Are satellite cells lost during short-term disuse-induced muscle fiber atrophy?

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TO THE EDITOR: Arentson-Lantz et al. (1) report that 14 days of bed rest (BR) induces a profound decline in muscle strength (~13%) and fiber cross-sectional area (CSA) (~24%) in middle-aged adults. More importantly, they report that short-term disuse-induced muscle fiber atrophy is accompanied by a reduction in satellite cell content (~38%). These results are in sharp contrast with other human studies reporting no changes (3), or even an increase (4), in satellite cell content during short-term disuse-induced muscle fiber atrophy. Arentson-Lantz and colleagues speculate that “Differences in subject age and disuse model used (cast immobilization vs. bed rest) may have contributed to the discrepancy...” and “...that the complete removal of gravitational loading may also play a key role in mediating changes in satellite cell activity during disuse” (1). However, we believe there might also be an alternative explanation for the observed findings. In resting human skeletal muscle, satellite cell content is commonly reported to be around 0.06 – 0.10 satellite cells per muscle fiber in young/middle aged men and women (2). In the present study, pre-BR satellite cell content was ~30 – 60% higher (~0.13 – 0.16 satellite cells per fiber) compared with other studies in humans and is typically only observed during the first days after a stimulus like exercise or injury (2). In contrast, post-BR satellite cell content appeared to be more in line with what one would expect in the basal state (between 0.07 and 0.09 satellite cells per fiber). A simple explanation for the relatively high satellite cell number at baseline may be the timing of the pre-BR muscle biopsy. Two days before the beginning of BR (i.e., 2 days before pre-BR muscle biopsy sampling) all participants performed a graded exercise test on a cycle ergometer to assess peak aerobic capacity, a maximal knee extensor strength test (5 knee maximal contractions on 180°/s) and a knee muscle endurance test (20 repetitions at 180°/s) on a dynamometer. Previous studies clearly indicate that satellite cell pool expansion occurs after a single bout of exercise, which is known to peak around 48 h of postexercise recovery (2). Although the pre-BR “exercise stimulus” (VO2peak, knee muscle extensor strength, and endurance test) may not have been damaging, it certainly could have resulted in an expansion of the pre-BR muscle satellite cell pool, making it more likely that a “contraction” in the satellite cell pool would be observed after 14 days of BR. When evaluating satellite cell number/activity level and/or response to an intervention, care should be taken in the timing of muscle biopsy sampling to exclude the possibility of other confounding factors influencing the study results.

DISCLOSURES
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REFERENCES