

The Influence of Limb Immobilization and Exercise on the Structure and Function of Mouse Soleus Muscle

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1990 Fiscal Year Final Research Report Summary

The Influence of Limb Immobilization and Exercise on the Structure and Function of Mouse Soleus Muscle

Research Project

Project/Area Number

63480338

Research Category

Grant-in-Aid for General Scientific Research (B)

Allocation Type

Single-year Grants

Research Field

Orthopaedic surgery

Research Institution

Kanazawa University

Principal Investigator

TACHINO Katsuhiko Kanazawa University, School of Allied Medical Professions, Professor, 医療技術短期大学部, 教授 (40092788)

Co-Investigator(Kenkyū-buntansha)

SUSAKI Toshio Kanazawa University, School of Allied Medical Professions, Assistant, 医療技術短期大学部, 助手 (40171194)

SOMEYA Fujiko Kanazawa University, School of Allied Medical Professions, Associate Professor, 医療技術短期大学部, 助教授 (60187903)

HAIDA Nobuhide Kanazawa University, School of Allied Medical Professions, Associate Professor, 医療技術短期大学部, 助教授 (00135089)

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1988 – 1990

Keywords

muscle atrophy / hindlimb suspension / muscle fiber type / motor endplate / morphometry / treadmill running

Research Abstract

This study was undertaken to determine the amelioration effect of a daily exercise on disuse atrophy of mouse soleus induced by hindlimb suspension. Physiologic, histologic and morphometric examination were made on mice were divided into control (CON), hindlimb suspension (HS) and HS plus exercise (HS-EX) with daily treadmill running. Immediately after checking the contractile function of this muscle, Adenosine triphosphatase staining was employed to classify into type 1 or 2 fibers. The ultrstructure of the cytoplasmic organelles of both fibers and their motor endplates were studied and compared morphometrically or qualitatively. The soleus muscle activity was reduced to below 2/3 on HS, but increased to over 1.4 times of its normal activity on HS-EX. Maximum twitch and tetanic tensions in the HS group were less than those in CON, with those HS-EX being significantly greater than those in HS. HS reduced the size of both type 1 and 2 fibers and and increased the percentage of type 1 fibers, but not in the HS-EX muscles. Atrophy of a few myofibrills was observed after HS-EX, wheras after HS many myofibrills showed degeneration of the sarcomere of both 1 and 2 fibers. Endplates in the HS group were found to exhibit a great deal of ultrastructural evidence of degeneration and regeneration, but those in the HS-EX group were less affected. The endplates in 2 fibers exhibited structural alteration to a greater extent than type 1 endplates in HS alone. This suggests that type 1 endplates were more resistant to degenerative changes than the 2 fibers. The mitochondrial volume fraction after HS decreased both in the 1 and 2 fibers, whereas it diminished only in the 2 fibers HS-EX as compared with the values in the CON. These data show that exercise training can markedly attenuate the detrimental effects of HS on the soleus muscle.

Research Products (6 results)

		All	Other
		All	Publications (6 results)
[Publications]	灰田 信英: "マウスヒラメ筋の廃用性萎縮の病態ならびに運動負荷効果に関する研究" 十全医学会雑誌. 100. 1-18 (1991)		▼
[Publications]	立野 勝彦・他: "部分脱神経筋に対する運動負荷の実験的研究" 運動療法研究会論文集. 14. 28-30 (1990)		▼
[Publications]	灰田 信英: "運動療法の科学的基礎—末梢神経・筋障害を中心として—" 理学療法ジャーナル. 23. 203-209 (1989)		▼
[Publications]	Haida, Nobuhide: "Influence of Hindlimb Suspension and Exercise on Mouse Soleus Muscle" Journal of Juzen Medical Society,. 100(1),. 1-18, (1991)		▼
[Publications]	Tachino, Katsuhiko: "The effect of exercise for the partial denervated muscle" Japanese Journal of Therapeutic Exercise. 14,. 28-30, (1990)		▼
[Publications]	Haida, Nobuhide: "Physical Therapy as Science. 3 Scientific basis of therapeutic exercise. Effect of exercise for muscle atrophy." Japanese Journal of Physical Therapy,. 23(3),. 203-209 (1989)		▼

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