

Curcumin Mitigates Neuropathic-Induce Muscle Atrophy by Suppressing CaMK2/NF- κ B Pathway

CASEY R. APPELL¹, NIGEL C. JIWAN¹, CHWAN-LI SHEN², HUI-YING LUK¹

¹ Department of Kinesiology and Sport Management, Texas Tech University, Lubbock, TX

² Department of Pathology, Texas Tech University Health Sciences Center, Lubbock, TX

Category: Doctoral

Advisor / Mentor: Luk, Hui-Ying (HuiYing.Luk@ttu.edu)

ABSTRACT

Neuropathy can induce inflammation that results in muscle atrophy. Curcumin has been shown to exert an anti-inflammatory effect, preserving muscle mass in diabetic rats. However, the mechanism of curcumin to preserve muscle mass in neuropathy is not known. **PURPOSE:** To examine the effect of curcumin on the intramuscular inflammation and muscle cross-sectional area (CSA) in a neuropathy rodent model. **METHODS:** Twelve rats were randomly assigned to three groups: sham (CON), spinal nerve ligation (SNL), and SNL+100curcumin/kg BW (100CUR). The right (R) lumbosacral section (i.e., L5/L6) of the spinal cord was ligated (SNL and 100CUR) or sham surgery (CON) was performed, whereas the contralateral side (left: L) was served as their own control. Rats were fed with a control diet without (i.e., CON and SNL) or with (i.e., 100CUR) curcumin supplementation for 4 weeks. Plantaris (left and right) and tibialis anterior (TA; right) muscles were collected. TA was stained for dystrophin to measure CSA. Left and right plantaris were analyzed for protein content for AChR, CaMK2, CaMK2^{Thr286}, CaMK2^{Thr286}/CaMK2, NF- κ B, NF- κ B^{Ser536}, NF- κ B^{Ser536}/NF- κ B, IL-1 β , and GAPDH. Each protein was normalized to GAPDH then to the CON. **RESULTS:** A significant ($p \leq 0.05$) group effect was observed for TA CSA and a group \times leg interaction effect was observed for CaMK2^{Thr286}/CaMK2, NF- κ B^{Ser536}, IL-1 β protein content. For muscle CSA, CON ($9027.33 \pm 603.39 \mu\text{m}^2$) and 100CUR ($8853.68 \pm 696.73 \mu\text{m}^2$) were larger than SNL ($4771.01 \pm 539.69 \mu\text{m}^2$). No difference was observed in CSA between CON and 100CUR. Additionally, when compared between left and right plantaris muscles, only SNL had greater CaMK2^{Thr286}/CaMK2 (R: 2.63 ± 1.87 vs. L: 1.56 ± 1.65), NF- κ B^{Ser536} (R: 1.85 ± 0.83 vs. L: 0.55 ± 0.33), and IL-1 β (R: 2.11 ± 1.32 vs. L: 0.65 ± 0.29) protein content in the right than the left leg, whereas, no difference was observed for left leg among groups. For NF- κ B^{Ser536}, SNL (1.85 ± 0.83) was greater than 100CUR (0.91 ± 0.52) in the right leg. No significant differences were observed for AChR, CaMK2, CaMK2^{Thr286}, and NF- κ B^{Ser536}/NF- κ B. **CONCLUSION:** In a neuropathic model, muscle atrophy was observed with concomitant increase in CaMK2/NF- κ B/IL-1 β activation in the ipsilateral plantaris. Curcumin supplementation appears to mitigate this inflammatory response and muscle mass loss.