

Example papers for Seminar – Paul LaStayo and Robin Marcus

REVIEW PAPERS

- 1: Nutr Rev. 2003 May;61(5 Pt 1):157-67.

[Related Articles, Links](#)



Sarcopenia and aging.

Kamel HK.

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Sarcopenia refers to the gradual decline in muscle mass and quality noted with advancing age. There is growing evidence linking sarcopenia to functional disability, falls, decreased bone density, glucose intolerance, and decreased heat and cold tolerance in older adults. Factors implicated in the etiology of sarcopenia include decreased physical activity, malnutrition, increased cytokine activity, oxidative stress, and abnormalities in growth hormone and sex steroid axes. At present, progressive resistance training is the best intervention shown to slow down or reverse this condition. Preliminary studies show that the utilization of several trophic factors, notably testosterone and DHEA, may have a salutary effect on muscle mass and/or strength in older adults. More research is needed, however, before drawing definite conclusion as to the clinical utility of these substances in the management of sarcopenia.

Publication Types:

- Review
- Review, Tutorial

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Age-related muscle loss and progressive dysfunction in mechanosensitive growth factor signaling.

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Loss of muscle mass and function (sarcopenia) is one of the most marked problems associated with aging because it has major healthcare as well as socioeconomic implications. The growth hormone/IGF-I axis is regarded as an important regulator of muscle mass. However, it is now appreciated that other tissues in addition to the liver express IGF-I. Also, there are local as well as systemic forms of IGF-I that have different functions. We cloned two different IGF-Is that are expressed by skeletal muscle, and both are derived from the IGF-I gene by alternative splicing. One of these is expressed in response to physical activity, which has now been called "mechanogrowth factor" (MGF). The other is similar to the systemic or liver type (IGF-IEa) and is important as the provider of mature IGF-I required for upregulating protein synthesis. MGF differs from systemic IGF-IEa in that it has a different peptide sequence that is responsible for activating muscle satellite (stem) cells. Therefore, it appears these two forms of IGF-I have different actions and that they are important regulators of muscle growth. Growth hormone treatment apparently upregulates the level of IGF-I gene expression, and when it is combined with resistance exercise more is spliced toward MGF. This results in an increase in muscle cross-sectional area in the elderly subjects who otherwise would produce less MGF. The possibility of ameliorating sarcopenia using MGF delivered as a peptide or by gene therapy will be discussed.

Publication Types:

- Review
- Review, Tutorial

Functional and metabolic consequences of sarcopenia.

[Article in English, French]

Vandervoot AA, Symons TB.

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Sarcopenia associated with the normal aging process is often combined with the detrimental effects of a sedentary lifestyle in older adults, leading to a significant reduction in reserve capacity of the neuromuscular system. A clear example of the aging effect is the pattern of reduction in muscle strength after the sixth decade for both isometric and concentric contractions. However, older adults are relatively stronger for movements in which muscles lengthen, due to the inherent advantage of eccentric contractions, plus their stiffer muscle structures and prolonged myosin cross-bridge cycles. Also, the capacity for physiological adaptations in the motor pathways remains into very old age when an appropriate exercise stimulus is given, and older adults can obtain adaptations in both enhanced neural control of motor units and increased protein synthesis leading to moderate muscle hypertrophy. Since periods of sedentary lifestyle or bed rest due to illness can have severe detraining consequences on the neuromuscular function of an older person, long-term prevention strategies are advocated to avoid excessive physical impairments and activity restrictions in this age group.

Publication Types:

- Review
- Review, Tutorial



Muscle tissue changes with aging.

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PURPOSE OF REVIEW: This review article focuses on the changes that occur in muscle with age, specifically the involuntary loss of muscle mass, strength and function, termed sarcopenia. Particular emphasis is given to the metabolic alterations that characterize sarcopenia, and to the potentially treatable causes of this condition, including age-related endocrine and nutritional changes, and inactivity. **RECENT FINDINGS:** Recent data reported include those regarding the potential role of insulin resistance in the development of sarcopenia, the potential role of androgens and growth hormone in the treatment of this condition, the usefulness of exercise including both resistance and aerobic training to improve muscle growth and function, and, finally, the possible use of nutritional manipulations to improve muscle mass. **SUMMARY:** Sarcopenia is likely a multifactorial condition that impairs physical function and predisposes to disability. It may be prevented or treated with lifestyle interventions and pharmacological treatment. Further long-term investigations are needed, however, to ascertain what type and combinations of interventions are the most efficacious in improving muscle mass and function in older people.

Publication Types:

- Review
- Review, Tutorial

PMID: 15192443 [PubMed - indexed for MEDLINE]



Chronic obstructive pulmonary disease and chronic heart failure: two muscle diseases?

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Chronic obstructive pulmonary disease and congestive heart failure are two increasingly prevalent chronic diseases. Although care for these patients often is provided by different clinical teams, both disease conditions have much in common. In recent decades, more knowledge about the systemic impact of both diseases has become available, highlighting remarkable similarities in terms of prognostic factors and disease management. Rehabilitation programs deal with the systemic consequences of both diseases. Although clinical research also is conducted by various researchers investigating chronic obstructive pulmonary disease and chronic heart failure, it is worthwhile to compare the progress in relation to these two diseases over recent decades. Such comparison, the purpose of the current review, may help clinicians and scientists to learn about progress made in different, yet related, fields. The current review focuses on the similarities observed in the clinical impact of muscle weakness, the mechanisms of muscle dysfunction, the strategies to improve muscle function, and the effects of exercise training on chronic obstructive pulmonary disease and chronic heart failure.

Publication Types:

- Review
- Review, Tutorial

PMID: 15235292 [PubMed - indexed for MEDLINE]



Molecular mechanisms involved in muscle wasting in cancer and ageing: cachexia versus sarcopenia.

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The aim of the present review is to summarize and evaluate the different mechanisms and catabolic mediators involved in cancer cachexia and ageing sarcopenia since they may represent targets for future promising clinical investigations. Cancer cachexia is a syndrome characterized by a marked weight loss, anorexia, asthenia and anemia. In fact, many patients who die with advanced cancer suffer from cachexia. The degree of cachexia is inversely correlated with the survival time of the patient and it always implies a poor prognosis. Unfortunately, at the clinical level, cachexia is not treated until the patient suffers from a considerable weight loss and wasting. At this point, the cachectic syndrome is almost irreversible. The cachectic state is often associated with the presence and growth of the tumour and leads to a malnutrition status due to the induction of anorexia. In recent years, age-related diseases and disabilities have become of major health interest and importance. This holds particularly for muscle wasting, also known as sarcopenia, that decreases the quality of life of the geriatric population, increasing morbidity and decreasing life expectancy. The cachectic factors (associated with both depletion of fat stores and muscular tissue) can be divided into two categories: of tumour origin and humoral factors. In conclusion, more research should be devoted to the understanding of muscle wasting mediators, both in cancer and ageing, in particular the identification of common mediators may prove as a good therapeutic strategies for both prevention and treatment of wasting both in disease and during healthy ageing.



Chronic heart failure and skeletal muscle catabolism: effects of exercise training.

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Although the clinical picture of cardiac cachexia is well-known in patients with advanced chronic heart failure (CHF) the factors that determine who is at risk for this progressive catabolic syndrome and who is not remain unclear. Different endocrine systems have been accused of being involved in this process: an imbalance between catabolic and anabolic steroids with an elevated cortisol/dihydroepiandrosterone ratio, an increased resting metabolic rate due to high levels of circulating catecholamines, various cytokines are activated in CHF (i.e. TNF-alpha, IL-6, IL-1beta and others), and elevated levels of growth hormone (GH) with inappropriately normal or low serum levels of insulin-like growth factor-I (IGF-I) have been described in cardiac cachexia. These catabolic factors contribute to peripheral muscle atrophy, augment the expression of the inducible nitric oxide synthase (iNOS), which in turn inhibits the aerobic cellular metabolism. The present review examines whether the catabolic factors can be influenced by a classical anabolic intervention: regular physical exercise training. Long-term training programs increase skeletal muscle cytochrome c oxidase activity and are associated with reduced local expression of pro-inflammatory cytokines as well as iNOS, and augment local IGF-I production. In concert, these beneficial effects of exercise training may help to retard the catabolic process in CHF finally leading to cardiac cachexia and death.

Publication Types:

- Review
- Review, Tutorial

PMID: 12163219 [PubMed - indexed for MEDLINE]

OTHER

1: Am J Prev Med. 2003 Oct;25(3):226-31.

[Related Articles,](#)

[Links](#)

Erratum in:

- Am J Prev Med. 2004 Oct;27(3):265.



Sarcopenia in elderly men and women: the Rancho Bernardo study.

Castillo EM, Goodman-Gruen D, Kritz-Silverstein D, Morton DJ, Wingard DL, Barrett-Connor E.

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BACKGROUND: Sarcopenia risk factors are poorly understood. **METHODS:** This study examines sarcopenia prevalence and risk factors in community-dwelling men (694) and women (1006) aged 55-98 years (mean=73) who attended a 1988-1992 Rancho Bernardo Study clinic visit. Height, weight, muscle strength, fat-free mass (FFM), fat mass by bioelectric impedance analysis, and grip strength were measured; alcohol and medication use, smoking, and physical activity were ascertained. **RESULTS:** Mean FFM was 43.5 kg for women and 61.7 kg for men. Sarcopenia, defined as FFM of $>$ or $=$ 2.0 standard deviations below the gender-specific mean of a young reference population, was present in 6.0% overall. Prevalence increased dramatically from 4% of men and 3% of women aged 70-75 to 16% of men and 13% of women aged 85 and older. Both men and women with sarcopenia had a significantly lower fat mass and body mass index than those without sarcopenia. Men with sarcopenia were twice as likely to have fallen in the past year compared with those without sarcopenia. Grip strength, but not quadriceps strength, was lower in men and women with sarcopenia. Physically active women were about half as likely to have sarcopenia, but no association was found in men. Few men and women were current smokers, but they were more likely to have sarcopenia. Comorbidities (heart disease, diabetes, pulmonary disease, arthritis, cancer) and medications (thyroid hormones, corticosteroids, and hormone replacement therapy) were not associated with sarcopenia. **CONCLUSIONS:** Sarcopenia increases with age. This study also identified lack of physical activity and current smoking as reversible risk factors for sarcopenia.

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Weight stability masks sarcopenia in elderly men and women.

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Skeletal muscle loss or sarcopenia in aging has been suggested in cross-sectional studies but has not been shown in elderly subjects using appropriate measurement techniques combined with a longitudinal study design. Longitudinal skeletal muscle mass changes after age 60 yr were investigated in independently living, healthy men (n = 24) and women (n = 54; mean age 73 yr) with a mean \pm SD follow-up time of 4.7 \pm 2.3 yr. Measurements included regional skeletal muscle mass, four additional lean components (fat-free body mass, body cell mass, total body water, and bone mineral), and total body fat. Total appendicular skeletal muscle (TSM) mass decreased in men (-0.8 \pm 1.2 kg, P = 0.002), consisting of leg skeletal muscle (LSM) loss (-0.7 \pm 0.8 kg, P = 0.001) and a trend toward loss of arm skeletal muscle (ASM; -0.2 \pm 0.4 kg, P = 0.06). In women, TSM mass decreased (-0.4 \pm 1.2 kg, P = 0.006) and consisted of LSM loss (-0.3 \pm 0.8 kg, P = 0.005) and a tendency for a loss of ASM (-0.1 \pm 0.6 kg, P = 0.20). Multiple regression modeling indicates greater rates of LSM loss in men. Body weight in men at follow-up did not change significantly (-0.5 \pm 3.0 kg, P = 0.44) and fat mass increased (+1.2 \pm 2.4 kg, P = 0.03). Body weight and fat mass in women were nonsignificantly reduced (-0.8 \pm 3.9 kg, P = 0.15 and -0.8 \pm 3.5 kg, P = 0.12). These observations suggest that sarcopenia is a progressive process, particularly in elderly men, and occurs even in healthy independently living older adults who may not manifest weight loss.

Publication Types:

- Clinical Trial



Muscle strength and mass of lower extremities in relation to functional abilities in elderly adults.

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BACKGROUND: Functional and physiological declines in advancing age may be significant limiting factors in reduced physical activity. Sarcopenia of aging, as a normative process or disease, cannot entirely explain reduced physical activity in the elderly. **OBJECTIVE:** The purpose of the study was to investigate the relationship between muscle loss and reduction in functional abilities in elderly adults and also to determine whether an exercise program can improve functional performance and muscle quality. **METHODS:** Anthropometric measurements and sensorimotor testing were conducted on 28 volunteers (12 men and 16 women, 82.7 +/- 2.4 years of age) who were permanent residents in a skilled nursing facility. Twenty-nine elderly adults (79.3 +/- 3.5 years of age) served as a control, nonexercising group. Anthropometric measurements included: weight, height, body fat, and thigh circumference. The muscle strength was tested with a medical isokinetic system. We assessed two sensorimotor functions including a 'timed up-and-go' test and a 3-min distance walking test. The institutionalized participants undertook an exercise training program lasting 12 weeks. **RESULTS:** No significant changes were observed in thigh circumference, body weight, or percentage of body fat in either gender as a result of the exercise training. An improvement in muscle strength was noticed in 82% of the relatively younger group (79-83 years of age) under a slow voluntary contraction at 60 degrees /s ($p < 0.05$). Post-training results showed a significant improvement in performance in the two sensorimotor tests ($p < 0.05$). The correlation coefficients between muscle strength and functional ability were weak: $r = 0.60$ and $r = 0.57$ for males and females, respectively. **CONCLUSIONS:** This study confirmed the positive effects of an exercise program on functional performance in older adults. The improvement in functional abilities did not correlate with muscle strength, body weight, or body fat. Copyright 2000 S. Karger AG, Basel

PMID: 10965180 [PubMed - indexed for MEDLINE]



Quadriceps muscle wasting persists 5 months after total hip arthroplasty for osteoarthritis of the hip: a pilot study.

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AIMS: To determine whether additional muscle fibre wasting of the ipsilateral vastus lateralis muscle occurs in the early postoperative period after total hip arthroplasty for osteoarthritis of the hip and whether there is an improvement in preoperative measures of quadriceps muscle thickness, strength, pain and function over a 5-month postoperative period. **METHODS:** Twelve patients had ipsilateral needle quadriceps biopsy for muscle morphology and bilateral quadriceps muscle thickness ultrasound preoperatively, 5 days and 4 weeks postoperatively and a further muscle thickness measurement at 5 months. Seven additional patients and five age-matched control subjects had bilateral quadriceps muscle ultrasound thickness preoperatively, 6 weeks and 5 months postoperatively, with assessment of quadriceps muscle dynamometry, pain scores and Timed Up and Go (TUG) test. **RESULTS:** Preoperatively, all 19 patients demonstrated significant atrophy of the ipsilateral compared with the contralateral quadriceps muscle ($P = 1.8 \times 10^{-7}$) on muscle ultrasound, which persisted at 5 months follow up ($P = 0.009$). Muscle morphology preoperatively showed type 2A and 2B muscle fibre atrophy on needle muscle biopsy, with further atrophy of all three fibre types ($P = 0.029$) at 5 days postoperatively associated with a fibre type shift from type 1 to 2A fibres ($P = 0.0011$) at 1 month. There was improvement in hip pain postoperatively and a significant improvement in the TUG test ($P = 0.007$). However, there was no improvement in muscle strength on dynamometry. **CONCLUSIONS:** There is significant ipsilateral quadriceps atrophy and weakness with 2A and 2B fibre atrophy preoperatively in patients with osteoarthritis of the hip with exacerbation and further atrophy of all three fibre types 5 days postoperatively. Postoperative follow up showed that the reduction in ipsilateral quadriceps muscle thickness persisted at 5 months despite physical rehabilitation. Patients did note significant improvement in pain postoperatively and improvement on functional assessment with the TUG test. Other therapeutic strategies may have to be developed to reverse disuse muscle atrophy.

PMID: 11478364 [PubMed - indexed for MEDLINE]

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Quadriceps weakness and osteoarthritis of the knee.

Slemenda C, Brandt KD, Heilman DK, Mazzuca S, Braunstein EM, Katz BP, Wolinsky FD.

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BACKGROUND: The quadriceps weakness commonly associated with osteoarthritis of the knee is widely believed to result from disuse atrophy secondary to pain in the involved joint. However, quadriceps weakness may be an etiologic factor in the development of osteoarthritis. **OBJECTIVE:** To explore the relation between lower-extremity weakness and osteoarthritis of the knee. **DESIGN:** Cross-sectional prevalence study. **SETTING:** Population-based, with recruitment by random-digit dialing. **PARTICIPANTS:** 462 volunteers 65 years of age or older. **MEASUREMENTS:** Radiographs of the knee were graded for the presence of osteoarthritis. Knee pain and function were assessed with the Western Ontario and McMaster Universities Arthritis Index, the strength of leg flexors and extensors was assessed with isokinetic dynamometry, and lower-extremity lean tissue mass was assessed with dual-energy x-ray absorptiometry. **RESULTS:** Among participants with osteoarthritis, quadriceps weakness, but not hamstring weakness, was common. The ratio of extensor strength to body weight was approximately 20% lower in those with than in those without radiographic osteoarthritis. Notably, among women with tibiofemoral osteoarthritis, extensor weakness was present in the absence of knee pain and was seen in participants with normal lower-extremity lean mass (extensor strength, 30.1 lb-ft for those with osteoarthritis and 34.8 lb-ft for those without osteoarthritis; $P < 0.001$). After adjustment for body weight, age, and sex, lesser quadriceps strength remained predictive of both radiographic and symptomatic osteoarthritis of the knee (odds ratio for prevalence of osteoarthritis per 10 lb-ft loss of strength, 0.8 [95% CI, 0.71 to 0.90] for radiographic osteoarthritis and 0.71 [CI, 0.51 to 0.87] for symptomatic osteoarthritis). **CONCLUSION:** Quadriceps weakness may be present in patients who have osteoarthritis but do not have knee pain or muscle atrophy; this suggests that the weakness may be due to muscle dysfunction. The data are consistent with the possibility that quadriceps weakness is a primary risk factor for knee pain, disability, and progression of joint damage in persons with osteoarthritis of the knee.

PMID: 9230035 [PubMed - indexed for MEDLINE]

A decline in lower extremity lean body mass per body weight is characteristic of women with early phase osteoarthritis of the knee.

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OBJECTIVE: Sarcopenia progresses with aging, but the effect of muscle loss on degenerative joint disorders has not been precisely evaluated. We assessed the distribution of lean body mass (LBM) in middle aged women who had osteoarthritis (OA) of the knee for < 5 years. **METHODS:** Two hundred thirty-five Japanese women aged 45-69 years, including 117 with knee OA for < 5 years, and 118 age and sex matched healthy controls were studied. Body composition measurements were carried out by segmental bioelectrical impedance using 8 surface electrodes. Anthropometric data consisting of LBM of upper extremities/body weight (U-LBM/W), LBM of trunk/body weight (T-LBM/W), and LBM of lower extremities/body weight (L-LBM/W) for knee OA participants were compared to corresponding data for controls. In the knee OA group, the significance of correlations between anthropometric data and Lequesne index of severity for knee OA and between anthropometric data and disease duration were assessed. **RESULTS:** L-LBM/W was significantly lower in knee OA participants compared with controls (19.2 +/- 2.7% vs 21.0 +/- 2.9%; $p < 0.0001$). However, no significant differences in U-LBM/W and T-LBM/W were observed between the knee OA and control groups ($p > 0.2$). L-LBM/W did not correlate significantly with the index of severity or disease duration ($p > 0.2$). **CONCLUSION:** Decline in L-LBM/W, but not U-LBM/W or T-LBM/W, may be important in the pathogenesis of knee OA.

Metabolism

Appendicular lean tissue mass and the prevalence of sarcopenia among healthy women.

Tanko LB, Movsesyan L, Mouritzen U, Christiansen C, Svendsen OL.

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Studies indicate that deficient skeletal muscle mass or sarcopenia is a major cause of disability and morbidity among the elderly. In part, due to the lack of generally applicable normal values, there is still insufficient epidemiologic data available on the frequency and severity of sarcopenia in health and under various disease-related conditions. The objectives of the present study were to (1) characterize the age- and menopause-related variations in appendicular lean tissue mass (LTM(A)), (2) provide young-normal means and estimate the age-specific prevalence of sarcopenia among healthy women. A total of 754 healthy women were included in the study of cross-sectional design. LTM(A) was estimated by dual-energy x-ray absorptiometry (DEXA). Physical characteristics and menopausal status were also registered. LTM(A) as well as height showed significant negative correlation with age with Pearson's r values of -0.43 and -0.06 , respectively ($P < .05$). Trend of finding lower mean values with advancing age remained even when LTM(A) was adjusted for height(2) (ht(2)). Menopause did not seem to have any influence on LTM(A). Young-normal means were obtained from 216 premenopausal women aged 18 to 39 years. Prevalence rates of sarcopenia in healthy women were determined with reference to a cut-off line corresponding to LTM(A) or LTM(A)/ht(2) less than young-normal mean 2 SD and were found to be 40.2% and 12.3%, respectively, among the healthy elderly (>70 years of age). Results of the present study provide further evidence that sarcopenia exists even among otherwise healthy women with increasing age-specific prevalence. Further studies are needed (1) to estimate the prevalence of sarcopenia under various health and disease-related conditions with reference to the hereby given cut-off values and (2) to find therapeutic strategies with beneficial effects in conserving skeletal muscle mass. Copyright 2002 by W.B. Saunders Company

Heavy resistance training increases muscle size, strength and physical function in elderly male COPD-patients--a pilot study.

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This study investigated the effects of heavy resistance training in elderly males with chronic obstructive pulmonary disease (COPD). 18 Home-dwelling male patients (age range: 65-80 years), with a mean forced expiratory volume in the first second (FEV1) of 46 +/- 3.4% of predicted value, were recruited. Baseline and post-training assessments included: Cross-sectional area (CSA) of quadriceps assessed by MRI, isometric and isokinetic knee extension strength, isometric trunk strength, leg extension power, normal and maximal gait-speed on a 30 m track, stair climbing time, number of chair stands in 30 s, lung function (FEV1) and self-reported health. Subjects were randomized to a resistance training group (RE, n = 9) or a control group conducting breathing exercises (CON, n = 9). RE performed heavy progressive resistance training twice a week for 12 weeks. 6 RE and 7 CON completed the study. In RE the following improved ($P < 0.05$): Quadriceps CSA: 4%, isometric knee extension strength: 14%, isokinetic knee extension strength at 60 degrees /s.: 18%, leg extension power: 19%, maximal gait speed: 14%, stair climbing time: 17%, isometric trunk flexion: 5% and self-reported health. In CON no changes were found. In conclusion, 12 weeks of heavy resistance training twice a week resulted in significant improvements in muscle size, knee extension strength, leg extension power, functional performance and self-reported health in elderly male COPD patients.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15481277 [PubMed - indexed for MEDLINE]

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Physiological and functional responses to low-moderate versus high-intensity progressive resistance training in frail elders.

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BACKGROUND: The purpose of this efficacy study was to measure the dose-response effect of a free weight-based resistance training program by comparing the effects of two training intensities (low-moderate and high) of the knee extensor (KE) muscles on muscle function, functional limitations, and self-reported disability. **METHODS:** The authors conducted a single-blinded, randomized, placebo-controlled trial. Twenty-two institutionalized elders (mean age, 81.5 years) were assigned to either high-intensity strength training (HI; n = 8), low-moderate intensity strength training (LI; n = 6), or weight-free placebo-control training (PC; n = 8). The HI group trained at 80% of their 1-repetition maximum and the LI group trained at 40%. All groups performed 3 sets of 8 repetitions, 3 times per week for 10 weeks. Outcome measures included KE maximal strength, KE endurance, and functional performance as assessed by 6-minute walking, chair-rising, and stair-climbing tests, and by self-reported disability. **RESULTS:** KE strength and endurance, stair-climbing power, and chair-rising time improved significantly in the HI and LI groups compared with the PC group. Six-minute walking distance improved significantly in the HI group but not in the LI group compared with the PC group. Changes observed in HI were significantly different from those observed in the LI group for KE strength and endurance and the 6-minute walking test, with a trend in the same direction for chair-rising and stair-climbing. Changes in strength were significantly related to changes in functional outcomes, explaining 37% to 61% of the variance. **CONCLUSIONS:** These results show strong dose-response relationships between resistance training intensity and strength gains, and between strength gains and functional improvements after resistance training. Low-moderate intensity resistance training of the KE muscles may not be sufficiently robust from a physiologic perspective to achieve optimal improvement of functional performance. Supervised HI, free weight-based training for frail elders appears to be as safe as lower intensity training but is more effective physiologically and functionally.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

Comment in:

- [Clin Sci \(Lond\). 2001 Aug;101\(2\):171.](#)

Clinical Science

Effects of hormone replacement therapy and high-impact physical exercise on skeletal muscle in post-menopausal women: a randomized placebo-controlled study.

Sipila S, Taaffe DR, Cheng S, Puolakka J, Toivanen J, Suominen H.

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An age-related decline in muscle performance is a known risk factor for falling, fracture and disability. In women, a clear deterioration is observed from early menopause. The effect of hormone replacement therapy (HRT) in preserving muscle performance is, however, unclear. This trial examined the effects of a 12-month HRT and high-impact physical exercise regimen on skeletal muscle in women in early menopause. A total of 80 women aged 50-57 years were assigned randomly to one of four groups: exercise (Ex), HRT, exercise+HRT (ExHRT) and control (Co). The exercise groups participated in a high-impact training programme. The administration of HRT (oestradiol/noretisterone acetate) or placebo was carried out double-blind. Knee extension torque and vertical jumping height were evaluated. Lean tissue cross-sectional area (LCSA) and the relative proportion of fat within the muscle compartment were measured for the quadriceps and lower leg muscles. The ExHRT group showed significant increases in knee extension torque (8.3%) and vertical jumping height (17.2%) when compared with the Co group (-7.2%). Vertical jumping height also increased after HRT alone (6.8%). The LCSA of the quadriceps was increased significantly in the HRT (6.3%) and ExHRT (7.1%) groups when compared with the Ex (2.2%) and Co (0.7%) groups. Lower leg LCSA was also increased in the ExHRT group (9.1%) when compared with the Ex (3.0%) and Co (4.1%) groups. In addition, the increase in the relative proportion of fat in the quadriceps in the Co group (16.6%) was significant compared with those in the HRT (4.9%) and ExHRT (-0.6%) groups. Thus, in post-menopausal women, muscle performance, muscle mass and muscle composition are improved by HRT. The beneficial effects of HRT combined with high-impact physical training may exceed those of HRT alone.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

The effects of high- and moderate-resistance training on muscle function in the elderly.

Kalapotharakos VI, Michalopoulou M, Godolias G, Tokmakidis SP, Malliou PV, Gourgoulis V.

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The purpose of this study was to investigate the effects of a 12-week resistance-training program on muscle strength and mass in older adults. Thirty-three inactive participants (60-74 years old) were assigned to 1 of 3 groups: high-resistance training (HT), moderate-resistance training (MT), and control. After the training period, both HT and MT significantly increased 1-RM body strength, the peak torque of knee extensors and flexors, and the midhigh cross-sectional area of the total muscle. In addition, both HT and MT significantly decreased the abdominal circumference. HT was more effective in increasing 1-RM strength, muscle mass, and peak knee-flexor torque than was MT. These data suggest that muscle strength and mass can be improved in the elderly with both high- and moderate-intensity resistance training, but high-resistance training can lead to greater strength gains and hypertrophy than can moderate-resistance training.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial



Limb muscle dysfunction in COPD: effects of muscle wasting and exercise training.

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PURPOSE: Lower-limb muscle weakness has often been reported in COPD, and contributes to exercise intolerance. Controversial information is available regarding upper-limb muscle adaptations and the influence of muscle wasting on muscle weakness. We investigated leg and arm muscle function in 59 stable COPD patients (GOLD stage III) with preserved fat-free mass (FFM) and in 28 patients with reduced FFM relative to age- and sex-matched healthy control subjects and studied the effects of 8 wk of whole-body exercise training. **METHODS:** FFM was measured with bioelectrical impedance analysis. Isokinetic quadriceps (F-leg) and biceps strength (F-arm), as well as quadriceps (E-leg) and biceps endurance (E-arm) were determined with a Biodex dynamometer. Exercise training consisted of cycle ergometry, treadmill walking, weight training, and gymnastics during 5 d.wk. **RESULTS:** F-leg (76.2 ± 3.6 vs 118.2 ± 6.3 N.m, $P < 0.001$) and F-arm (25.6 ± 1.3 vs 38.1 ± 2.1 N.m, $P < 0.001$) were significantly and similarly reduced in the COPD patient group compared with controls. Also, E-leg (-2.13 ± 0.12 vs -1.61 ± 0.11 , $P < 0.01$), but not E-arm (-2.72 ± 0.11 and -2.47 ± 0.13 NS), was decreased in patients. F-leg (62.4 ± 4.3 vs 82.8 ± 4.7 N.m, $P < 0.01$), but not F-arm or muscle endurance, was reduced in FFM-depleted compared with non-FFM-depleted patients. Whereas after training F-leg and E-leg significantly increased by 20% in the whole COPD group, biceps muscle function remained unchanged. **CONCLUSION:** Lower- and upper-limb muscle dysfunction was observed in COPD patients, irrespective of the presence of FFM depletion. Generalized muscle weakness suggests systemic muscular involvement, although the preserved arm endurance and the poor response of arm performance to exercise training is indicative for intrinsic differences in muscular adaptations between leg and arm muscles.

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