Introduction: Urinary excretion of 3-methylhistidine (3-MH) has been used as marker for degradation of myofibrillar protein. However, doubt about the interpretation of urinary 3-MH excretion as an index of the rate of local skeletal muscle breakdown in response to exercise has hindered a widespread application of the method.

Purpose: to measure changes in local interstitial 3-MH concentration in the muscle tissue response to strenuous exercise.

Material and Method: Untrained males (n=8, 22-27 yrs, range) performed 210 maximum isokinetic eccentric contractions with each leg on an isokinetic dynamometer, voluntary (VOL) with one leg and electrically induced (EL) with the other leg. Interstitial 3-MH concentration was obtained from microdialysis probes placed in m. vastus lateralis in each leg right after exercise, and one and three days postexercise.

Results: Interstitial 3-MH concentration was significantly higher after EL compared to VOL immediately after exercise (mean±std; EL 3.3±1.2, VOL 2.4±0.9 nmol/ml), but no differences were observed one and three days postexercise between the legs due to a decrease in 3-MH in the EL leg. Interstitial 3-MH concentration did not change in the four day period after strenuous voluntary muscle contractions. Histochemical stainings showed intracellular disruption and destroyed Z-lines, which were markedly more pronounced after EL. Furthermore, significant disruption of cytoskeletal proteins (desmin, 15% negative cells) was observed only after EL.

Conclusion: Only unphysiological, electrically induced muscle contractions, associated with severe myofibre muscle damage, were associated with enhanced interstitial 3-MH concentration in the hours after the exercise. No change in interstitial 3-MH concentrations was observed during the 4 day period after strenuous voluntary muscle contractions. Therefore, these results indicate that interstitial 3-MH can be used as a marker for increase in muscle breakdown after exercise, but only if the exercise is extreme and associated with muscle damage.

Keywords: Muscle Damage, Electrical/Mechanical Stimulation, Protein Metabolism