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Delayed generalized muscle atrophy following unilateral hindlimb casting in old rats is prevented by a whey or a high protein diet but not a free leucine-enriched diet.

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Introduction

During ageing, limb immobilization induces general and delayed muscle atrophy during the rehabilitation period. Understanding the underlying mechanisms and limit this generalized muscle atrophy is then a major issue in elderlies.

Objective

We investigated the impact of dietary supplementations on generalized and delayed muscle atrophy induced by immobilization and subsequent recovery in old-adult-rats.

Methods

185 old-adult-rats were subjected to unilateral hindlimb casting immobilization for 8 days (I0-I8) and allowed to recover for 10-40 days (R10, R20, R30, R40). Animals were fed during the recovery period a control diet (C) or the same diet supplemented with leucine (LEU), whey (WHEY) or high-protein diet (HIGH-PROT). Muscle mass, muscle protein breakdown (MPB) and protein synthesis (MPS) were measured in non-immobilized *gastrocnemius* muscles. Data were analyzed by ANOVA.

Results

Muscle mass was unchanged in the non-immobilized limb from I0 to R20 but atrophied thereafter (-15.5%), traducing a general atrophy. MPB was unaltered in this limb but MPS became resistant to food intake compared to pair-fed non-immobilized-controls. In LEU group, *gastrocnemius* atrophied similarly despite a better stimulation of postprandial MPS (+20%). In the WHEY and HIGH-PROT groups, no atrophy was observed in the the non-immobilized-*gastrocnemius* throughout the experimental period (no difference at R40vsI0).

Discussion/conclusion

LEU supplementation was able to stimulate MPS in the non-immobilized limb via the mTOR-signalling-pathway, but it remained inefficient to prevent the muscle atrophy in the non-immobilized limb. By contrast, WHEY or HIGH PROT diets were able to prevent atrophy of the non-immobilized limb by sustaining MPS during the entire rehabilitation.