BÖLÜM 2

MOTOR KONTROLDEN BİLİŞE: EGZERSİZİN YAŞLANAN SİNİR AĞLARI ÜZERİNDEKİ CANLANDIRICI GÜCÜ

Dilek SEVİMLİ[1]

GİRİŞ

Yaşlı yetişkin nüfusu günümüzde tarihin gördüğü en büyük ve hareketsiz yaşam tarzı en yüksek olan popülasyona sahiptir. Yaşın doğal ilerlemesi motor nöron dejenerasyonuna yol açabilir. Bu da sinir iletiminin yavaşlamasına, sinir kaybına ve motor fonksiyonların azalmasına neden olur. Yavaş sinir iletimi, bireyin tepki süresini olumsuz yönde etkileyerek düşme riskini artırabilir. Egzersiz müdahalelerinin yaşa bağlı sinir bozulmasını azaltmadaki potansiyel rolünü belirlemek için detaylı değerlendirmelere araştırmaya ihtiyaç bulunmaktadır.

Yaşlanma, kişinin yaşam kalitesini etkileyen fizyolojik ve morfolojik değişikliklerle karakterize çok boyutlu bir süreçtir ve motor becerilerdeki düşüşler dördüncü on yıl kadar erken bir dönemde ortaya çıkar (Shıelds ve ark., 2025;Choy, Brauer, Nitz 2003).). Kanıtlar, özellikle 60 yaşından sonra işlevsel becerilerin önemli ölçüde azaldığına ve periferik sinir sisteminin (PSS) bozulmasının birincil nedenlerden biri olabileceğine dair inancı desteklemektedir (Verdú ve ark.,2000; Lexell, 1997). Ne yazık ki, kas kütlesini ve işlevini korumaya odaklanan sarkopeniyle ilgili önemli araştırmalar olmasına rağmen, periferik sinir işlevini korumak için karşı önlemlere yönelik kolektif araştırma asgari düzeydedir.

Periferik sinirlerin bozulması, daha az sayıda işlevsel motor nöron aksonunun ve/veya motor aksonların bozulmasının bir yansımasıdır. Bu sonuçlar, hedef etkili kası besleyen sinir uyarısının daha yavaş iletilmesine neden olur ve daha yavaş hareketler veya azalmış hareketlilik gibi işlevsel sonuçlara yol açabilir; bunların

[1] Prof. Dr., Çukurova Üniversitesi, Spor Bilimleri Fakültesi, Spor Sağlık Bilimleri AD., dilek.sevmli@gmail.com, ORCID iD: 0000-0001-6463-1678

DOI: 10.37609/akya.3866.c1454

KAYNAKLAR

Berger, M. J., Watson, B. V., & Doherty, T. J. (2010). Effect of maximal voluntary contraction on the amplitude of the compound muscle action potential: Implications for the interpolated twitch technique. *Muscle & Nerve*, *42*(4), 498–503.

Caserotti, P., Aagaard, P., Buttrup Larsen, J., & Puggaard, L. (2008). Explosive heavy-resistance training in old and very old adults: Changes in rapid muscle force, strength and power. *Scandinavian Journal of Medicine & Science in Sports*, *18*(6), 773–782.

Chapman, T. W., & Hill, R. A. (2020). Myelin plasticity in adulthood and aging. *Neuroscience Letters*, *715*, 134645.

Choy, N. L., Brauer, S., & Nitz, J. (2003). Changes in postural stability in women aged 20 to 80 years. *The Journals of Gerontology: Series A, Biological Sciences and Medical Sciences*, *58*(6), M525–M530.

Clark, B. C., Clark, L. A., & Law, T. D. (2016). Resistance exercise to prevent and manage sarcopenia and dynapenia. *Annual Review of Gerontology and Geriatrics*, *36*(1), 205–228.

Doherty, T. J., Vandervoot, A. A., Taylor, A. W., & Brown, W. F. (1993). Effects of motor unit losses on strength in older men and women. *Journal of Applied Physiology*, *74*(2), 868–874.

Eslami, R., Tartibian, B., & Najarpour, M. (2019). Effect of six weeks resistance training on nerve conduction velocity, strength, balance and walking speed in multiple sclerosis patients. *Journal of Gorgan University of Medical Sciences*, *21*(3), 63–68.

Faulkner, J. A., Davis, C. S., Mendias, C. L., & Brooks, S. V. (2008). The aging of elite male athletes: Age-related changes in performance and skeletal muscle structure and function. *Clinical Journal of Sport Medicine*, *18*(6), 501–507.

Fiatarone, M. A., O'Neill, E. F., Ryan, N. D., Clements, K. M., Solares, G. R., Nelson, M. E., Roberts, S. B., Kehayias, J. J., Lipsitz, L. A., & Evans, W. J. (1994). Exercise training and nutritional supplementation for physical frailty in very elderly people. *The New England Journal of Medicine*, *330*(25), 1769–1775.

Fragala, M. S., Cadore, E. L., Dorgo, S., Izquierdo, M., Kraemer, W. J., Peterson, M. D., & Ryan, E. D. (2019). Resistance training for older adults: Position statement from the National Strength and Conditioning Association. *Journal of Strength and Conditioning Research*, *33*(8), 2019–2052.

Frontera, W. R., Hughes, V. A., Fielding, R. A., Fiatarone, M. A., Evans, W. J., & Roubenoff, R. (2000). Aging of skeletal muscle: A 12-yr longitudinal study. *Journal of Applied Physiology*, *88*(4), 1321–1326.

Gasser, H. S., & Erlanger, J. (1927). The role played by the sizes of the constituent fibers of a nerve trunk in determining the form of its action potential wave. *American Journal of Physiology*, *80*, 522–547.

Gillespie, M. J., & Stein, R. B. (1983). The relationship between axon diameter, myelin thickness and conduction velocity during atrophy of mammalian peripheral nerves. *Brain Research*, *259*(1), 41–56.

Häkkinen, K. (1994). Neuromuscular adaptation during strength training, aging, detraining, and immobilization. *Critical Reviews in Physical and Rehabilitation Medicine*, *6*(2), 161–198.

Häkkinen, K., Kraemer, W. J., Newton, R. U., & Alen, M. (2001). Changes in electromyographic activity, muscle fibre and force production characteristics during heavy resistance/power strength training in middle-aged and older men and women. *Acta Physiologica Scandinavica*, *171*(1), 51–62.

Häkkinen, K., Pakarinen, A., Kraemer, W. J., Häkkinen, A., Valkeinen, H., & Alen, M. (2001). Selective muscle hypertrophy, changes in EMG and force, and serum hormones during strength training in older women. *Journal of Applied Physiology*, *91*(2), 569–580.

Lange-Maia, B. S., Newman, A. B., Strotmeyer, E. S., Harris, T. B., & Boudreau, R. M. (2016). Sensorimotor peripheral nerve function and the longitudinal relationship with endurance walking in the Health, Aging, and Body Composition study. *Archives of Physical Medicine and Rehabilitation*, *97*(1), 45–52.

Lexell, J. (1997). Evidence for nervous system degeneration with advancing age. *The Journal of Nutrition*, *127*(5), 1011S–1013S.

Metter, E. J., Conwit, R., Metter, B., Pacheco, T., & Tobin, J. (1998). The relationship of peripheral motor nerve conduction velocity to age-associated loss of grip strength. *Aging*, *10*(6), 471–478.

Narici, M. V., Maffulli, N., & Maganaris, C. N. (2008). Ageing of human muscles and tendons. *Disability and Rehabilitation*, *30*(20–22), 1548–1554.

Naruse, M., Trappe, S., & Trappe, T. A. (2023). Human skeletal muscle-specific atrophy with aging: A comprehensive review. *Journal of Applied Physiology*, *134*(4), 900–914.

Norris, A. H., Shock, N. W., & Wagman, I. H. (1953). Age changes in the maximum conduction velocity of motor fibers of human ulnar nerves. *Journal of Applied Physiology*, *5*(10), 589–593.

Padkao, T., & Prasertsri, P. (2019). Effectiveness of an upper and lower limb resistance training program on body composition, nerve conduction velocity, and cardiac autonomic nervous activity in university athletes. *Journal of Exercise Physiology Online*, *22*(2), 78–98.

Patten, C., Kamen, G., & Rowland, D. M. (2001). Adaptations in maximal motor unit discharge rate to strength training in young and older adults. *Muscle & Nerve*, *24*(4), 542–550.

Petrella, J. K., Kim, J. S., Tuggle, S. C., & Bamman, M. M. (2007). Contributions of force and velocity to improved power with progressive resistance training in young and older adults. *European Journal of Applied Physiology*, *99*(4), 343–351.

Reeves, N. D., Maganaris, C. N., Longo, S., & Narici, M. V. (2009). Differential adaptations to eccentric versus conventional resistance training in older humans. *Experimental Physiology*, *94*(7), 825–833.

Roth, S. M., Martel, G. F., Ivey, F. M., Lemmer, J. T., Metter, E. J., Hurley, B. F., & Rogers, M. A. (2000). High-volume, heavy-resistance strength training and muscle damage in young and older women. *Journal of Applied Physiology*, *88*(3), 1112–1118.

Sale, D., McComas, A. J., MacDougall, J. D., & Upton, A. R. M. (1982). Neuromuscular adaptation in human thenar muscles following strength training and immobilization. *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology*, *53*(2), 419–424.

Sale, D. G., Upton, A. R. M., McComas, A. J., & MacDougall, J. D. (1983). Neuromuscular function in weight-trainers. *Experimental Neurology*, *82*(3), 521–531.

Shields, J. E., Smith, C. M., Reese, S. M., Dos Santos, M. L., Parodi, M., & DeFreitas, J. M. (2025). An exercise intervention may counteract the degradation of nerve conduction from age-related disuse. *Medicine & Science in Sports & Exercise*, *57*(10), 2101–2107.

Sleivert, G. G., Backus, R. D., & Wenger, H. A. (1995). The influence of a strength-sprint training sequence on multi-joint power output. *Medicine & Science in Sports & Exercise*, *27*(12), 1655–1665.

Slivka, D., Raue, U., Hollon, C., Minchev, K., & Trappe, S. (2008). Single muscle fiber adaptations to resistance training in old (>80 yr) men: Evidence for limited skeletal muscle plasticity. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*, *295*(1), R273–R280.

Verdú, E., Ceballos, D., Vilches, J. J., & Navarro, X. (2000). Influence of aging on peripheral nerve function and regeneration. *Journal of the Peripheral Nervous System*, *5*(4), 191–208.

Vincent, H. K., Bourguignon, C. M., & Vincent, K. R. (2006). Resistance training lowers exercise-induced oxidative stress and homocysteine levels in overweight and obese older adults. *Obesity*, *14*(11), 1921–1930.

Wang, F. C., De Pasqua, V., & Delwaide, P. J. (1999). Age-related changes in fastest and slowest conducting axons of thenar motor units. *Muscle & Nerve*, *22*(8), 1022–1029.

Ward, R. E., Caserotti, P., Cauley, J. A., Boudreau, R. M., Goodpaster, B. H., Vinik, A. I., Harris, T. B., & Newman, A. B. (2016). Mobility-related consequences of reduced lower-extremity peripheral nerve function with age: A systematic review. *Aging and Disease*, *7*(4), 466–478.

Yarasheski, K. E. (2002). Managing sarcopenia with progressive resistance exercise training. *The Journal of Nutrition, Health & Aging*, *6*(5), 349–356.