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Latest perspectives of resistance training (RT) on muscle and fat in the physical medicine

Abstract

For rehabilitation and sports medicine, resistance training (RT) has been known to increase muscle strength. Several latest reports showed the changes in muscle and fat tissues by RT and endurance training (ET). Systematic review and meta-analysis from 58 papers included about 3000 subjects, 45-60min session, 2.7 times a week and 5 months. As a result, RT group showed 1.46% reduction in body fat, which is equivalent to 0.55kg of fat mass. When one emphasizes the weight result by the scale, clinical effect of RT cannot be evaluated correctly, because RT brings increased muscle mass and decreased fat mass.

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Abbrevations: RT, resistance training; ET, endurance training; RE, resistance exercise; CON, non-exercise control; NPR, narrow-pyramid system; WPR, wide-pyramid system; CRP, C-reactive protein; SMM, skeletal muscle mass; LMM, lean muscle mass; FMM, fat-free mass; ACLS, Aerobics Center Longitudinal Study; BMI, mass index; WC, waist circumference; PBF, percent body fat; HR, hazard ratio; UNSW University of New South Wales; RCT, randomized controlled trials;

Introduction

For long period, there has been widely known standard knowledge in the rehabilitation and sports medicine. It is that resistance training (RT) or resistance exercise (RE) can bring increased muscle strength by continuous repeating movement. Comparative investigations have often found between RT and endurance training (ET) so far, in which the both were described as anaerobic exercise and aerobic exercise, respectively.[1] From RT point of view, some studies have been recently reported in the following.

The efficacy of RT for muscular hypertrophy and strength was investigated for female cases from 24 studies of 14067 articles.[2] As a result, RT showed remarkable efficacy in muscular hypertrophy and strength, and important variables seem to be training frequency and volume influencing muscular strength. Comparative study was conducted for RT and ET for 8 weeks.[3] Cases were 57 healthy young females, which were divided into RT, ET and non-exercise groups. As a result, RT showed greater improvement of force capacity and muscle strength than ET. Recent recommendations are shown for the relationship between repeated exercise and loading amount.[4] It means that specific adaptations are found by adequate number of repetitions at certain loading amount. As a general rule, low-loading optimizes increased muscular endurance, middle-loading brings increased muscle hypertrophy and heavy loading provides increased maximal muscle strength.

Some studies are recently reported concerning the differences of RT, ET and control groups, and concerning other biomarkers. For 36 elder men, compared investigation was found for suspension training, traditional training and non-exercise groups for 12 weeks.[5] As to handgrip strength as classical exam, 3 groups showed the results of increased, stable and decreased, respectively. Suspension training seemed to be more effective for older men by investigating several specific bioelectric impedance vector analyses. The detail method of RT system was investigated in 59 older females for three groups.[6] They were non-exercise control (CON), narrow-pyramid system (NPR), and wide-pyramid system (WPR). Beneficial changes were found in glucose, HDL-C, LDL-C, C-reactive protein (CRP) and body fat in NPR/WPR groups compared to CON. The results may suppose the reduction of cardiovascular risk in elderly female.

As to muscle growth degree due to continued RT, systematic review and meta-analysis were performed concerning clinical trial interventions.[7] From several database, 111 studies with 1927 cases were analyzed for 3 factors, which were skeletal muscle mass (SMM), lean muscle mass (LMM) and fat-free mass (FMM). As a result, these three were significantly increased by RT. Furthermore, RT brings hypertrophic changes of muscles. In Aerobics Center Longitudinal Study (ACLS) for18 years, obesity cases attended RT program.[8] The evaluation was conducted by body mass index (BMI), waist circumference (WC) and percent body fat (PBF) for 6 years. The result showed clinical efficacy by RT continuation. Meeting RT guideline brought significant reduction of obesity risk defined by hazard ratio (HR) of BMI 0.82, WC 0.70, PBF 0.70. Thus, RT seems to suggest a decrease in fat mass.

As an impressive perspective, there was a latest report with detail investigation.[9] It was a new University of New South Wales (UNSW) Sydney-led study. The remarkable medical evidence of the research was shown that RT alone has enough efficacy of burning fat tissue from physical point of view. A systematic review and meta-analysis were conducted of 58 research papers extracted from five databases. All of these studies are randomized controlled trials (RCT) comparing a group with full-body strength training for more than 4 weeks with a control group without strength training. The subjects included a total of 3,000 people who had never undergone strength training in the past. The contents of training program were different, but sessions showed approximately 45-60 minutes, 2.7 times a week on average for about 5 months.

The results of the study revealed that the RT group had revealed 1.46% reduction in body fat compared to the control group [9xx]. This is equivalent to a 0.55 kg reduction in fat mass for human body. In our previous usual information, many people think that weight reduction

may require diet therapy and anaerobic exercise. From this study, it seems to be not necessary for everyone to continue endurance exercise. Instead, it is likely that body fat can be reduced by performing only resistance training (anaerobic exercise). As a matter of fact, however, it doesn't mean that traditional aerobic exercise can be completely deleted.

It is rather common that many people want to lose weight, and to think it effective when the weight is decreased. However, the digital number displayed on the scale means total body weight.[10] This includes not only fat mass, but also everything else such as muscle, water, and bones. The ideal fitness is to gain muscle mass and reduce fat mass. Two cases are understood.[11] 1) For aerobic training, muscle mass usually does not increase, and fat mass gradually decreases. When weight is checked, small reduction can be expected. 2) For resistance training, muscle mass actually increases and body fat decreases. Consequently, the weight change is equivocal. [12] Furthermore, when comparing the weight of muscle and fat in the body, the former is heavier. Therefore, if the change in the body is evaluated by scale, the effect of muscle training is unlikely to appear. As a new treatment, future possible measure includes the administration of Liraglutide in addition to exercise.[13]

Conclusion

The best way to reduce body fat may involve the following three factors. They are i) have a nutrition-rich food, ii) continue aerobic exercise, and iii) try to include some degree of RT. In particular, it would be ideal to perform both exercises of ii) and iii) in the ordinary daily habit. From mentioned above, some recommendation would be given to various subjects. Any person can choose ii), iii), or ii)+iii) as one likes, due to the actual circumstances of each lifestyle with working and family life. This article will be hopefully useful for future research development.

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Conflicts of interest

The author states there are no conflicts of interest.

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