Satellite cells are critical for skeletal muscle hypertrophy, and it has repeatedly been shown that exercise can enhance the satellite cell pool, although the fate of the new satellite cells in healthy adult muscle remains unclear. In order to investigate this, we compared the effects of 2 different muscle contraction intensities on satellite cell activity. The protocol involved one leg exercising against a high load (H) and the other leg against a lighter load (L). The number of repetitions was adjusted such that the work performed by the two legs was equal. We hypothesized that, compared to L training, H training would induce greater hypertrophy and therefore a greater response of the satellite cell pool.

12 young healthy men (mean age 25 ± SD 3 yrs) volunteered for the study, which involved training 3 times a week for 12 weeks. Muscle biopsies were collected from the m. vastus lateralis of both legs before and after the training period. Satellite cells were visualised by immunofluorescence double staining of 10mm muscle cross-sections with antibodies against neural cell adhesion molecule (NCAM) and laminin. Hypertrophy was assessed from ATPase-stained biopsy cross-sections and by MRI scanning of the thigh.

While no evidence of muscle hypertrophy could be detected at the biopsy level, MRI scanning revealed hypertrophy with training in both groups, though significantly more hypertrophy in the H group compared to the L group. Compared to the pre training values, there was a significant increase in the number of NCAM+ cells (per myonuclear number) post training in both groups (H: from 4.16 ± 1.01 to 5.32 ± 1.22; L: from 4.01 ± 0.78 to 4.72 ± 1.72; mean ± SD, p < 0.05, Wilcoxon signed rank test). No significant group effect was observed. There was no change in the number of myonuclei per fibre, centrally located nuclei, embryonic+ fibres, or myogenin+ cells.

In contrary to what we had expected, satellite cell number was observed to increase similarly in response to both training protocols, despite significantly greater hypertrophy in the H group compared to the L group. The lack of change in differentiation status of the satellite cells as assessed by myogenin staining, together with the lack of change in the number of myonuclei per fibre, indicates that the training stimulus was not enough to induce terminal differentiation and ultimately incorporation of the new satellite cells.

Keywords: Hypertrophy, Sports Training, Muscle Plasticity