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"Integrating Traditional And Modern Metrics: A Cross-Sectional Study Of Dhatu Sarata And Ergographic Muscle Efficiency"

Dr. Umesh Ghate[1*],Dr. Kavita Indapurkar[2], Dr. Suryajeet Pawar[3]Dr.Sachin Patil[4],Dr.Sarika Abhijit Patil[5],Dr.Advait Menon[6]

1.*Assistant Professor, Department of Kriya Sharir, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Pune.

2. Professor & HOD, Department of Kriya Sharir, Bharati Vidyapeeth (Deemed to be University) College of Ayurved, Pune.

3. Associate Professor, Department of Agadtantra, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Pune.

4. Assistant Professor, Department of Rachan Sharira, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Pune.

5. Assistant Professor, Department of Rasashastra & Bhaishajya Kalpana, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Pune.

6. Assistant Professor, Department of Roganidan, Bharati Vidyapeeth (Deemed to be University), College of Ayurved, Pune.

***Corresponding Author:**
Dr.Umesh Ghate
Ph.D. College of Ayurved, Bharati Vidyapeeth (Deemed to be University), Pune, India.
Email ID: drumeshghate@gmail.com ; umesh.ghate@bharatividyapeeth.edu
ORCID ID - 0000-0003-2686-5988

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Abstract

This study investigates the correlation between Dhatu Sarata (tissue excellence) in Ayurveda and muscular performance measured through Mosso's ergography. Dhatu Sarata evaluates the qualitative state of bodily tissues (Dhatu), which Ayurvedic texts associate with physical strength (Bala). Modern ergography objectively quantifies muscle endurance and work capacity. A cross-sectional analysis was conducted on 215 healthy participants (105 male, 110 female) aged 18–25 years. Dhatu Sarata was assessed using the standardized AyuSoft C-DAC questionnaire, while Mosso's ergograph measured finger flexor contractions under controlled resistance.

Statistical analysis revealed significant positive correlations ($p < 0.05$) between Mamsa Dhatu Sarata (muscle tissue excellence) and ergographic work output in both genders (Male: $r = 0.570$; Female: $r = 0.228$). Similarly, Asthi Dhatu Sarata (bone tissue excellence) showed significant associations (Male: $r = 0.224$; Female: $r = 0.348$). No significant correlations were observed for other Dhatu (Rasa, Rakta, Meda, Majja, Shukra) or Satva Sarata .

These findings validate Ayurvedic principles linking Mamsa and Asthi Dhatu to physical

strength, demonstrating convergence between traditional tissue assessment and modern biomechanical metrics. The study highlights the potential of integrating Ayurvedic diagnostics with ergographic analysis for a holistic understanding of muscular efficiency. Further research should explore molecular and structural mechanisms underlying these correlations to enhance integrative health approaches.

Keywords: Dhatu Sarata , Ergography, Muscle Performance, Ayurveda, Biomechanics

Introduction

Ayurveda, the ancient Indian system of medicine, presents a comprehensive framework for understanding human health through the lens of bioenergetic principles (doshas), structural components (dhatus), and metabolic byproducts (malas). Among these foundational concepts, the evaluation of dhatu sarata (tissue excellence) occupies a pivotal position in assessing an individual's constitutional strength and physiological resilience [1]. This sophisticated diagnostic approach classifies tissue quality into eight distinct categories—seven pertaining to bodily tissues (rasa, rakta, mamsa, meda, asthi, majja, shukra) and one addressing mental constitution (satva) [2]. The classical texts emphasize that optimal tissue quality (sarata) directly correlates with physical vigor, disease resistance, and overall vitality [3].

Contemporary exercise physiology has developed precise methodologies for quantifying muscular performance, with Mosso's ergography standing as a pioneering technique in this domain [4]. Originally developed by Angelo Mosso in the late 19th century, this innovative apparatus provides objective measurements of muscular work capacity, endurance thresholds, and fatigue patterns through standardized protocols [5]. The ergographic approach offers several advantages over conventional strength assessments, including its ability to capture subtle variations in contractile efficiency and its sensitivity to neuromuscular fatigue mechanisms [6].

The theoretical foundations of Ayurveda posit that mamsa dhatu (muscle tissue) and asthi dhatu (osseous tissue) serve as primary determinants of physical strength and structural integrity [7]. This perspective finds remarkable parallels in modern myology research, which identifies muscle fiber composition and bone architecture as crucial factors influencing mechanical performance [8]. Recent advances in osteomyology further substantiate the biomechanical interdependence between muscular and skeletal systems, particularly in force transmission and movement efficiency [9].

Despite these conceptual convergences, the empirical relationship between Ayurvedic tissue assessment and modern physiological metrics remains underexplored. Previous studies have primarily focused on validating individual assessment tools—either examining the reliability of dhatu sarata parameters [10] or establishing the precision of ergographic measurements [11]. However, no systematic investigation has attempted to bridge these distinct evaluation paradigms through rigorous correlational analysis.

This research gap assumes particular significance in light of growing interest in integrative medicine approaches that combine traditional wisdom with modern scientific methodologies

[12]. The current study addresses this need by examining potential associations between dhatu sarata classifications and objective ergographic performance metrics. Such an investigation serves dual purposes: it provides empirical validation for Ayurvedic diagnostic principles while simultaneously expanding the interpretive framework for modern biomechanical assessments.

The conceptual framework for this study draws upon both Ayurvedic physiology and contemporary exercise science. According to Charaka Samhita , individuals with superior mamsa sarata exhibit well-developed musculature, exceptional endurance, and remarkable physical stamina [1]. Similarly, those with optimal asthi sarata demonstrate robust skeletal structure, excellent posture, and enhanced mechanical advantage in movement [2]. These qualitative descriptors find their quantitative counterparts in ergographic parameters such as work output, fatigue resistance, and contractile efficiency [4].

Methodologically, this study employs standardized assessment protocols from both traditions. The AyuSoft C-DAC system provides a validated tool for dhatu sarata evaluation, incorporating classical parameters into a structured scoring framework [10]. Concurrently, the computerized Mosso ergograph delivers precise measurements of finger flexor performance under controlled resistance conditions [5]. This dual-method approach ensures both cultural fidelity to Ayurvedic principles and scientific rigor in data collection.

The potential implications of this research extend across multiple domains. From a clinical perspective, establishing reliable correlations between tissue quality and muscular performance could enhance preventive strategies in sports medicine and rehabilitation [13]. From a research standpoint, it opens new avenues for investigating the physiological substrates of dhatu sarata through advanced imaging and molecular techniques [14]. Moreover, it contributes to the growing body of evidence supporting integrative approaches to health assessment and promotion [15].

By systematically examining these relationships in a healthy young adult population, this study aims to establish foundational evidence for future investigations in diverse demographic and clinical populations. The findings may ultimately contribute to developing more comprehensive models of health assessment that honor both traditional knowledge systems and modern scientific understanding.

Study Objectives

1. To quantitatively assess tissue quality parameters using validated Ayurvedic diagnostic criteria.
2. To measure muscular work capacity through standardized ergographic protocols.
3. To statistically analyze potential correlations between tissue excellence classifications and biomechanical performance metrics.
4. To evaluate gender-specific variations in observed relationships.

Methodological Framework

Participant Characteristics

- Sample Composition : 215 healthy participants (105 male, 110 female).
- Age Range : 18–25 years (mean 21.3 ± 2.1).
- Selection Criteria :
  - Right-hand dominance (confirmed by Edinburgh Handedness Inventory).
  - No neuromuscular disorders or musculoskeletal injuries.
  - No performance-enhancing substance use.

Assessment Instruments

1. AyuSoft C-DAC Diagnostic System :
   - Validated questionnaire assessing all eight Sarata categories [10].
   - Scoring system based on classical Ayurvedic parameters [1].
2. Computerized Mosso Ergograph :
   - Precision measurement of finger flexor contractions.
   - Standardized 2kg resistance protocol.
   - Digital recording of work output ($W = F \times S$).
3. Control Variables :
   - Environmental conditions maintained at 28 ± 1°C.
   - Consistent morning testing schedule (9–11 AM).
   - Pre-test hydration and nutritional standardization.

Analytical Approach

- Primary Analysis : Pearson correlation coefficients.
- Secondary Analysis : Multivariate regression modeling.
- Statistical Power : 80% power to detect medium effect sizes ($\alpha = 0.05$).

Key Findings

Significant Correlations

1. Mamsa Dhatu Sarata :
   - Male participants: $r = 0.57$ ($p < 0.001$).
   - Female participants: $r = 0.23$ ($p = 0.017$).
2. Asthi Dhatu Sarata :
   - Male participants: $r = 0.22$ ($p = 0.023$).
   - Female participants: $r = 0.35$ ($p < 0.001$).

Non-Significant Associations

All other Dhatu categories (Rasa, Rakta, Meda, Majja, Shukra, Satva) showed correlation coefficients below 0.20 with p -values exceeding 0.05 threshold.

Interpretation and Discussion

The robust correlation between Mamsa Sarata and ergographic performance aligns with fundamental Ayurvedic physiology describing Mamsa Dhatu as the principal determinant of muscular strength [1]. Contemporary myology research similarly identifies muscle tissue quality as the primary factor in work capacity [8]. This convergence of traditional and modern perspectives strengthens the validity of both assessment approaches.

The observed Asthi Dhatu correlations may reflect the biomechanical reality that bone structure serves as the essential leverage system for muscular force transmission [9]. Recent

studies in osteomyology have demonstrated how bone density and architecture influence mechanical advantage in movement [16].

Gender differences in correlation magnitudes likely relate to established variations in muscle composition and hormonal influences on tissue characteristics [17]. The stronger association in males corresponds with known androgen-mediated effects on muscle hypertrophy [18], while the female pattern suggests additional regulatory factors may be operational [19].

Conclusions and Future Directions

1. This study establishes empirical evidence linking Ayurvedic tissue excellence parameters with objective biomechanical measurements.
2. The findings validate classical Ayurvedic concepts regarding Mamsa and Asthi Dhatu as foundations of physical capacity.
3. Future research should:
   - Incorporate advanced imaging modalities for tissue characterization [20].
   - Explore longitudinal training effects on Sarata parameters [21].
   - Investigate molecular correlates of Dhatu excellence [22].

Conflicts of Interest: The authors declare no competing financial interests.
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