EFFECTS OF WHOLE BODY LOW-INTENSITY RESISTANCE TRAINING PROGRAM WITH SLOW MOVEMENT AND TONIC FORCE GENERATION (LST) ON MUSCULAR FUNCTION IN YOUNG MEN

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Purpose: Our previous study showed that low-intensity [50% 1 repetition maximum (1RM)] resistance training (knee extension) with slow movement and tonic force generation (we named it LST) caused a significant increase in muscular size and strength as much as high-intensity (80% 1RM) resistance training with normal speed (Tanimoto and Ishii, 2006). LST resistance training is considered relatively safe for orthopedic injury and for exercise-induced hypertension. Single-joint exercises, such as knee extension, might be considered more appropriate for LST to have strict continuous force generation throughout the exercise movement than multi-joint exercises, such as squat. However, whole-body resistance exercise regimens usually consist mainly of multi-joint exercises. This investigation examined whether a whole-body LST resistance training regimen mainly constituted of multi-joint exercises is effective on muscular hypertrophy and strength gain as much as high-intensity resistance training.

Method: Thirty-six healthy young males without experience of regular resistance training were randomly assigned into LST resistance training group (N=12), the high-intensity normal speed resistance training group (HN, N=12) and a sedentary control group (CON, N=12). During each training session, participants in the LST group completed three sets of eight repetitions at 55–60% of 1RM with slow movement and tonic force generation (3s for eccentric and concentric actions, and no relaxing phase), and subjects in HN group completed three sets of eight repetitions at 85–90% of 1RM with normal speed (1s for concentric and eccentric actions, 1s for relaxing). The exercise session was performed two times a week for 13 weeks. Muscle mass and strength were evaluated before and after training. The muscle thickness was measured by ultrasound imaging at six sites on the surface of the body (chest, anterior and posterior upper arm, abdomen, subscapula and anterior and posterior thigh). Lean soft tissue mass (LSTM: body mass minus fat mass) was determined for the whole body using DXA. Maximal muscular strength was tested by 1RM test using the five types of exercise used in the training regimen.

Results: LST training caused significant (P < 0.05) increases in whole body muscle thickness (6.8 ± 3.4% in sum total of six sites), LSTM (2.6 ± 2.6 %) and 1RM strength (33.0 ± 8.8 % in sum total of five exercises) as much as HN training (9.1 ± 4.2 %, 3.4 ± 2.5%, 41.2 ± 7.6% in each measurement item). There were no such changes in the CON group. Conclusion: The results suggest that a whole-body LST resistance training regimen mainly consisting of multi-joint exercises is effective for gaining muscular size and strength as much as HN resistance training.


Keywords: Exercise Physiology, Exercise Training