[1] Univerzitet u Beogradu, Medicinski fakultet, Institut za anatomiju, Centar za biologiju kosti
[2] Univerzitet u Beogradu, Medicinski fakultet, Institut za medicinsku fiziologiju „Rihard Burijan“

NEUROOSTEOLOGIJA: ULOGA INERVACIJE U HOMEOSTAZI I PATOLOGIJI KOSTIJU

Petar Milovanović [1], Dragan Hrnčić [2]

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Iako su kosti inervisane, dugo se nije mnogo znalo o vrsti nervnih vlakana u kostima i njihovim ulogama u koštanoj homeostazi. Novija istraživanja su pokazala da su kosti inervisane različitim vrstama nervnih vlakana, uključujući somatosenzorna i autonomna, pretežno simpatička vlakna. Premda još uvek nije u potpunosti razjašnjeno koje uloge igraju različite vrste vlakana u kostima, sve je više dokaza da nervna vlakna u kostima ostvaruju i „aferentne“ i „eferentne“ uloge. Sa jedne strane, pojedina vlakna prenose senzorne informacije, prevashodno o bolu, ka centralnom nervnom sistemu, a sa druge strane, dovode do oslobađanja različitih medijatora koji deluju na koštane ćelije. Na taj način, inervacija kostiju igra značajnu ulogu u regulaciji koštanog remodelovanja, kako u fiziološkim tako i u patološkim uslovima. Aktuelna istraživanja su dovela u vezu koštanu inervaciju i česta patološka stanja kao što su osteoporoza, osteoartritis, koštane metastaze i kancerski bol. Osim što nervni sistem utiče na kosti, sve je više podataka o tome da je njihova komunikacija dvosmerna, budući da određeni produkti koštanih ćelija poput hormona utiču na moždane procese.

Ključne reči: kost, nervna vlakna, remodelovanje kostiju, osteoporoza, koštane metastaze

*Pamukkale University, Faculty of Medicine, Department of Medical Biology and Genetics

NEUROPHYSIOLOGY OF PHYTOCHEMICALS: FERULIC ACID AND BRAIN IN FOCUS

Yavuz Dodurga*, Sevda Sağ*

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Phytochemicals have emerged as pivotal modulators of neurophysiology, offering novel therapeutic avenues for neurodegenerative diseases. Ferulic acid (FA), a hydroxycinnamic acid derivative widely distributed in whole grains, coffee, fruits, and vegetables, exemplifies this potential through its broad spectrum of biological actions within the central nervous system (CNS). Its amphipathic structure allows FA to cross the blood–brain barrier, thereby directly interacting with neuronal and glial cells.

At the molecular level, FA counteracts oxidative stress by scavenging free radicals, chelating transition metals, and upregulating transcriptional regulators such as Nrf2, which orchestrates the antioxidant response. Concomitantly, FA downregulates pro-inflammatory mediators through suppression of TLR4/NF-κB signaling, attenuating microglial overactivation and subsequent cytokine release. This dual antioxidant and anti-inflammatory profile preserves synaptic homeostasis, prevents neuronal apoptosis, and mitigates excitotoxicity driven by excessive glutamate signaling.

Electrophysiological and behavioral studies further demonstrate that FA enhances synaptic plasticity, potentiates long-term potentiation in hippocampal circuits, and improves spatial learning and memory performance. In experimental Alzheimer's disease models, FA reduces β-amyloid aggregation and tau hyperphosphorylation, while in Parkinsonian models, it stabilizes dopaminergic neurons and mitigates mitochondrial dysfunction. Beyond chronic neurodegeneration, FA confers neuroprotection in acute insults, including ischemic stroke, through regulation of calcium homeostasis and inhibition of apoptotic cascades.

From a translational standpoint, FA's poor bioavailability and rapid metabolism present significant obstacles. Innovative strategies such as nanoparticle delivery systems, liposomal encapsulation, and FA drug conjugates are under active investigation to optimize pharmacokinetics. Moreover, synergistic combinations of FA with other phytochemicals or conventional drugs may provide additive or potentiated neuroprotective effects.

In summary, ferulic acid represents a promising phytochemical with multifactorial mechanisms that integrate antioxidant, anti-inflammatory, and anti-apoptotic pathways to preserve CNS function. Its ability to enhance synaptic resilience and cognitive performance underscores its potential as both a nutraceutical and therapeutic candidate in brain health.

Rigorous clinical studies are essential to validate its efficacy and translate these neurophysiological benefits into therapeutic reality.

Keywords: phytochemical, ferulic acid, synaptic plasticity, CNS

Univerzitet u Beogradu, Medicinski fakultet
Institut za medicinsku fiziologiju „Rihard Burijan“

NEUROFIZIOLOŠKE OSNOVE HRONIČNOG PELVIČNOG BOLA I KOMORBIDITETA: POTENCIJALNE METE ZA NOVE TERAPIJSKE PRISTUPE

Nikola Šutulović

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Hronični pelvični bol (HPB) predstavlja složen klinički sindrom koji obuhvata perzistentan bol u karličnoj regiji, često bez jasno identifikovanog organskog uzroka. Najčešći oblici su intersticijalni cistitis kod žena i hronični prostatitis/sindrom hroničnog pelvičnog bola (CP/CPPS) kod muškaraca, koji dele slične patofiziološke mehanizme. Multifaktorijalna etiopatogeneza CP/CPPS podrazumeva kombinaciju genetskih, hormonskih, imunoloških, neurofizioloških i psihosocijalnih faktora.

Periferne neurofiziološke promene se odnose na perifernu senzitizaciju senzornih neurona posredovanu proinflamatornim medijatorima (IL-1β, IL-6, TNFα, NGF,