



THE IMPACT OF STRESS ON HUMAN MUSCULATURE: AN INTEGRATIVE EVALUATION OF NEUROMUSCULAR PATHOPHYSIOLOGY AND THE AYURVEDIC CONCEPT OF MANAS ROGA

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ABSTRACT

Stress represents a multifactorial psychophysiological state that exerts profound effects on cerebral function and the integrity of skeletal muscle tissue. Prolonged psychological strain and sustained cognitive rumination (mental stress) trigger intricate neuroendocrine cascades influencing motor regulation, muscular tone, metabolic activity, and structural stability. Contemporary neuroscience attributes these alterations to dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, modified cortico-limbic interactions, and persistent sympathetic nervous system activation. In Ayurvedic doctrine, stress is categorized under Manas Roga, particularly involving aggravation of Rajas and Tamas with derangement of Vata Dosha, predisposing to pathological entities such as Unmada. The present article provides an integrative analytical review of stress-mediated muscular pathology, emphasizing brain-muscle intercommunication, activated neural substrates, and Ayurvedic pathogenesis with classical reference to Charaka Samhita, Chikitsa Sthana, Chapter 8 (Unmada Chikitsa).

KEYWORDS : Stress, Skeletal muscle, Cognitive rumination, HPA axis, Manas Roga, Unmada, Ayurveda

INTRODUCTION

Stress originally evolved as an adaptive survival mechanism; however, within the context of modern lifestyle patterns, sustained psychological pressure and repetitive over analysis have transformed this protective response into a pathological phenomenon. In contrast to acute stress responses, chronic stress produces enduring influences on the central nervous system (CNS) and musculoskeletal apparatus, resulting in persistent muscle tightness, exhaustion, pain syndromes, and neuromuscular impairment.¹

From a biomedical perspective, stress modifies neural networks responsible for motor output, autonomic equilibrium, and endocrine regulation. Ayurveda interprets these disturbances as Manasika Vyadhi, wherein deranged Manas impacts Sharira through Dosha imbalance.² Charaka Samhita clearly delineates how mental disturbances affect bodily tissues, particularly Mamsa Dhatu, under disease conditions such as Unmada.³

An understanding of stress through both biomedical science and Ayurveda provides a comprehensive framework explaining muscular pathology and supports the development of integrative therapeutic strategies.

DISCUSSION

Neurobiological Mechanisms of Stress-Induced Muscular Alterations

Cognitive Stress and Cerebral Activation⁴

Persistent cognitive overactivity stimulates specific cerebral regions:

- Prefrontal Cortex (PFC): Excessive analytical processing, rumination, and reduced executive modulation
- Amygdala: Enhanced fear perception and emotional hyperactivity
- Hippocampus: Disturbed memory processing and impaired stress feedback regulation
- Hypothalamus: Primary activation of the HPA axis
- Anterior Cingulate Cortex (ACC): Integration of emotional and motor responses and modulation of pain perception

Sustained stimulation of these structures perpetuates stress signalling rather than physiological resolution.

HPA Axis Dysregulation and Muscular Consequences⁵

Stress exposure provokes hypothalamic release of corticotropin-releasing hormone (CRH), leading to:

- ↑ Adrenocorticotrophic hormone (ACTH)
- ↑ Cortisol secretion

Chronic cortisol excess produces the following muscular effects:

- Enhanced proteolysis resulting in muscle tissue wasting
- Diminished glucose utilization contributing to fatigue
- Suppression of muscle repair and regenerative processes
- Impaired neuromuscular junction performance

Sympathetic Hyperactivity and Muscle Tone

Prolonged dominance of sympathetic outflow results in:

- Continuous low-grade muscular contraction
- Suppression of parasympathetic relaxation mechanisms
- Relative ischemia within muscle fibers
- Accumulation of lactic acid and inflammatory mediators

These processes account for tension commonly observed in cervical, trapezius, lumbar, and masticatory muscle groups in individuals experiencing chronic stress.

Brain-Muscle Axis Disruption⁶

Stress interferes with cortico-striato-spinal motor pathways, producing:

- Altered motor neuron excitability
- Increased sensitivity of muscle spindles
- Impaired motor coordination
- Development of stress-associated myofascial pain syndromes

Neuroplastic adaptations may contribute to stress-related movement disorders and chronic pain conditions.

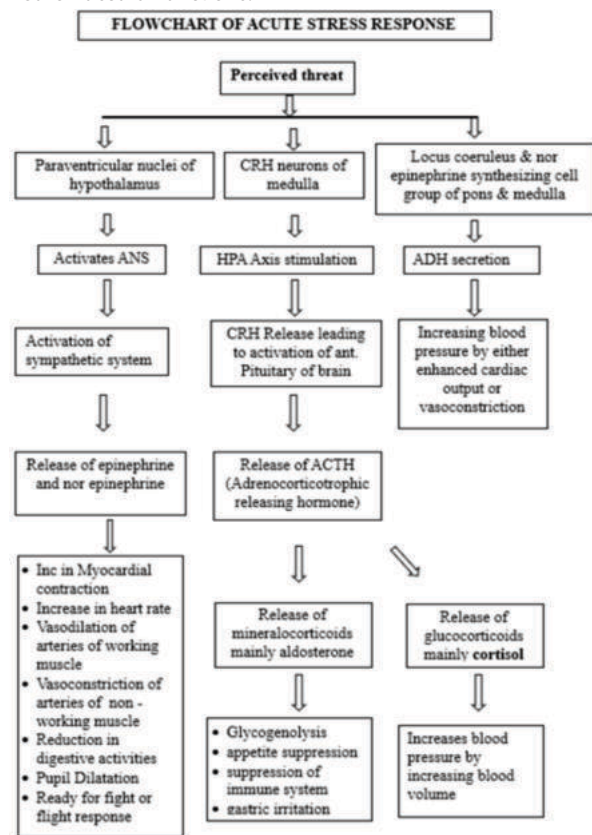
Ayurvedic Perspective: Manas Roga and Muscular Dysfunction

Concept of Manas Roga

Ayurveda attributes mental illness to disequilibrium of Rajas and Tamas Guna, affecting Manas and subsequently Sharira. Continuous psychological stress is recognized as:

- Chinta Atiyoga (excessive worry)
- Bhaya (fear)
- Shoka (grief)

These factors provoke Vata Prakopa, which governs neuromuscular functions.



Unmada Chikitsa

Charaka describes Unmada as a disorder characterized by:⁸

“मनः बुद्धि संज्ञा ज्ञान स्मृति भक्ति शील चेष्टा आचार विचार”

(Alteration of mind, intellect, awareness, memory, behavior, conduct, and functional activities)

Pathogenesis (Samprapti) Includes:

- Mental causative factors → increase in Rajas and Tamas
- Predominance of Vata → disturbance of Manovaha Srotas
- Involvement of Hridaya and Shiras
- Secondary impairment of Mamsa Dhatu leading to stiffness, debility, and tremors

Mamsa Dhatu in Stress According to Ayurveda⁹

- Vata induces dryness and rigidity of musculature
- Rajas produces hyperactivity and restlessness
- Tamas leads to lethargy and fatigue

The imbalance of these three Gunas explains muscular stiffness, pain, and reduced strength in chronically stressed individuals.

Integrative Interpretation

Both contemporary neuroscience and Ayurveda concur that mental processes regulate muscular function. Chronic stress sustains abnormal cerebral activation and hormonal dysregulation, whereas Ayurveda emphasizes disturbed Manas influencing Dosha and Dhatu. The association between amygdala hyperactivity and Rajas Vriddhi, and between cortisol elevation and Vata Prakopa, demonstrates significant conceptual parallels.

Therapeutic approaches described in Unmada Chikitsa—including Sattvavajaya Chikitsa, Abhyanga, Shirodhara, and Medhya Rasayana—correspond with modern stress-reduction modalities targeting neuroplastic adaptation and autonomic stabilization.

CONCLUSION

Stress and persistent cognitive overactivity initiate a complex brain-muscle pathological axis involving neuroendocrine imbalance, disrupted motor regulation, and muscular degeneration. Ayurveda offers a holistic interpretation under Manas Roga, particularly Unmada, emphasizing prevention and restoration of mental homeostasis. An integrative understanding enhances therapeutic accuracy and supports comprehensive muscular health.

REFERENCES

1. Guyton AC, Hall JE. Skeletal muscle. In: Textbook of Medical Physiology. 14th ed. Philadelphia: Elsevier; 2021. p. 73-95.
2. Sharma RK, Dash B. Unmada Chikitsa. In: Charaka Samhita. Vol IV, Chikitsa Sthana. Varanasi: Chaukhamba Sanskrit Series; 2018. p. 110-145
3. Tripathi B. Unmada Chikitsa with Chakrapani commentary. In: Charaka Samhita. Varanasi: Chaukhamba Surbharati; 2017. p. 402-430.
4. Ulrich-Lai YM, Herman JP. Neural regulation of endocrine and autonomic stress responses. Nat Rev Neurosci. 2009;10(6):397-409.
5. Guyton AC, Hall JE. Skeletal muscle. In: Textbook of Medical Physiology. 14th ed. Philadelphia: Elsevier; 2021. p. 73-95.
6. Kandel ER, Schwartz JH, Jessell TM, Siegelbaum SA, Hudspeth AJ. Stress and higher cortical function. In: Principles of Neural Science. 6th ed. New York: McGraw-Hill; 2021. p. 1409-1432
7. Sharma RK, Dash B. Unmada Chikitsa. In: Charaka Samhita. Vol IV, Chikitsa Sthana. Varanasi: Chowkhamba Sanskrit Series; 2018. p. 110-145
8. Tripathi B. Unmada Chikitsa with Chakrapani commentary. In: Charaka Samhita. Varanasi: Chaukhamba Surbharati; 2017. p. 402-430
9. Singh RH. The concept of psychosomatic disorders in Ayurveda. Anc Sci Life. 1986;6(1):23-29.