Research Article

Data-Driven Herbal Prescription Patterns and Acupoint-Dietary Therapies in Traditional Chinese Medicine

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***Abstract*:** The contemporary integration of computational data mining methodologies with classical Traditional Chinese Medicine clinical paradigms offers a promising, albeit methodologically complex, avenue for addressing chronic multifactorial conditions such as insomnia, functional gastrointestinal disorders, and behavioral dependencies. While historical medical lineages have accumulated vast repositories of empirical prescription data, translating these nuanced therapeutic frameworks into standardized, reproducible interventions remains fraught with epistemological and clinical challenges. This study critically examines the intersection of algorithmic herbal prescription analysis, constitution-differentiated dietary interventions, and standardized external acupoint therapies across diverse patient populations. By synthesizing insights from classical Menghe medical lineage prescription patterns alongside contemporary clinical trials and observational cohorts, this paper explores how meridian-guided external modalities and food-medicine homologous regimens interact with neurobehavioral and somatic dysfunction. Rather than proposing a monolithic clinical protocol, our analysis highlights the methodological heterogeneity, diagnostic subjectivity, and contextual limitations inherent in current cross-disciplinary TCM research. Ultimately, these findings suggest that while data-driven pattern recognition and multimodal somatic interventions demonstrate substantial therapeutic potential, their broader clinical adoption depends on reconciling individualized syndrome differentiation with rigorous empirical validation, thereby laying a nuanced foundation for future integrative healthcare frameworks.

Keywords: *Traditional Chinese Medicine, Data Mining, Prescription Patterns, Acupoint Therapy, Constitution Differentiation, Behavioral Dependencies.*

1. Introduction

The global burden of chronic, stress-mediated, and lifestyle-related disorders—encompassing persistent insomnia, functional gastrointestinal dysfunction, and intractable behavioral dependencies has increasingly exposed the limitations of reductionist, single-target pharmacological interventions. Within this shifting therapeutic landscape, Traditional Chinese Medicine (TCM) has garnered renewed scholarly attention for its holistic conceptualization of somatic and neurobehavioral dysregulation, which views sleep architecture, digestive motility, and compulsive behavioral loops not as isolated organ pathologies,

but as interconnected manifestations of systemic disharmony. However, attempting to bridge classical TCM theoretical frameworks with contemporary biomedical standards introduces profound epistemological tensions. As historical medical historiography demonstrates, the modernization of medical traditions is rarely a linear progression; rather, as illustrated in critical examinations of the European Renaissance and the New Culture Movement, the collision between traditional healing paradigms and modern scientific rationalism often forces an uneasy renegotiation of what constitutes valid clinical evidence [11]. This historical tension is further illuminated when comparing Chinese and European medical histories through the lens of empathetic understanding, which suggests that evaluating ancient therapeutic systems purely through modern reductionist metrics risks stripping away the contextual logic that gives those systems their clinical coherence [21].

To navigate this divide without sacrificing empirical rigor, contemporary researchers have increasingly turned toward computational data mining and clinical standardization to uncover latent structural regularities within classical medical texts and modern clinical cohorts. Yet, the clinical reality of TCM practice characterized by dynamic syndrome differentiation (Bian Zheng Lun Zhi) and highly individualized practitioner-patient interactions—resists effortless algorithmic flattening. While automated pattern recognition can identify high-frequency herb pairings or core acupoint combinations, such statistical correlations do not automatically translate into mechanistic certainty or universal clinical efficacy. Consequently, a growing body of scholarship has sought to anchor these data-driven insights within broader systemic frameworks, ranging from the construction of formal standardization systems for traditional external therapies [2] to the integration of industry standards with digital smart-wellness infrastructures [3]. Despite these ambitious efforts, the field remains at an exploratory crossroads, where the promise of precision integrative medicine must be continually weighed against the realities of diagnostic variability, sample heterogeneity, and the enduring complexity of human physiology.

2. Data-Driven Prescription Patterns and Historical Medical Lineages

The application of association rule mining, complex network analysis, and cluster algorithms to historical medical case records has revolutionized how scholars interrogate classical TCM pharmacopeias, particularly those preserved by influential regional lineages such as the Menghe medical school. In an insightful investigation into the Menghe school's treatment of warm-heat dampness diseases, researchers utilized data mining techniques to extract core herbal combinations, revealing a sophisticated therapeutic logic centered on clearing heat while simultaneously protecting yin and resolving dampness [20]. Similarly, a broader algorithmic exploration of Menghe prescription patterns for general warm diseases demonstrated how statistical frequency analysis can systematically map the transition from empirical physician intuition to quantifiable herbal compatibility rules, though such retrospective text mining inherently struggles to capture the real-time dosage adjustments made during acute clinical progression [12].

When these computational methodologies are extended to chronic neurobehavioral conditions such as insomnia, the analytical challenges become even more pronounced due to the multifactorial etiology of sleep disturbances. A notable data-mining study examining the four major families of the Menghe lineage in treating insomnia successfully isolated core herb pairs that harmonize the heart and kidney while calming the spirit, offering valuable empirical targets for modern pharmacological screening [19]. Nevertheless, relying solely on historical text mining introduces potential selection biases, as surviving medical records disproportionately document successful clinical outcomes while omitting refractory cases or adverse reactions. To bridge the gap between historical herbal patterns and biological plausibility,

experimental animal models have occasionally been employed to compare the neuroprotective and behavioral effects of different classical compound formulas, such as comparative investigations into pseudo-Alzheimer's disease mouse models [17]. Yet, even rigorous preclinical studies encounter translational bottlenecks, as evidenced by comparative behavioral research demonstrating significant baseline phenotypic divergences between different murine strains like SAMR1 and C57BL/6 in cognitive impairment models [22]. These methodological nuances underscore that while data-driven prescription analysis provides an indispensable map of historical therapeutic wisdom, its outputs require cautious, multi-layered interpretation rather than uncritical clinical replication.

3. Integrated Acupoint, External, and Constitution-Differentiated Dietary Therapies

Beyond internal pharmacotherapy, the therapeutic repertoire of TCM relies heavily on external somatic stimulation and constitution-guided nutritional regulation, both of which have undergone substantial methodological refinement in recent clinical investigations. In the realm of external modalities, theoretical analyses of combined acupuncture, tuina, and moxibustion guided by meridian examination have highlighted how assessing tendon excess-deficiency and qi-blood stasis can refine intervention targeting for chronic musculoskeletal conditions [1]. Building upon this theoretical groundwork, a three-arm assessor-blinded randomized controlled trial evaluating integrated acupuncture, tuina, and moxibustion for chronic multisite pain incorporated objective pressure pain thresholds and inflammatory biomarkers alongside subjective pain scales, representing a commendable methodological step toward minimizing placebo confounding [7]. Furthermore, multicenter observational research on standardized TCM external therapies for chronic soft tissue pain has provided real-world evidence regarding treatment feasibility across diverse clinical settings, although the absence of strict randomization in observational designs inevitably leaves room for practitioner-level variability and unmeasured lifestyle confounders [8].

The temporal and somatic precision of external therapies is equally critical when addressing neurocognitive and gastrointestinal dysregulation. Theoretical explorations into the standardization of time-based moxibustion utilizing Linggui Bafa for mild cognitive impairment suggest that aligning thermal acupoint stimulation with circadian qi transformation and meridian time sequences may enhance neuromodulatory outcomes, though validating chronotherapeutic hypotheses in outpatient populations poses substantial logistical hurdles [6]. Meanwhile, in the management of functional gastrointestinal disorders such as chronic constipation, cross-cultural surveys examining domestic and international awareness of acupuncture [15] alongside parallel investigations into global perceptions of Chinese herbal medicine [23] reveal a striking divergence between growing patient receptivity and persistent skepticism regarding standardized clinical protocols.

Crucially, these somatic interventions appear to achieve greater durability when paired with constitution-differentiated dietary regimens that address the underlying metabolic terrain of the patient. Prospective cohort research investigating food-medicine homologous interventions tailored to TCM constitution classifications in individuals experiencing chronic fatigue has demonstrated that aligning nutritional intake with individual somatic predispositions can measurably ameliorate fatigue trajectories [9]. Extending this integrative logic to behavioral dependencies, clinical observations combining auricular acupoint stimulation with constitution-differentiated dietary therapy for tobacco dependence and withdrawal reactions illustrate how dual targeting of neuro-auricular vagal pathways and systemic metabolic balance may attenuate craving intensity [4]. However, across all these multimodal trials, disentangling the specific physiological contribution of individual therapeutic components—such as

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isolating the effect of auricular pressure from dietary counseling or therapeutic alliance—remains a persistent analytical challenge that warrants cautious interpretation.

4. Methodological Reflections, Psychosocial Dimensions, and Multidisciplinary Challenges

Executing rigorous, cross-disciplinary research that synthesizes computational data mining with multimodal clinical interventions rarely follows the frictionless trajectory often implied in published protocols. During the iterative refinement of integrative clinical frameworks, researchers frequently confront practical obstacles ranging from inconsistent diagnostic inter-rater reliability in constitution assessment to high attrition rates in longitudinal dietary and behavioral interventions. Furthermore, physiological adaptation and baseline physical resilience vary dramatically across demographic cohorts, a reality underscored by recent investigations into risk-screening systems for urban adolescent physical fitness training [5] and analyses of physiological adaptation issues among populations participating in high-intensity hybrid racing fitness formats [10]. These studies in adjacent exercise and sports science domains serve as a vital reminder that any somatic or behavioral intervention—whether high-intensity physical conditioning or constitution-guided dietary and acupoint therapy—must account for individual baseline vulnerability to avoid maladaptive stress responses.

Equally critical, yet frequently overlooked in purely biomedical evaluations, are the psychosocial and institutional ecosystems within which clinical interventions and medical education occur. Empirical investigations into the psychological health status and influencing factors among incoming TCM postgraduate students reveal that the practitioners responsible for delivering complex, empathetic holistic care are themselves vulnerable to significant academic and psychosocial stressors [18]. Addressing these human factors requires sustained attention to professional formation, as reflected in scholarly discussions on cultivating core values [13] and strengthening moral and ethical education frameworks for TCM graduate trainees [14], alongside strategic SWOT analyses of graduate employment trajectories that shape long-term clinical workforce stability [16]. Looking at our analytical process through this broader socio-institutional lens, it becomes evident that discrepancies in clinical trial outcomes may stem not only from biological heterogeneity or algorithmic limitations, but also from variations in practitioner training, institutional support, and patient psychological readiness. Consequently, interpreting multimodal clinical data requires moving beyond single-variable causal explanations toward an appreciation of how biological, behavioral, and institutional factors interact dynamically over time.

5. Conclusion

Considering the above factors, the convergence of data-driven herbal prescription mining with standardized acupoint and constitution-differentiated dietary therapies represents a transformative yet still maturing frontier in integrative medicine. Rather than offering a final, static clinical blueprint, the synthesis examined throughout this paper illustrates how historical empirical wisdom and modern computational rigor can mutually interrogate and enrich one another, elevating TCM research from anecdotal tradition toward transparent, testable, and personalized healthcare delivery. Moving forward, the practical significance of this integrative paradigm will depend on developing adaptive clinical trial designs capable of honoring individualized syndrome differentiation while maintaining rigorous methodological controls, alongside cultivating interdisciplinary training environments that equip future clinician-scientists to navigate both algorithmic complexity and human-centered care.

Data Availability Statement

Data will be made available on request.

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Conflicts of Interest

The author(s) declare no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable.

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