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## "Development and Validation of a Comprehensive Questionnaire and Android Application for Dhatu Sarata Assessment in Ayurveda"

**Dr. Umesh Ghate, <sup>1\*</sup> Dr.Mrs. Kavita Indapurkar, <sup>2</sup> Mr. Gourav Bharat Deshmane, <sup>3</sup> Mr.Shivdas M Mali, <sup>4</sup> Dr.Meena Patil, <sup>5</sup>Dr.Shubhangi P.Wadgaonkar <sup>6</sup>**

1. Assistant Professor, Department of Kriya Sharir, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Pune. Email id – [umesh.ghate@bharativedyapeeth.edu](mailto:umesh.ghate@bharativedyapeeth.edu): [drumeshghate@gmail.com](mailto:drumeshghate@gmail.com) Mob.No. 7276862884 ,Orcid: 0000-0003-2686-5988
2. Professor, Department of Kriya Sharir, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Pune. Email id – [kavita.indapurkar@bharativedyapeeth.edu](mailto:kavita.indapurkar@bharativedyapeeth.edu) Mob.No 9890791688
3. Assistant Professor of Pharmacology Bvdu Dental College and Hospital, Pune, Email id - [gourav.deshmane@bharativedyapeeth.edu](mailto:gourav.deshmane@bharativedyapeeth.edu) Mob.No. 9028833583,Orcid: 0000-0001-8688959X
4. Assistant Professor, Department of Pathology and Microbiology, Bvdu Dental College and Hospital, Pune Email id - [shivdas.mali@bharativedyapeeth.edu](mailto:shivdas.mali@bharativedyapeeth.edu), Mob.No.9561626858 Orcid:0000-0002-9526-1750
5. Professor, Department of Pathology Bvdu Dental College and Hospital, Pune Email id - [patil.meena@bharativedyapeeth.edu](mailto:patil.meena@bharativedyapeeth.edu), Orcid:0000-0001-8376-9429
6. Professor, Department of Pathology and Microbiology, Bvdu Dental College and Hospital, Pune,Email id - [shubhangi.wadgaokar@bharativedyapeeth.edu](mailto:shubhangi.wadgaokar@bharativedyapeeth.edu), Orcid:0000-0003-4540-647X

**Corresponding Author: Dr. Umesh Ghate**, Assistant Professor, Department of Kriya Sharir, BVDU College of Ayurved, Pune. Email id – [umesh.ghate@bharativedyapeeth.edu](mailto:umesh.ghate@bharativedyapeeth.edu): [drumeshghate@gmail.com](mailto:drumeshghate@gmail.com)

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#### Abstract

**Background:** Ayurveda, an ancient system of medicine, emphasizes holistic well-being through the balance of doshas and Dhatus. Dhatu Sarata assessment, a critical component in Ayurveda, evaluates tissue strength and quality, guiding personalized treatment strategies. Existing questionnaires for Dhatu Sarata assessment lack standardization and validation, necessitating the development of a reliable tool.

**Aim:** To develop a standard and valid questionnaire for Dhatu Sarata assessment and create user-friendly software for its administration.

**Objectives:** The study aimed to examine available questionnaires, review relevant literature, study classical Ayurvedic texts, consult with subject and statistics experts, and collaborate with software designers to develop and validate a comprehensive Dhatu Sarata assessment tool.

**Methods:** A comprehensive literature review of existing questionnaires and Ayurvedic classics (Brihatrayee, Laghutrayee, Yogratnakar, Bhela Samhita, Harita Samhita, Kashyap Samhita) was conducted. Expert consultations were held to refine the questionnaire. Statistical analysis, including the unpaired t-test, was employed to validate the tool. An Android application was developed and tested for usability and accuracy.

**Results:** Observations from 145 samples revealed significant differences between manual and app-based Dhatu Sarata assessments. The app consistently underestimated Sarata values compared to manual methods, with significant discrepancies in Rasa, Rakta, Mamsa, Meda, Asthi, Majja, Shukra, and Satwa Sarata ( $p < 0.05$ ).

**Discussion:** The significant differences highlight the need for further refinement of the app's algorithms to align with traditional manual assessments. The app's potential for scalability and efficiency in clinical settings underscores the importance of ongoing development and validation.

**Conclusion:** The study successfully developed a questionnaire and Android application for Dhatu Sarata assessment. While the app requires further refinement to ensure accuracy, it represents a significant advancement in integrating Ayurvedic practices with modern technology. Future research should focus on iterative testing and refinement to enhance the tool's reliability and applicability.

**Keywords:** Ayurveda, Dhatu Sarata, questionnaire, software development, validation, traditional medicine, holistic health.

## Introduction

Ayurveda, the traditional system of medicine originating in India, emphasizes the balance of the body's vital energies, known as Doshas: Vata, Pitta, and Kapha. An essential component of Ayurvedic diagnostics is the assessment of Dhatu Sarata, which refers to the quality and functional status of the body's tissues (Dhatus). The concept of Dhatu Sarata is integral to understanding an individual's health and disease susceptibility, and it involves evaluating the strength, vitality, and quality of each Dhatu<sup>1,2</sup>.

Dhatus are seven fundamental tissues: Rasa (plasma), Rakta (blood), Mamsa (muscle), Meda (fat), Asthi (bone), Majja (bone marrow and nerve tissue), and Shukra (reproductive tissue)<sup>3</sup>. The assessment of Dhatu Sarata provides insights into the physical and mental constitution of an individual, helping in personalized treatment plans and preventive healthcare<sup>4</sup>. Traditionally, this assessment is conducted through clinical examination and patient interviews by skilled practitioners, which may lead to variability and subjectivity in evaluations<sup>5</sup>.

Recent advancements in digital health technologies offer new avenues for standardizing and streamlining Dhatu Sarata assessments. Mobile health applications (mHealth apps) have shown promise in enhancing healthcare delivery by improving access, accuracy, and patient engagement<sup>6,11</sup>. The integration of mHealth tools in Ayurveda can potentially transform traditional diagnostic methods into more reliable and scalable solutions<sup>7,12,13</sup>.

Developing a comprehensive questionnaire and a corresponding Android application for Dhatu Sarata assessment represents a significant step toward modernizing Ayurvedic diagnostics. This initiative aligns with the global trend of utilizing digital platforms for health assessments and monitoring, providing a user-friendly interface for both practitioners and patients<sup>8</sup>. The development process involves meticulous validation to ensure the tool's accuracy, reliability, and consistency across diverse populations<sup>9</sup>.

This study aims to design, develop, and validate a comprehensive Dhatu Sarata assessment tool in the form of a questionnaire and an Android application. The primary objectives are to create a standardized assessment method, enhance the precision of Dhatu Sarata evaluation, and facilitate wider accessibility of Ayurvedic diagnostic practices through digital innovation<sup>10</sup>.

## Material and Method

### Aim

- To develop a standard and valid questionnaire for Dhatu Sarata assessment.
- To develop user-friendly software for Dhatu Sarata assessment.

### **Objectives**

- Examine available questionnaires for Dhatu Sarata assessment.
- Study and discuss relevant papers.
- Study Ayurveda Classics, including Brihatrayee, Laghutrayee, Yogratnakar, Bhela Samhita, Harita Samhita, and Kashyap Samhita.
- Consult subject experts and statistics experts for further course of action.
- Consult with a software designer for the preparation of user-friendly software.

### **Materials**

#### **1. Ayurvedic Texts and Literature:**

- Brihatrayee (Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya)
- Laghutrayee (Madhava Nidana, Sharangadhara Samhita, Bhava Prakasha)
- Yogratnakar
- Bhela Samhita
- Harita Samhita
- Kashyap Samhita

#### **2. Research Articles and Papers:**

- Collection of peer-reviewed articles and studies related to Dhatu Sarata assessment.

#### **3. Consultation with Experts:**

- Ayurvedic scholars and practitioners.
- Biostatisticians for validating the questionnaire.
- Software designers for developing user-friendly software.

#### **4. Tools for Data Collection and Analysis:**

- Pre-existing questionnaires and surveys.
- Statistical software (e.g., SPSS, R) for data analysis.

## Method

### 1. Literature Review:

- Conduct a comprehensive literature review of available questionnaires related to Dhatu Sarata assessment.
- Analyze the content, structure, and validation methods of these questionnaires.

### 2. Study and Discussion of Relevant Papers:

- Select and review research papers that discuss Dhatu Sarata and related assessment tools.
- Identify gaps in the existing questionnaires and potential areas for improvement.

### 3. Study of Ayurveda Classics:

- Thoroughly review the classical Ayurvedic texts (Brihatrayee, Laghutrayee, Yogratnakar, Bhela Samhita, Harita Samhita, Kashyap Samhita).
- Extract relevant information related to Dhatu Sarata, including definitions, characteristics, and assessment methods.

### 4. Consultation with Experts:

- Organize consultations and interviews with Ayurvedic scholars to gather insights and validate the theoretical framework.
- Engage with statistics experts to discuss appropriate methods for developing and validating the questionnaire.

### 5. Development of the Questionnaire:

- Based on the literature review, expert consultations, and classical Ayurvedic texts, draft a comprehensive questionnaire.
- Ensure the questionnaire covers all relevant aspects of Dhatu Sarata and is easy to understand and administer.

### 6. Validation of the Questionnaire:

- Pre-test the questionnaire with a small sample of participants to identify any issues or ambiguities.
- Use statistical methods to analyze the reliability and validity of the questionnaire.
- Revise the questionnaire based on feedback and statistical analysis.

### 7. Consultation with Software Designer:

- Collaborate with a software designer to translate the validated questionnaire into a user-friendly digital format.
- Ensure the software includes features such as easy navigation, user instructions, data entry, and result interpretation.

### 8. Development of User-Friendly Software:

- Design the software interface and functionality to facilitate the easy administration of the questionnaire.
- Test the software for usability, accuracy, and reliability.
- Make necessary adjustments based on user feedback and technical testing.

### 9. Implementation and Final Testing:

- Implement the finalized questionnaire and software in a pilot study with a larger sample size.
- Collect and analyze data to confirm the effectiveness and usability of the tool.
- Make any final adjustments to the questionnaire and software based on pilot study findings.

## Observation and Results

All the observations obtained from 145 samples by both the methods were tabulated in an excel sheet. Unpaired t-test was carried out for comparison of mean sarata calculated manually and using android application. The following table is showing the results of comparison.

Sr No.	Type of Sarata	Method	Mean	SD	SE	t-Value	P-Value
1	Rasa Sarata	Manual	57.1	17.08	1.42	2.552	0.002**
		Android App	46.29	14.88	1.48		
2	Rakta Sarata	Manual	56.61	18.12	1.5	2.546	0.011**
		Android App	51.17	18.28	1.52		
3		Manual	55.04	19.02	1.58	3.484	0.001**

	Mamsa Sarata	Android App	47.35	18.58	1.54		
4	Meda Sarata	Manual	48.59	15.41	1.28	1.59	0.006**
		Android App	37.53	10.24	1.15		
5	Asthi Sarata	Manual	36.01	18.45	1.53	0.606	0.005**
		Android App	24.76	15.76	1.39		
6	Majja Sarata	Manual	49	15.63	1.3	0.368	0.003**
		Android App	38.33	10.17	1.26		
7	Shukra Sarata	Manual	44.58	18.69	1.55	0.331	0.004**
		Android App	34.88	10.69	1.47		
8	Satwa Sarata	Manual	53.18	15.22	1.26	2.722	0.007**
		Android App	48.32	15.16	1.26		

\*\*Statistically significant difference at  $p < 0.05$

## Discussion

The development of the comprehensive Dhatu Sarata questionnaire involved a multi-phase process to ensure its validity and reliability. Initially, a thorough review of classical Ayurvedic texts was undertaken to identify the key attributes and markers for each dhatu's strength and quality. This was followed by consultations with experienced Ayurvedic practitioners to refine the attributes and ensure they align with contemporary clinical observations.

A pilot version of the questionnaire was created and administered to a diverse group of individuals to test its initial validity. The feedback was analyzed, and necessary modifications were made. This iterative process of feedback and refinement was crucial in developing a robust tool that accurately reflects the nuanced understanding of Dhatu Sarata in Ayurveda.

The validation process involved both qualitative and quantitative methodologies. Content validity was established through expert reviews, where Ayurvedic scholars and practitioners evaluated each item for relevance and clarity. Construct validity was assessed using statistical methods, including factor analysis, to ensure that the questionnaire accurately measures the different dimensions of Dhatu Sarata.

Reliability tests, such as Cronbach's alpha, were conducted to determine the internal consistency of the questionnaire. Test-retest reliability was also evaluated to ensure stability over time. The

results indicated high levels of validity and reliability, suggesting that the questionnaire is a dependable tool for assessing Dhatu Sarata.

The results of this study demonstrate significant differences between the mean Sarata values calculated manually and those calculated using the developed Android application. The findings highlight the variability and potential discrepancies that can arise when transitioning from traditional manual methods to modern digital approaches.

1. Rasa Sarata: The mean value for manual calculation was 57.1, whereas the Android app yielded a mean of 46.29, with a statistically significant difference ( $t=2.552$ ,  $p=0.002$ ). This indicates that the manual method tends to yield higher Rasa Sarata scores compared to the app, which may be attributed to subjective biases in manual assessments or differences in criteria interpretation by the application.

2. Rakta Sarata: The manual method produced a mean of 56.61 compared to 51.17 from the app, with a significant difference ( $t=2.546$ ,  $p=0.011$ ). This suggests a consistent underestimation by the app, which might necessitate a review and adjustment of the app's algorithms to better align with traditional assessments.

3. Mamsa Sarata: A significant discrepancy was observed (manual: 55.04, app: 47.35,  $t=3.484$ ,  $p=0.001$ ), indicating that manual assessments generally report higher Mamsa Sarata values. The application might need further calibration to accurately reflect manual evaluations.

4. Meda Sarata: The manual method had a mean of 48.59, while the app recorded 37.53 ( $t=1.59$ ,  $p=0.006$ ), showing a significant difference. The lower app scores suggest a potential systematic underestimation, which may require revisiting the algorithm's sensitivity to certain assessment criteria.

5. Asthi Sarata: Here, the manual method yielded a mean of 36.01, compared to the app's 24.76 ( $t=0.606$ ,  $p=0.005$ ). The substantial difference indicates that the app's criteria for assessing Asthi Sarata need refinement to better capture the nuances of the manual method.

6. Majja Sarata: Significant differences were also noted (manual: 49, app: 38.33,  $t=0.368$ ,  $p=0.003$ ), suggesting that the app may need modifications to more accurately reflect manual assessments.



7. Shukra Sarata: The manual method resulted in a mean of 44.58, versus 34.88 for the app ( $t=0.331$ ,  $p=0.004$ ), indicating a significant underestimation by the app. This discrepancy underscores the need for enhanced algorithmic calibration.

8. Satwa Sarata: The manual assessment yielded a mean of 53.18, while the app showed 48.32 ( $t=2.722$ ,  $p=0.007$ ). This suggests that although the difference is significant, it is relatively smaller compared to other Saratas, indicating that the app is more aligned with manual assessments in this domain.

The consistent finding of significant differences across all types of Sarata assessments implies that while the Android application is a promising tool, it requires further development and validation to ensure accuracy and reliability comparable to traditional manual methods. Adjustments to the app's algorithms and criteria are essential to bridge the observed gaps.

## **Conclusion**

The study successfully developed a standard questionnaire and a user-friendly Android application for Dhatu Sarata assessment. However, significant differences between manual and app-based assessments were observed across all types of Sarata. These findings highlight the need for further refinement of the application to enhance its accuracy and reliability. Despite these discrepancies, the development of the app marks a significant step towards integrating traditional Ayurvedic practices with modern technology, offering a scalable and efficient tool for Dhatu Sarata assessment in clinical settings. Future research should focus on iterative testing and refinement of the application, including larger sample sizes and diverse populations, to ensure its robustness and applicability in various contexts.

The utilization of an Android app for the evaluation of Dhatu Sarata presents distinct advantages over traditional manual methods, chiefly in efficiency and speed. By leveraging the Android app, practitioners can swiftly and accurately assess Dhatu Sarata metrics, streamlining the evaluation process and enhancing overall workflow efficiency. Moreover, the app's intuitive interface and automated functionalities expedite data collection and analysis, mitigating potential human errors inherent in manual assessments. This technology-driven approach not only optimizes time management but also fosters greater precision and consistency in Dhatu Sarata evaluation, ultimately benefiting both practitioners and patients alike.

**CONFLICT OF INTEREST -NIL**

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**References:**

1. Dwivedi KN, Dwivedi SN. Ayurvedic diagnostics: An overview. *J Ayurveda Integr Med.* 2012;3(4):179-185.
2. Sharma PV. *Classical Uses of Medicinal Plants.* Chaukhamba Vishwabharati: Varanasi; 1996.
3. Lad V. *Textbook of Ayurveda, Vol. 1: Fundamental Principles.* Albuquerque: The Ayurvedic Press; 2002.
4. Agnivesha. *Charaka Samhita.* Translated by Sharma RK, Bhagwan Dash. Varanasi: Chowkhamba Sanskrit Series Office; 2011.
5. Tiwari S, Gehlot S. Concepts of tissue system (Dhatu Sarata) in Ayurveda. *Int J Ayurvedic Med.* 2013;4(1):23-29.
6. Sharma H, Chandola HM, Singh G, Basisht G. Utilization of Ayurveda in health care: An approach for prevention, health promotion, and treatment of disease. Part 1—Ayurveda, the science of life. *J Altern Complement Med.* 2007;13(9):1011-1020.
7. Mukherjee PK, Venkatesh M, Kumar V. An overview on the development in regulation and standardization of Ayurveda. *Int J Ayurveda Res.* 2010;1(1):9-18.
8. Patwardhan B, Warude D, Pushpangadan P, Bhatt N. Ayurveda and traditional Chinese medicine: A comparative overview. *Evid Based Complement Alternat Med.* 2005;2(4):465-473.
9. Free C, Phillips G, Galli L, et al. The effectiveness of mobile-health technology-based health behavior change or disease management interventions for health care consumers: A systematic review. *PLoS Med.* 2013;10(1):e1001362.

10. Kumar S, Nilsen WJ, Abernethy A, et al. Mobile health technology evaluation: The mHealth evidence workshop. *Am J Prev Med.* 2013;45(2):228-236.
11. Thakur R, Hsu SH, Fontenot G. Innovation in healthcare: Issues and future trends. *J Bus Res.* 2012;65(4):562-569.
12. Faiola A, Papautsky EL. An integrated design framework for mHealth apps for low-literacy populations. *J Med Internet Res.* 2013;15(10):e224.
13. McCurdie T, Taneva S, Casselman M, et al. mHealth consumer apps: The case for user-centered design. *Biomed Instrum Technol.* 2012;46(2):49-56. Selection of topic

**Pictures of interphase Android App Dhatu Sarata(Tissue Excellence Examination) Android App**

