slowly but good memory	C6
7	Interest	Hot(1), sweet(2), sour(3), salt(4)	A7	Cold(1), sweet(2), bitter(3)	B7	Hot(1), bitter(2), pungent(3), astringent(4)	C7
8	Friendship	Few friends, unsteady company	A8	Becomes support for the dependents	B8	Strong	C8
	Score	**V /24**		**P /24**		**K /24**	

V= A1*5 +A2*3 +A3*6 +A4*5 +A5*4 +A6*5 +A7(1)*7 +A7(2)*5 +A8*5

P= B1*8 +B2*3 +B3*5 +B4*7 +B5*4 +B6*5 +B7(1)*5 +B7(2)*3 +B7(3)*3 +B8*3

K= C1*4 +C2*4 +C3*6 +C4*5 +C5*6 +C6*5 +C7(3)*7 +C7(4)*5 +C8*5

VP = B1*2+A3*4+B3*2+A4*2+B4*2+A5*2+B5*2+A6*3+B6+A7(2)*5+A8

VK =A1*2+C1+C3+A4*2+C4*2+C5*2+C6+A7(1)*7+A8*2+C8

KP =B1*3+C1*3+C2*2+C3*3+B4+C4+B5+C5*2+B6*2+C6+B7(2)*3+C7(4)*3+B8*2+C8*3

Final Diagnosis

Prakriti

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