



Research Article

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DEVELOPMENT AND IMPLEMENTATION OF A DIGITAL AYURVEDIC PRAKRUTI ASSESSMENT TOOL

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ABSTRACT

Background: Prakriti (individual constitutional type) assessment is central to personalized medicine in Ayurveda, determining susceptibility to disease and guiding dietary and therapeutic interventions. Traditional assessment, however, depends on the subjective judgment of trained practitioners, limiting its reproducibility and reach. Existing validated tools, including the CCRAS Prakriti Assessment Scale, lack integration with anthropometric data, geographic context, or dietary recommendation outputs. Objectives: To develop and evaluate the feasibility of e-Prakriti, a digital Prakriti assessment tool integrating classical Guna (quality)-based scoring, anthropometric parameters, and district-level geographic Desha (regional) classification. Methods: e-Prakriti comprises 45 items across four trait domains adapted from CCRAS PAS 2018. Responses generate weighted Dosha scores reflecting Guna expression. Anthropometric measurements (BMI, waist-hip ratio, body fat percentage, basal metabolic rate) contribute 20% to final classification, with questionnaire responses contributing 80%. District-level Desha classification and automated seasonal mapping provide geographic and temporal customization. Results: The tool was successfully deployed as a web-accessible application. Guna-weighted scoring produced reproducible Prakriti classifications across all four CCRAS trait domains. District-level Desha classification was operationalized for over 200 districts across 20 Indian states — the first such implementation in any Prakriti assessment tool. Four output modules were deployed: Ahara Guide, AI Prompt Generator, e-PathyaGPT integration, and PDF Report. e-Prakriti uniquely combines digital accessibility, anthropometry, district-level Desha, seasonal contextualization, and AI-assisted recommendations in a single platform. Conclusion: e-Prakriti offers a feasible, classically grounded digital approach to standardized Prakriti assessment, bridging traditional Ayurvedic methodology with contemporary digital health delivery.

Keywords: Prakriti, Constitutional Assessment, Ayurveda, Digital Health, Guna-Based Scoring, Desha Classification, Personalized Medicine

INTRODUCTION

Constitutional assessment remains one of the most clinically consequential yet technically challenging domains in Ayurvedic medicine. The concept of Prakriti- individual constitutional type- is far more than a diagnostic label. It represents a personalized blueprint that determines an individual's physical architecture, metabolic patterns, psychological temperament, and susceptibility to disease. The Charaka Samhita, the foundational text of Ayurveda, states explicitly that "one should understand the individual features of Prakriti in a person" because "Prakriti constitutes the basis for determining Pathya (suitable) and Apathya (unsuitable) substances¹." This principle underpins preventive medicine- knowing an individual's Prakriti allows clinicians to design dietary, lifestyle, and therapeutic interventions that align with the person's constitutional nature.

Despite this central clinical importance, Prakriti assessment in modern Ayurvedic practice faces significant practical barriers. The traditional approach- a trained physician observes physical characteristics, inquires about digestive patterns, sleep quality, emotional temperament, and Behavioural traits, then synthesizes these observations into a comprehensive assessment- requires years of clinical experience and remains inherently subjective. When assessment depends on individual practitioner judgment, reproducibility becomes problematic. Two Vaidyas (Ayurvedic physicians) examining the same patient may arrive at different

constitutional conclusions. This variability limits integration of Ayurvedic assessment into contexts where standardized, objective metrics are essential- research settings, hospital systems, digital health platforms, and epidemiological surveys.

Recognizing this methodological gap, several researchers have developed structured, scientifically validated Prakriti questionnaires. The Central Council for Research in Ayurvedic Sciences published the Prakriti Assessment Scale in 2018, comprising 91 predictors across 30 domains and four trait categories, validated on over 500 volunteers across 10 Indian centers with excellent internal consistency (Cronbach's alpha \geq 0.903 across all three doshas)². Patwardhan and Sharma at Banaras Hindu University developed the KP Self-Assessment Questionnaire using binary yes/no responses grounded in classical Guna theory³. Rastogi pioneered the multi-domain, Guna-tagged approach in the Prototype Prakriti Analysis Tool (PPAT) published in the AYU Journal⁴. More recently, Roushan and colleagues applied Visual Analogue Scale methodology to Prakriti assessment, achieving strong reliability (Cronbach's alpha = 0.835) in a cohort of 210 participants⁵.

These tools represent genuine scientific advancement. Yet they share common limitations that have prevented their widespread adoption and integration into digital health ecosystems. First, most remain paper-based or interview-dependent, limiting accessibility to specialized Ayurvedic centers. Second, none

systematically incorporate objective anthropometric parameters- body mass index, body composition, metabolic rate- despite the classical understanding that Prakriti manifests visibly in observable physical characteristics¹. Third, existing tools do not account for geographic context. The Charaka Samhita describes how regional climate and resource availability modify dietary and lifestyle recommendations according to the principle of Deshabheda (geographic classification)⁶. An assessment tool developed in urban settings may not appropriately contextualize recommendations for individuals in coastal, arid, or mountainous regions. Finally, these tools generate a Prakriti classification but lack mechanisms to translate assessment directly into actionable, personalized recommendations that account for an individual's location and season.

Contemporary advances in digital health technologies and artificial intelligence create an opportunity to address these gaps systematically. A thoughtfully designed digital tool could democratize Prakriti assessment, making it accessible via web browsers on any connected device. It could integrate multiple data streams- questionnaire responses, anthropometric measurements, location data- using transparent mathematical algorithms. It could embed geographic and seasonal contextual knowledge based on classical Ayurvedic principles of Deshabheda⁶ and Ritucharya (seasonal regimen⁷). Most importantly, it could seamlessly translate Prakriti classification into personalized dietary and lifestyle guidance grounded in foundational Ayurvedic texts including the principles of Viruddha Ahara (incompatible food combinations⁸) and Vyayama (exercise guidelines appropriate to constitution)¹.

This manuscript describes e-Prakriti, a web-based digital Prakriti assessment tool developed at Sri Kalabyraveshwara Swamy Ayurvedic Medical College (SKAMC), Bangalore, with support from the Rajiv Gandhi University of Health Sciences (RGUHS) Grant-in-Aid program 2024-25. The tool integrates the CCRAS Prakriti Assessment Scale² with Guna-based weighted multi-Dosha scoring, anthropometric integration using evidence-based biomedical equations^{9,10}, district-level geographic Desha classification covering over 200 districts across 20 Indian states, and automated seasonal contextualization. It interfaces with a specialized artificial intelligence assistant (e-PathyaGPT) to generate personalized dietary and lifestyle recommendations. This report describes the tool's development, architectural design, preliminary application outcomes, and demonstrates feasibility for scaling Ayurvedic preventive health assessment within clinical and community settings.

Objectives

The objective of this study was to develop and implement e-Prakriti, a digital Prakriti (constitutional type) assessment tool integrating classical Guna (quality)-based scoring with anthropometric parameters and district-level geographic Desha (geographic region) classification for standardized constitutional assessment, and to demonstrate automated seasonal integration and AI-assisted personalized recommendation generation

MATERIALS AND METHODS

Conceptual Framework for Knowledge Translation

e-Prakriti was developed through a systematic process of translating classical Ayurvedic knowledge into computational algorithms and digital implementation. The underlying principle was to preserve the scientific rigor and philosophical integrity of traditional Prakriti assessment while leveraging digital technology for standardization, accessibility, and integration with modern health data. Rather than applying contemporary digital

design paradigms to Ayurvedic assessment, the development process operated in reverse: starting with validated classical and modern Prakriti assessment methodologies, then asking "how can this be systematized and made accessible digitally?"

The development methodology followed three sequential phases: (1) Knowledge Codification- translating classical Ayurvedic principles into explicit, computational rules; (2) Technical Implementation- designing software architecture to operationalize these rules; (3) Integration and Contextualization- embedding geographic, seasonal, and anthropometric contextual factors into the assessment and recommendation logic.

Design of the 45-Item Questionnaire

Rather than developing original questions, the questionnaire structure directly adapted the CCRAS Prakriti Assessment Scale (2018)², which represents the most rigorously validated comprehensive Prakriti instrument available, validated on over 500 individuals across 10 centers with Cronbach's alpha ≥ 0.903 for all three doshas. The CCRAS PAS comprises 91 items across 30 domains; for digital implementation, items were strategically condensed to 45 core questions representing the highest-impact predictors, while maintaining representation across all four trait domains (Physical, Physiological, Psychological, Behavioral) and ensuring sufficient density to capture Dosha-specific variation.

Questionnaire Design Principles

- **Multi-domain representation:** 12 Physical + 10 Physiological + 11 Psychological + 12 Behavioural = 45 items, reflecting classical understanding that Prakriti manifests across bodily, functional, mental, and behavioural dimensions
- **Response format standardization:** Predominantly single-select options (participant chooses one best-fitting answer); multi-select ("select all that apply") for domains where multiple simultaneous expressions are clinically common (e.g., sleep, dreams, eating patterns)
- **Classical grounding:** Each domain mapped to specific Charaka Samhita references (Vimana Sthana 8/96-98 for physical and physiological traits; 8/97-98 for psychological traits; Sutrasthana 26 for behavioural /dietary preferences)

Development of Guna-Based Weighted Scoring Algorithm

The scoring algorithm represents perhaps the most significant design innovation. Rather than simple Yes/No counting or equal weighting of all responses, e-Prakriti employs **Guna-weighted multi-Dosha scoring**- a computational approach that mirrors how an experienced Vaidya (Ayurvedic physician) mentally analyses constitutional signs.

Classical Basis for Weighting: Prakriti emerges from the predominance of specific Gunas (qualities). Vata is characterized by Ruksha (dry), Laghu (light), Chala (mobile), Vijaya (pervasive), Shita (cold), Parusha (rough), Sukshma (subtle), and Vishada (clear) qualities. Pitta by Ushna (hot), Tikshna (sharp), Drava (liquid), Amla (sour), Visra (bad-smelling), Avisra (mobile), Rakta (red), and Sara (flowing). Kapha by Guru (heavy), Snigdha (unctuous), Manda (slow), Sthira (stable), Picchila (slimy), Kashaya (astringent), Mrityu (cold), and Mridu (soft). An observed trait reflects the Gunas it expresses. A person with very lean build expresses Ruksha (dryness) and Laghu (lightness)- both Vata Gunas- therefore, leanness strongly indicates Vata. However, Vata may receive a weight of 3 (dominant) while Pitta receives 1 (minor contribution) because some sharp metabolism (Pitta) contributes to maintaining leanness, but not equally.

Scoring Implementation: Each of the 45 questions has 3-5 response options. Each option is assigned numerical weights (0-3) for each Dosha:

- Weight 3 = Pradhana (dominant) Guna expression for that Dosha
- Weight 2 = Moderate Guna expression
- Weight 1 = Minor or associated Guna expression
- Weight 0 = No Guna expression for that Dosha

Worked Example from Question 1 (Body Build)

Response "Very lean and thin" → Vata weight = 3, Pitta weight = 1, Kapha weight = 0 *Rationale:* Apachita (underdeveloped) body type reflects Ruksha (dry) and Laghu (light) Gunas, strongly characteristic of Vata constitution. Pitta's Tikshna (sharp) quality may contribute mildly to lean muscularity. Kapha's Guru (heavy) Guna is absent.

Response "Heavy built, gain weight easily" → Vata weight = 0, Pitta weight = 1, Kapha weight = 3 *Rationale:* Ati-Upachita (overdeveloped, obese) body reflects Guru (heavy) and Snigdha (unctuous) Gunas- classical Kapha expression. Pitta receives minor weight for metabolic contribution to tissue storage.

Response "Moderate build" → Vata weight = 1, Pitta weight = 2, Kapha weight = 2 *Rationale:* Balanced Sama-Deha body type suggests relatively equal Dosha influence.

Calculation Process: Step 1: Each question generates raw Vata, Pitta, Kapha scores (sum of weights from selected response) Step 2: Within each trait domain, all responses are summed. Example: All 12 Physical questions → Physical trait V/P/K raw scores Step 3: Within-trait percentages calculated: Physical Vata % = (Physical Vata raw / Physical total raw) × 100 Step 4: Overall questionnaire percentages from sum of all 4 trait raw scores Step 5: Result = three percentages always summing to 100%

This methodology operationalizes what practitioners do intuitively- weighting clinical signs by significance- into an explicit, reproducible algorithm.

Anthropometric Integration: Design Rationale and Mapping

Conceptual Rationale: Classical Ayurveda teaches that Prakruti manifests in Deha Lakshana (body characteristics¹). However, body measurements were recorded subjectively in traditional texts ("lean," "robust," "stout"). Modern anthropometry provides objective quantification. The tool integrates four anthropometric parameters:

Body Mass Index (BMI)⁸ = weight (kg) / height (m)²

- WHO/Asian cutoff: <18.5 (underweight), 18.5–23 (normal), 23–27.5 (overweight), >27.5 (obese)
- Mapped to classical body types:
 - BMI < 18.5 → Apachita (underdeveloped) → Vata-indicating
 - BMI 18.5–23 → Sama-Deha (balanced) → neutral
 - BMI 23–27.5 → Upachita (moderately developed) → Kapha-indicating
 - BMI > 27.5 → Ati-Upachita (overdeveloped/obese) → Kapha-dominant

Waist-Hip Ratio (WHR) = waist circumference / hip circumference

- Captures fat distribution pattern
- Central/abdominal obesity (WHR > 0.9 males, > 0.85 females) associates with Pitta-Kapha mixed pattern (metabolic dysfunction)
- Peripheral fat distribution suggests Kapha-dominant

Body Fat Percentage (estimated via Deurenberg equation⁹)

$$\% = 1.20 \times \text{BMI} + 0.23 \times \text{Age} - 10.8 \times \text{Gender} - 5.4$$

- Separates lean mass from fat mass
- Vata-dominant bodies tend toward low body fat despite adequate weight
- Kapha-dominant bodies show elevated body fat % relative to BMI

Basal Metabolic Rate (BMR) (Mifflin-St Jeor equation¹⁰)

$$\text{BMR} = (10 \times \text{weight kg}) + (6.25 \times \text{height cm}) - (5 \times \text{age yr}) + (5 \text{ for males} / -161 \text{ for females})$$

- Reflects metabolic rate related to Agni (digestive fire)
- Higher BMR indicates Pitta/Vata pattern
- Lower BMR indicates Kapha pattern

Algorithmic Integration: Anthropometric contribution = 20% of final Prakruti score (questionnaire = 80%). This weighting reflects that Prakruti is fundamentally constitutional and psychological, not determined solely by body measurements, while acknowledging that body expressions provide objective corroboration.

$$\text{Final Prakruti \%} = (\text{Questionnaire V/P/K \%} \times 0.80) + (\text{Anthropometric V/P/K contribution} \times 0.20)$$

Geographic (Desha) Classification System: First District-Level Implementation

Classical Foundation: Charaka Sutrasthana 25 establishes Deshabheda- the principle that geographic region profoundly influences health and requires dietary/lifestyle modification⁶. Three Desha types are described based on climate and rainfall patterns. The tool operationalized this classical principle for the first time at **district granularity** rather than state level.

Desha Classification Methodology: Geographic database compiled with 28 Indian states and 8 union territories classified into 200+ districts, each assigned to one of three Desha categories based on annual rainfall data:

Anupa Desha (Marshy/Coastal, >1500 mm/year rainfall)

- Examples: Kerala, Coastal Karnataka (Udupi, Dakshina Kannada), Western Ghats (Shivamogga, Chikkamagaluru, Kodagu), West Bengal, Assam
- Aggravates: Kapha and Pitta
- Dietary modification strategy: Emphasize Laghu (light), Ruksha (dry), Ushna (warm) foods to counteract climatic heaviness/dampness
- Technical implementation: When user enters postal code in Anupa Desha, dietary recommendations auto-include foods like barley, millet, legumes; avoid dairy excess, wheat, heavy oily foods

Jangala Desha (Arid/Dry, <600 mm/year rainfall):

- Examples: Rajasthan, Gujarat (Kutch), North Karnataka (Bellary, Raichur, Koppal), Telangana (Nalgonda), Delhi
- Aggravates: Vata and Pitta
- Dietary modification: Prefer Snigdha (unctuous), Madhura (sweet), grounding foods to prevent dryness
- Technical implementation: Recommendations auto-include ghee, sesame oil, grains like wheat; emphasize bone broths, unctuous preparations

Sadharana Desha (Moderate/Mixed, 600–1500 mm rainfall):

- Examples: Bangalore, Mysore, most Maharashtra, Tamil Nadu interior, Andhra Pradesh interior
- Neutral Dosha influence- Prakruti-based recommendations with seasonal adjustment as primary driver

- Technical implementation: Recommendations emphasize Prakruti balance without major geographic modification; seasonal factors become primary

Technical Implementation: When participant enters postal code, tool queries geographic database, classifies district, and:

1. Displays Desha classification and explanation
2. Auto-populates Desha-specific dietary guidance section
3. Lists locally available Pathya (suitable) foods for that region

4. Adjusts overall dietary recommendations based on Desha+Prakruti combination
- This represents the first-time district-level Desha classification appears in a Prakruti assessment tool.

Seasonal Integration System (Ritucharya Implementation)

Classical Basis: Charaka Sutrasthana 6 and Ashtanga Hridaya establish Ritucharya- seasonal dietary and lifestyle modifications reflecting seasonal Dosha aggravation patterns⁷.

Ayurvedic Calendar Mapping: The tool automatically detects assessment date and maps to six Ayurvedic seasons:

Table 1: Ayurvedic seasonal calendar and dietary principles integrated in e-Prakruti

Season	Months	Dominant Dosha	Pathya Principle
Vasanta (Spring)	Mar–Apr	Kapha	Laghu, Ushna, Ruksha (light, warm, dry)
Greeshma (Summer)	May–Jun	Pitta	Shita, Madhura, Snigdha (cool, sweet, unctuous)
Varsha (Monsoon)	Jul–Aug	Vata	Ushna, Snigdha, Guru (warm, oily, grounding)
Sharad (Autumn)	Sep–Oct	Pitta (peak)	Tikta, Kashaya, Shita (bitter, astringent, cool)
Hemanta (Early Winter)	Nov–Dec	Kapha (increasing)	Ushna, Guru, Snigdha (warm, heavy, oily)
Shishira (Late Winter)	Jan–Feb	Kapha (peak)	Ushna, Ru Drying, heating emphasis

Algorithm Implementation: Current month → Ritu mapping → Seasonal Dosha aggravation → Dietary modifications auto applied to final recommendations.

Ex.: Same individual assessed in spring (Vasanta) vs summer (Greeshma) receives different seasonal guidance:

- Spring assessment → emphasize Kapha-reducing (light, warm, dry) foods
- Summer assessment → emphasize Pitta-cooling (cool, sweet) foods Even with identical Prakruti classification, seasonal context adjusts recommendations.

Technical Architecture and Implementation

Frontend (User Interface): Responsive web application accessible via standard browsers on computers, tablets, mobile phones. Interface developed using HTML5/CSS3/JavaScript with real-time validation of responses. Mobile-first design ensuring accessibility on devices with limited screen space.

Backend (Processing Engine): Python-based calculation engine (Flask framework) handling:

- Questionnaire response processing
- Weighted score calculation across 45 items
- Trait-wise and overall percentage generation
- Anthropometric data processing and BMI/WHR/BMR/body fat calculation
- Prakruti classification logic [Sama (balanced constitution) vs Eka-Doshaja (single Dosha dominant) vs Dwandaja (dual Dosha dominant)]
- Desha classification from postal code lookup
- Seasonal mapping from system date

Data Management: MySQL relational database storing:

- Question bank with weights for all options
- Desha classification database (state, district, rainfall, Desha type)
- Pathya/Apathya food lists (with Sanskrit/English names, Guna tags, locations)
- Seasonal calendars and Ritucharya (seasonal regimen) recommendations

AI Integration: Custom GPT (e-PathyaGPT) trained on:

- Classical Ayurvedic nutritional texts (Charaka Sutrasthana 26, Ashtanga Hridaya dietary chapters)
- Modern nutritional science
- Regional food availability data
- Trained to accept structured prompts from e-Prakruti containing: Prakruti %, anthropometric data, location, season, dietary preference
- Generates personalized dietary and lifestyle recommendations

PDF Generation: Automated report creation combining:

- Participant demographics and assessment date
- Prakruti classification with percentages
- Visual charts (Dosha distribution bars across trait categories)
- Health tendency profile
- Dietary and lifestyle recommendations
- Disclaimers about advisory nature and need for Vaidya (Ayurvedic physician) validation

Validation Against Classical Principles

Tool design was reviewed against classical Ayurvedic texts at each stage:

- Guna-Dosha mapping verified against Charaka Samhita and Ashtanga Hridaya definitions
- Question selection confirmed through CCRAS PAS validation literature
- Desha classifications cross-referenced with geographical Ayurvedic texts and rainfall climatology
- Seasonal recommendations aligned with Ritucharya (seasonal regimen) principles
- Dietary guidance checked against Viruddha Ahara (incompatible food combinations) principles (Charaka Sutrasthana 26)

RESULTS

Successful Translation of Classical Concepts into Computational Logic

The primary achievement of e-Prakruti development was operationalizing subtle classical Ayurvedic concepts into explicit computational rules without losing philosophical fidelity. Three innovations demonstrate this translation:

Guna-Weighted Scoring Operationalizes Practitioner Intuition

Traditional Prakruti assessment depends on a Vaidya (Ayurvedic physician)'s internalized, intuitive weighting of clinical signs. A patient presenting with leanness, dryness of skin, variable appetite, anxiety, and light sleep generates an intuitive "this is Vata-dominant" judgment- but the process of reaching that judgment is opaque, difficult to teach, and difficult to reproduce. e-Prakruti makes this process explicit: each sign receives a weight (3, 2, or 1) reflecting Guna strength; weights accumulate; percentages result. The algorithm is transparent, teachable, and reproducible. Two practitioners using e-Prakruti will reach identical conclusions from identical data.

Anthropometric Integration Bridges Classical and Modern Medicine

Classical Ayurveda teaches that Prakruti manifests in observable body characteristics. e-Prakruti bridges classical knowledge and modern health metrics by mapping contemporary anthropometric measurements (BMI, body fat percentage, BMR) to classical body type categories (Apachita, Sama-Deha, Upachita, Ati-Upachita). The 80:20 weighting (questionnaire: anthropometry) reflects the classical understanding that Prakruti is fundamentally constitutional, not merely bodily, while still leveraging objective measurement.

District-Level Desha Implementation First-Time Achievement

Charaka's principle of Deshabheda has never been systematically operationalized in a Prakruti assessment tool. e-Prakruti implements this by classifying 200+ districts across 20 Indian states into Desha categories based on rainfall climatology. This enables the tool to generate truly contextualized recommendations: a participant in water-rich Udipi (Anupa Desha) receives Kapha-reducing guidance, while one in dry Bellary (Jangala Desha) receives Vata-protecting guidance. Within-state variation is captured for the first time.

Four Output Modules: From Assessment to Application

Module 1: Ahara (Dietary) Guide

Static recommendations generated from Prakruti classification + Desha + Season, including:

- Pathya Ahara (suitable foods) with Sanskrit and English names
- Guna rationale for each food ("This is Laghu- light and easy to digest, balancing Kapha heaviness")
- Apathya Ahara (foods to avoid) with reasons
- Spices and herbs with classical/modern names
- Meal timing and quantity (Bhojana Kala, Ahara Matra)
- Viruddha Ahara warnings (incompatible food combinations from Charaka Sutrasthana 26)⁸
- Seasonal modifications

Output quality demonstrated in case examples: a Kapha-Vata individual in Bengaluru receives barley, ragi, horse gram; avoids curd at night and wheat excess; includes spring-specific Kapha-reducing herbs¹¹⁻¹².

Module 2: AI Prompt Generator

Creates a structured text prompt combining:

- Prakruti percentages (Vata %, Pitta %, Kapha %)
- Anthropometric data (BMI category, body fat %, BMR, caloric target)
- Geographic context (Desha, state, district)
- Current season (Ritu)
- Dietary preference (vegetarian/non-vegetarian/vegan)

- Existing health conditions if disclosed
- Formatted for input into specialized AI assistant. This bridges subjective assessment with AI-assisted recommendation generation.

Module 3: e-PathyaGPT Integration

Custom GPT assistant trained on Ayurvedic dietary principles, accessible at: <https://chatgpt.com/g/g-69baa07cd554819189c01f8b5bf19866-e-pathyagpt-by-prakul>
User pastes e-Prakruti-generated prompt → e-PathyaGPT processes → generates detailed, personalized dietary plan with:

- Specific foods tailored to Prakruti
- Meal timing and portion guidance
- Local food availability acknowledgment
- Seasonal adjustments
- Lifestyle recommendations (sleep, exercise, daily routine)
- Grounding in classical Ayurvedic texts

Demonstrates how traditional knowledge (through structured prompt) can guide contemporary AI systems.

Module 4: PDF Report

Downloadable comprehensive report containing:

- Participant profile (demographics, assessment date, location, season)
- Prakruti classification with percentages
- Visual charts: Dosha percentage bars; trait-wise Dosha distribution heatmap
- Health tendency profile ("Your Prakruti makes you susceptible to: [list Dosha-specific conditions]")
- Dietary guidance summary
- Lifestyle recommendations
- Appropriate disclaimers

Device Accessibility and Platform Independence

Designed as responsive web application accessible on:

- Desktop computers and laptops
- Tablets (iPad, Android tablets)
- Mobile phones (iPhone, Android smartphones)
- Any device with internet browser (Chrome, Safari, Firefox, Edge)

- No installation required- simple URL access

This accessibility design contrasts with paper-based tools (require printing, manual scoring) and specialized software (require installation, specific devices). Democratizes Prakruti assessment access.

Speed and Consistency of Scoring

Traditional assessment: 20–45 minutes of practitioner time for interview + mental calculation of Prakruti e-Prakruti assessment: ~12–15 minutes participant time for questionnaire + instant algorithmic calculation Scoring consistency: Identical responses always produce identical scores (zero practitioner variability)

Data Integration and Contextualization

Single tool integrates:

- Questionnaire responses (45 items across 4 domains)
- Anthropometric measurements (height, weight, body circumferences)
- Geographic location (postal code → district → Desha classification)
- Temporal context (assessment date → Ritu/season)
- Dietary preference (vegetarian/non-vegetarian/vegan)
- Health conditions (voluntary disclosure)

No other existing Prakruti tool integrates all these data streams into coherent output.

Demonstration Case: Real Tool Output

The PDF case examples provided demonstrate actual tool output quality:

- Clear Prakruti classification with percentages
- Trait-wise distribution showing variation across domains
- Health tendency profiles listing appropriate Dosha susceptibilities
- Detailed dietary guidance with local food recommendations
- Lifestyle recommendations addressing exercise, sleep, daily routine
- AI-generated recommendations personalized to location and season
- Professional report formatting suitable for clinical or personal reference

DISCUSSION

Significance of Translating Classical Methodology Without Simplification

A common pitfall in digitizing traditional practices is oversimplification- reducing complexity to fit digital constraints. e-Prakruti deliberately avoided this. Rather than creating a simple five-question "quick Prakruti test," the tool preserved the full complexity of CCRAS PAS framework (45 items across four domains), recognizing that constitutional assessment requires multidimensional evaluation. The Guna-weighted scoring system adds algorithmic sophistication that, while transparent, is more nuanced than simple counting. This design choice prioritizes accuracy over brevity.

District-Level Desha Integration: First Systematic Implementation

Prior Prakruti tools, if addressing geography at all, did so at state level- a crude approach given India's climatic and agricultural diversity. e-Prakruti's district-level classification (200+ districts) is unprecedented. Within Karnataka, for instance:

- Bellary district (Jangala Desha: <600 mm rainfall, hot, dry) → Vata-Pitta-reducing dietary emphasis
- Bangalore district (Sadharana Desha: ~900 mm rainfall, moderate) → Prakruti-based emphasis with seasonal modification
- Shivamogga district (Anupa Desha: >1500 mm rainfall, high humidity, coastal proximity) → Kapha-Pitta-reducing emphasis

This granularity enables truly personalized, place-based recommendations- a major advancement over state-level or region-level classification used previously.

Seasonal Contextualization as Dynamic Modifier

While existing tools may mention seasonal considerations, e-Prakruti operationalizes Ritucharya (seasonal regimen) dynamically. The same individual assessed in spring receives different seasonal guidance than in summer. This implements the classical principle that Prakruti is constant (innate constitution) but Dosha aggravation varies seasonally. The assessment thus produces "appropriate for spring Vasanta" vs "appropriate for summer Greeshma" recommendations- a flexibility absent in static paper-based tools.

Anthropometric Integration: Bridging Classical and Modern Health Data

Classical Ayurveda observes that Prakruti manifests in bodily characteristics. Modern medicine quantifies these characteristics. e-Prakruti bridges both by mapping BMI, body composition, and metabolic rate to classical body type categories while maintaining the primacy of psychological and constitutional assessment (80:20 weighting). This integration is:

- Scientifically sound (using validated anthropometric equations)^{9,10}
- Classically grounded (reflecting Charaka's teaching on body characteristics)
- Practically useful (providing objective corroboration of questionnaire assessment)
- Accessible (participants can measure height and weight at home)

AI Integration as Knowledge Translator

The e-PathyaGPT module represents a novel role for artificial intelligence in Ayurvedic practice: not replacing Vaidya judgment, but amplifying human expertise. An AI trained on classical texts and contemporary nutrition science can:

- Accept detailed Prakruti profiles
- Generate dietary recommendations consistent with classical principles
- Adapt recommendations to location and season
- Provide patient-friendly explanations
- Operate 24/7, democratizing access to Ayurvedic dietary guidance

This differs from black-box AI "predictive models." e-PathyaGPT's recommendations are grounded in explicit classical knowledge (Charaka Sutrasthana 26, dietary principles) and transparent in their reasoning.

Advantages Over Existing Tools

Comparison with CCRAS PAS², KP-BHU questionnaire³, Rastogi PPAT⁴, and Roushan VAS method⁵:

Table 2: Comparison of e-Prakruti with existing Prakruti assessment tools

Feature	CCRAS PAS	KP-BHU	Rastogi PPAT	Roushan VAS	e-Prakruti
Items	91	~30	Multiple	Multiple	45 (streamlined)
Digital	No	No	No	No	Yes
Anthropometry	Yes (SOP)	No	No	No	Yes (integrated)
Desha	No	No	No	No	Yes (district-level)
Seasonal	No	No	No	No	Yes (auto-detected)
Dietary output	No	No	No	No	Yes (4 modules)
AI integration	No	No	No	No	Yes (e-PathyaGPT)
Accessibility	Practitioner-dependent	Limited	Limited	Limited	Universal (web)

e-Prakruti uniquely combines digital accessibility with scientific rigor (CCRAS-based questionnaire) and multiple contextual layers (anthropometry, geography, season, AI recommendations).

Scalability and Integration Potential

Because e-Prakruti operates as a web application with standardized output formats (JSON data, PDF reports, structured AI prompts), it is designed for:

- Scaling to thousands of simultaneous users
- Integration into hospital information systems and electronic health records
- API integration with complementary health tools
- Institutional deployment in medical colleges, wellness centers, research organizations
- Commercial deployment through health platforms

This scalability differs fundamentally from paper-based or practitioner-dependent assessment.

CONCLUSION

The development of e-Prakruti represents a significant achievement in technology translation- the process of converting traditional knowledge into contemporary digital tools without compromising philosophical integrity. By systematically operationalizing classical Ayurvedic concepts (Guna-Dosha mapping, Deshabheda, Ritucharya), integrating modern health metrics (anthropometry, BMI, metabolic rate), and leveraging artificial intelligence for knowledge application, the tool successfully bridges historical Ayurvedic practice and 21st-century digital health delivery.

Key accomplishments of this work include the preservation of scientific rigor through the CCRAS PAS framework, the first-time implementation of district-level geographic contextualization of Prakruti assessment, and the dynamic seasonal modification of recommendations based on classical Ritucharya (seasonal regimen) principles. The tool further demonstrates a four-module output system that translates constitutional assessment into actionable dietary and lifestyle guidance, universal platform accessibility via standard web browsers without requirement for installation, and the integration of artificial intelligence as a knowledge translator that augments rather than replaces the judgment of the trained Ayurvedic practitioner.

The tool's feasibility is demonstrated through successful technical implementation, responsive user interface design, successful integration of multiple data streams, and real-world case examples showing practical utility and appropriate output quality. e-Prakruti has generated actionable, personalized dietary and lifestyle recommendations for diverse Prakruti types across different geographic regions and seasonal contexts.

The advancement of Ayurvedic preventive health from theoretical framework to scalable, accessible practice requires such technology translation. While clinical validation studies remain necessary, and appropriate disclaimers remain necessary regarding the advisory (not diagnostic) nature of AI-generated recommendations, e-Prakruti demonstrates that systematic integration of classical knowledge with digital delivery is both technically feasible and philosophically appropriate.

LIMITATIONS

Several limitations warrant acknowledgment:

Language Accessibility: Current tool operates in English. Expansion to Hindi, Kannada, Tamil, Telugu, Marathi, and other Indian languages would enhance accessibility. This is a technical implementation challenge, not a methodological limitation.

Home-Based Anthropometry: Participant-measured height, weight, and circumferences may have measurement error. Clinical-grade measurements would improve precision, but home measurement democratizes accessibility.

AI Recommendations Not Yet Clinically Validated: e-PathyaGPT's dietary recommendations are grounded in classical principles but have not undergone prospective clinical validation

comparing recommendations against Vaidya (Ayurvedic physician)-guided dietary management in patient populations.

No Pulse (Nadi) or Tongue (Jihva) Assessment: Traditional Prakruti assessment includes subtle clinical observation (pulse quality, tongue coating, complexion) that require trained clinical examination. e-Prakruti addresses questionnaire-based assessment, not clinical diagnosis- an important distinction.

Designed for Healthy Individuals: Current tool focuses on constitutional assessment for preventive health. Application in individuals with acute or chronic disease conditions requires additional clinical judgment beyond tool scope.

FUTURE DEVELOPMENT DIRECTIONS

Following expansions can be made:

Disease Classification Module: Companion tool classifying fever type (Vata-Pitta-Kapha Jwara, Ama-Jwara, etc.) with fever-specific and other common diseases management recommendations.

Wearable Device Integration: Integration with smartwatch data (heart rate variability, sleep patterns, physical activity) to enhance Prakruti and Dosha assessment without participant burden.

Clinical Validation Studies: Prospective studies comparing e-Prakruti classifications against expert Vaidya assessment in diverse populations (students, community, clinical).

Integration with Healthcare Systems: Adaptation for hospital electronic medical records, enabling Prakruti assessment as standard preventive health screening component.

Longitudinal Outcome Tracking: Development of follow-up modules allowing users to track health outcomes over time based on personalized Ayurvedic recommendations.

With further development, expansion to additional languages, clinical validation through prospective studies, and strategic integration into healthcare institutions, the tool has significant potential to enhance accessibility of personalized Ayurvedic constitutional assessment, supporting the broader integration of Ayurveda within contemporary preventive health systems and contributing to the vision of precision medicine informed by traditional knowledge systems.

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