The study examines changes in parameters of strength and balance after 4-weeks of resistance exercise performed on an unstable surface in a 90° tilted environment. A group of 12 healthy young subjects (6 male of age 19.7 ± 0.5 y, height 176.8 ± 12.2 cm, weight 72.7 ± 6.8 kg and 6 female of age 20.0 ± 1.4 y, height 164.6 ± 6.1 cm, weight 62.9 ± 9.9 kg) performed squats (6 sets of 10 reps, separated by 1 min of rest) for a period of 4-weeks (4 sessions / week) on a balancing board while in supine position. They wore a backpack frame that was floating on air-bearings allowing movements for balance control to be performed in the frontal plane. Subjects’ visual surround was consistent with being upright in an upright environment. Progression was achieved by increasing additional load (from 50% to 70-75% of 1RM) and decreasing stability (two-legs and one-leg balancing on different unstable boards). Pre- and post-testing of balance was performed under both static and dynamic conditions (standing on two-legs and one-leg, with eyes open and eyes closed, respectively) using a force plate mounted in a moving balance platform. Ground reaction forces were recorded at 100 Hz and code written in Matlab was used to extract traditional (Mean COP Velocity, Mean COP Area, Mean Position, Mean Range, Mean Median Power Frequency) and stabilogram-diffusion parameters (Diffusion Coefficients, Scaling Exponents, Transitions Time Intervals, Transitions–Mean Squared Displacements, Critical Time Intervals, Critical–Mean Squared Displacements). An Ariel Dynamics Computerized Exercise System was used to measure power and force during squats at isokinetic velocities of 10 deg/s and 35 deg/s. Results showed a significant increase in power and force at slower velocity (from 332.2 ± 109.7 W to 398.3 ± 149.7 W, p<0.01 and from 1207.1 ± 397.1 N to 1356.4 ± 463.6 N, p<0.014, respectively), as well as at higher velocity (from 985.6 ± 401.9 W to 1056.5 ± 425.9 W, p<0.05 and from 946.2 ± 370.3 N to 1013.3 ± 394.5 N, p<0.03, respectively). Also an improvement in static (one-leg stance) and dynamic balance (bipedal stance) has been found. This effect was mainly observed in medio-lateral direction, specific to the one of postural challenge in tilted room. In addition, findings indicated less reliance on visual and/or increased use of somatosensory cues after training. Moreover, stabilogram diffusion parameters more sensitively revealed fine details in response to training than COP statistics. It may be concluded that combined resistance and balance exercises performed in a 90° tilted room improves both strength and postural stability. Such exercises may be applied in training of highly skilled athletes, in pre- and inflight regimens for astronauts, and in rehabilitation of bed-ridden patients.

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