CHANGES IN BODY COMPOSITION AND PHYSICAL FITNESS DURING THE 21-WEEK STRENGTH AND/OR ENDURANCE TRAINING PERIOD IN 40-65 YEARS OLD MEN

Sillanpää Elina², Häkkinen Arja², Nyman Kai³, Mattila Mari¹, Cheng Sulin¹, Karavirta Laura¹, Laaksonen David⁴, Huuhka Niina¹, Kraemer William J.⁵, Häkkinen Keijo¹

(University of Jyväskylä¹, Finland, University of Jyväskylä, Central Hospital of Jyväskylä², Finland, Central Hospital of Jyväskylä³, Finland, Kuopio University Hospital⁴, Finland, University of Connecticut⁵, USA)

Introduction: Aging is associated with reduced aerobic capacity, increases in adiposity as well as declines in muscle mass and strength. The specificity effects of strength vs. endurance training are well known. This study examined adaptations in body composition and physical fitness during strength or endurance training compared to their combination in 40-65 years old men.

Methods: 53 voluntary males were stratified by age and BMI and randomized into the endurance training (E, n=14), strength training (S, n=13), combined strength and endurance training (SE, n=15) or control group (C, n=11). S and E trained 2 x wk⁻¹ and SE 2+2 x wk⁻¹ for strength and endurance for 21 wks. Heart rate monitored endurance training by cycling and progressive total body strength training were utilized. Percentage of body fat (fat%) was estimated by dual energy X-ray absorptiometry (DXA, LUNAR), by bioimpedance (BIA, InBody 3.0) and by skin fold thicknesses (SF). Lean mass of the legs was measured by DXA. Muscle thickness of vastus lateralis+intermedius (VL+VI) was measured by ultrasound (Aloka SSD280). Maximal concentric force (1RM) of leg extensors, maximal oxygen uptake (VO₂ max) and waist circumference (WC) were measured.

Results: Fat% measured by DXA and SF decreased 6-8% in E, S and SE, but not in C (between groups (BG) p=0.08, SF ns.). Respectively, fat% measured by BIA decreased only in E (BG ns.). WC decreased by 1.7-2.9 cm (p<0.01) in E, S and SE, but not in C. At baseline (n=52) fat% measured by DXA correlated with BIA (r=0.90, p<0.001), SF (r=0.80, p<0.001) and WC (r=0.84, p<0.001). During the training the changes in fat% by DXA correlated with BIA (r=0.66, p<0.001), SF (r=0.78, p<0.001) and WC (0.74, p<0.001), respectively. 1RM increased (p<0.001) in S and SE (22% and 23%), E showed also a small increase in 1RM (7%, p=0.001) and C no change. Lean mass in legs increased only in S (2.0±1.5%, p<0.001) with no changes in E, SE or C (-0.1±2.4%, 1.1±2.7% and -0.6±2.1%, BG p=0.027). VL+VI thickness increased in all three training groups (E 7%, S 11% and SE 9%, p8804;0.001, BG p<0.001). E and SE increased VO₂max (11% and 11%, p<0.01) with no changes in S or C (BG p=0.042).

Discussion: The decreases recorded by DXA and SF in total body fat% were similar in all training groups. Both DXA and BIA were useful in the cross-sectional analysis but the ability of BIA to detect training induced changes in body composition was weaker. The combined training resulted in large gains both in muscle strength and VO₂max as detected by either strength or endurance training alone. Strength training only led to an increase in lean mass of the legs. Whether interference in muscle mass development in older adults really occurs in combined training of longer duration needs further examination. Combined training seems to be of greater value than endurance or strength training alone for optimizing body composition and physical fitness possibly associated with improved health in older adults.

Keywords: Strength Training, Body Composition, Endurance Training