

Aging and exercise, exercise, exercise

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Living a long life is good. However, living a long healthy life is better. Being healthy requires embracing a lifestyle that includes healthy eating habits, enjoyable friends and activities, and regularly scheduled exercise. Think in terms of food, fun, and fitness. In order to truly get fit you need to adopt a well-rounded exercise routine. Exercise generally falls into four main types: endurance, strength, balance, and flexibility. You need to incorporate all four to achieve the best physical outcome.

Many healthy aging indicators focus on the objective measures of physical capability that assess the elderly individual's capacity to undertake the physical tasks associated with activities of daily living. To age well and remain as independent as possible, you need to be able to engage in a self-regulated level of personal care in order to continue performing your activities of daily living. To continue living a self-directed, independent life, you have to be able to substantially engage in self-care and regular scheduled exercise will help you maintain or even increase your ability to physically care for self.

The benefits of exercise

Exercise is an integral part of healthy aging. Lack of regular exercise is a primary risk factor for chronic disease ^[2, 7] and significantly increases mortality risk. ^[12, 8, 20] Just as health is a multi-dimensional concept, exercise requires attention, practice and knowledge of your body its present capabilities, its future possibilities, and what types of exercises are best for you, as you work towards achieving your best health goals for this time in your life. Always check with your doctor for advice on what types of activity are safe for you given your current health condition(s).

The general benefits of exercise are well established. ^[5, 14, 34, 38] Physical activity is good for the body ^[26] for the heart ^[36] and for the lungs by increasing lung volume and lung capacity. ^[33] Over the years, many studies have shown robust benefits of physical activity for your heart and lungs. According to the National Institutes of Health, regular physical activity lowers your risk for many diseases, such

as coronary heart disease, diabetes, and cancer by mediating the risk factors associated with illnesses.

The National Heart, Lung, and Blood Institute notes that physical activity strengthens your heart and improves lung functioning. With regular, moderate to vigorous levels of exercise, the heart muscle strengthens, blood vessels widen, and oxygen levels in the blood increase, delivering more oxygen to the organs while carrying away more waste products.

Physical activity is good for the bones. Physical activity when young provides lifelong benefits to cortical bone size and strength that extend even into advanced age.^[49] Physical activity engaged in while young can have lasting benefits on bone size and strength.^[50] The skeletal frame has greatest plasticity to robust physical activity-related mechanical loads during youth but is more at risk for failure during aging; this makes it imperative that lifelong exercise is encouraged before and during aging to reduce the onslaught of skeletal structural decay.^[49]

Physical activity is good for the brain^[44, 46] and for psychological well-being.^[6] Exercise even attenuates some of the aspects associated with diabetes^[9] and moderates hypertension.^[33] Essential hypertension is a major health problem causing excess cardiovascular morbidity and mortality.^[45] Aerobic exercise reduces blood pressure (BP) on average 5–7 mmHg among those with hypertension.^[3] Adopting a philosophy and a lifestyle of attaining a better quality of life through improvement of personal nutritional and exercise behavior will go a long way towards bringing many chronic illnesses under control and avoiding many others.

The different categories of elderly friendly exercises

The four major classifications of exercise are strength, balance, flexibility, and endurance. It is important to try to include all 4 types of exercise within the context of a weekly exercise routine.

Strength training^[10, 19] incorporates the use of weights or resistance bands. This can increase muscle strength and help with everyday activities like lifting and carrying groceries or working with gardening tools. Upper body strength is

necessary for activities that require reaching, pulling, pushing and lifting and is beneficial for good posture. Lower body strength is necessary movement performance such as laying down, rising up, stooping, kneeling, sitting, standing positions, maintaining a normal walking gait and running.

Balance exercises ^[43] such as standing on one leg, Bosu ball exercises, or doing tai chi, not only make it easier to walk on uneven surfaces, but also can help prevent falls—a problem particular to the aged. Agility and dynamic balance performance are significant factors relevant to the risk of falling. Declines in upper and lower extremity muscle strength, accompanied by declines in aerobic endurance, agility and dynamic balance performance increase falling risks. ^[29]

Flexibility exercises ^[40] such as stretching workouts and movements that increase your range of motion can help your body stay flexible. An independent lifestyle requires freedom of movement for daily activities, such as getting dressed, reaching for objects, bending to tie your shoes or looking over your shoulder as you back out of the driveway. Upper body flexibility is important for maintaining activities such as cooking activities that require reaching, stirring, and dexterity. Lower body flexibility is important for the motions of the hip flexors and pelvic muscles. Tight muscles in the back, hamstrings, and lower body can cause pain and put stress on your spine. ^[42]

Endurance exercises ^[24] (also known as cardio or aerobic exercise) are represented by physical activities like brisk walking, dancing, or hiking. This form of exercise improves the health of your heart, lungs, and circulatory system. Aerobic exercise reduces cardiovascular risks. ^[47] They can make daily activities easier, such as mowing the lawn or climbing flights of stairs. ^[34] Aging, even in the absence of disease, results in stiffening of large elastic arteries (aorta and carotid arteries). Habitual exercise such as brisk daily walking reduces arterial stiffness. ^[39] Age-related increase in stiffness is specific to the large elastic arteries. In contrast, peripheral arteries do not stiffen with aging. ^[39, 41] Exercise is associated with reduced systemic inflammation. ^[24]

Where to exercise

Exercise can be formal, under the tutelage of kinesiology trained instructor, in an individual or gym class format. With the knowledge of anatomy and the biomechanical, physiological, and psychological mechanisms of human body movement, a holistic disciplined approach can be taken. Physical trainers can teach you ways to modify activities so that whatever your disability, you can exercise safely.

Exercise can also be successfully done in the comfort of your home environment, at little or no cost. If doing the exercise at home, take precautions to make sure your environment is safe and free from obstructions, slippery surfaces, and any tripping hazards. The National Institute on Aging under the guidance of the National Institutes of Health offers the specific guidelines for all four categories of suggested exercise. These exercises can be easily accomplished in the comfort of your home.

Endurance Exercises:

<https://nihseniorhealth.gov/exerciseandphysicalactivityexercisestotry/enduranceexercises/01.html>

Strength Exercises:

<https://nihseniorhealth.gov/exerciseandphysicalactivityexercisestotry/strengthexercises/01.html>

Balance Exercises:

<https://nihseniorhealth.gov/exerciseandphysicalactivityexercisestotry/balanceexercises/01.html>

Flexibility Exercises:

<https://nihseniorhealth.gov/exerciseandphysicalactivityexercisestotry/flexibilityexercises/01.html>

Per site suggestions, be creative, choose exercises from each of the four categories, and mix it up to see the best benefits. Select several types of physical activities to keep exercise interesting and fresh. Periodically make changes to your routine such as increasing resistance, intensity, weights, distance, and number of sets or repetitions. Some physical activities overlap and fit into more than one type of exercise. For example, some endurance activities help build strength, and some flexibility exercises correspondingly improve balance.

The National Institute on Aging also has a Go4Life website where you can get fitness news, motivational tips and utilize their free Go4Life virtual coaches

<https://go4life.nia.nih.gov/>

Reviewed options of physical exercise activities for the elderly

There are many types of physical exercise activities that have been researched and evaluated as successfully helping the elderly achieve greater endurance, strength, balance and flexibility. As previously mentioned, a physical therapist can help you modify many activities to suit your needs and expand your options. Try something new such as swimming or water aerobics^[36] cycling or treadmill^[28] dancing^[31] Pilates^[23] or yoga^[25, 48] table tennis^[16, 30] elastic band resistance training^[35, 21] boxing or Brazilian jiu-jitsu^[15] video or computer game-based exercises^[13, 17] chair exercise^[37] stability exercise ball^[32] or walking your neighborhood.^[1, 4] There are so many available exercise selections and alternatives that you can use to keep yourself fit, encouraged, and actively engaged for many years to come.

Conclusion

Decades of research consistently reveal the benefits of physical activity for older adults. Studies show exercise to be an effective treatment for reducing high blood pressure.^[45] Studies show exercise to be an effective intervention for preventing falls.^[43] Studies show exercise to be an effective treatment for managing many chronic health conditions.^[18, 27] Exercise plays a central role in the management and treatment of many common metabolic diseases.^[11] Regardless of whether you have a chronic health condition such as heart disease, diabetes, hypertension, or arthritis, you can become physically active now.

You can be active and even proactive in ways that suit your lifestyle, interests, health, and budget. Discuss with your primary care doctor how to accommodate any health conditions so you can exercise safely, eat wisely, more easily perform your activities of daily living, maintain your independent lifestyle, and begin enjoying an amplified quality of life.

Reference

1. America Walks (2017). Beyond the first step: The many benefits of walking. <http://americawalks.org/beyond-the-first-step-the-many-benefits-of-walking-january-11-2017/>
2. American Diabetes Association. (2015). Foundations of care: education, nutrition, physical activity, smoking cessation, psychosocial care, and immunization. *Diabetes Care*, 38(S1): S20-S30. doi: /10.2337/dc15-S007
3. Ash, G.I., Taylor, B.A., Thompson, P.D., MacDonald, H.V., Lamberti, L., Chen, M-H, Farinatti, P., Kraemer, W.J., Panza, G.A., Zaleski, A.L., Deshpande, V., Ballard, K.D., Mujtaba, M., White, C. M., Pescatello, L.S. (2017). The antihypertensive effects of aerobic versus isometric handgrip resistance exercise. *Journal of Hypertension*, 35(2): 291-299.
4. Barclay, R.E., Stevenson, T.J., Poluha, W., Ripat, J., Nett, C., & Srikesavan, C.S. (2015). Interventions for improving community ambulation in individuals with stroke. *The Cochrane Database of Systematic Reviews*, 13(3):CD010200. doi: 10.1002/14651858.CD010200.pub2.
5. Barreto, P.D-S., Morley, J.E., Chodzko-Zajko, W., Pitkala, K.H., Weening-Dijksterhuis, E., Rodriguez-Manas, L., Barbagallo, M., Rosendahl, E., Sinclair, A., Landi, F., Izquierdo, M., Vellas, B., & Rolland, Y. (2016). Recommendations on physical activity and exercise for older adults living in long-term care. *The Journal of Nursing Home Research Sciences*, 2: 7-20.
6. Bherer, L., Erickson, K.I., & Liu-Ambrose, T. (2013). A review of the effects of physical activity and exercise on cognitive and brain function in older adults. *Journal of Aging Research*, Article ID 657508
7. Booth, F. W., Roberts, C. K. and Laye, M. J. 2012. Lack of exercise is a major cause of chronic diseases. *Comprehensive Physiology*. 2:1143–1211.
8. Bouchard, C., Blair, S.N., & Katzmarzyk, P.T. (2015). Less sitting, more physical activity, or higher fitness. *Mayo Clinic Proceedings*, 90(1): 1533-1540.
9. Cadore, E.L., & Izquierdo, M. (2015). Exercise interventions in polypathological aging patients that coexist with diabetes mellitus: improving functional status and quality of life. *Age*, 37:64-76.
10. Cartee, G.D., Hepple, R.T., Bamman, M.M., & Zierath, J.R. Exercise promotes healthy aging of skeletal muscle. *Cell Metabolism*, 23(6): 1034–1047. doi.org/10.1016/j.cmet.2016.05.007
11. Cassidy, S., Thoma, C., Houghton, D., & Trenell, M.I. (2017). High-intensity interval training - A review of impact on glucose control and cardiometabolic health. *Diabetologia*, 60: 7-23.
12. Centers for Disease Control and Prevention (2017). Reducing potentially excess deaths from the five leading causes of death in the rural United States. *CDC Morbidity and Mortality Weekly Report*, January 13, 2017, *MMWR Surveillance Summaries*, 66(2).
13. Chao, S.D., Guo, L., Kang, D., & Xiong, S. (2016). Exergame technology and interactive interventions for elderly fall prevention: a systematic literature review. *Applied Ergonomics*, DOI:10.1016/j.apergo.2016.10.013
14. Chmelo, E.A., Crotts, C.I., Newman, J.C., Brinkley, T.E., Lyles, M.F., Leng, X., Marsh, A.P., & Nicklas, B.J. (2015). Heterogeneity of physical function responses to exercise training in older adults. *Journal of the American Geriatric Society*, 63(3): 462-469 doi:10.1111/jgs.13322
15. De Queiroz, J.L., Sales, M.M., Sousa, C.V., da Silva Aguiar, S., Asano, R.Y., de Moraes, J.F.V.N., Soares, B.R.A., Neves, R.V.P., de Moraes, M.R., & Simoes, H.G. (2016). 12 weeks of Brazilian jiu-jitsu training improves functional fitness in elderly men. *Sport Science Health*, DOI:10.1007/s11332-016-0287-8
16. Djokic, Z. (2009). Health, condition, wellbeing and table tennis in ages 30-80. In: *Proceedings of International Science Congress – Table tennis and the aging population*, Zagreb. Eds: M. Kondrič, M., Furjan Mandić, G. and Munivrana, G. European Table Tennis Union: Croatian table tennis association: University of Zagreb, Faculty of kinesiology; Ljubljana: University of Ljubljana, Faculty of Sport. 44-58.
17. Donath, L., Rossler, R., & Faude, O. (2016). Effects of virtual reality training (exergaming) compared to alternative exercise training and passive control on standing balance and functional mobility in healthy community-dwelling seniors: a meta-analytic review. *Sports Medicine*, DOI:10.1007/s40279-016-0485-1
18. Dutheil, F., Lac, G. Lesourd, B., Chapier, R., Walther, G., Vinet, A. Sapin, V., Verney, Ouchchane, L. Duclos, M., Obert, P., & Courteix, D. (2013). Different modalities of exercise to reduce visceral fat mass and cardiovascular risk in metabolic syndrome: the RESOVE randomized trial. *International Journal of Cardiology*, <http://dx.doi.org/10.1016/j.ijcard.2013.05.012>
19. Eriksen, C.S., Garde, E., Reisle, N.L., Wimmelmann, C.L. Bieler, T., Ziegler, A.K., Gylling, A.T., Dideriksen, K.J., Siebner, H.R., Mortensen, E.L., Kjaer, M. (2016). Physical activity as intervention for age-related loss of muscle mass and function: protocol for a randomized controlled trial (the LISA study). *BioMedical Journal*, 6:e012951. doi:10.1136/bmjopen-2016- 012951

20. Grant, R.W., Schmittiel, J.A., Neugebauer, R.S., Uratsu, C.S., Sternfeld, B. (2014). Exercise as a vital sign: A quasi-experimental analysis of a health system intervention to collect patient-reported exercise levels. *Journal of General Internal Medicine*, 29(2): 341-348.
21. Hofmann, M., Schober-Halper, B., Oesen, S., Franzke, B., Tschan, H., Bachl, N., Strasser, E-M., Quittan, M., Wagner, K-H., & Wessner, B. (2016). Effects of elastic band resistance training and nutritional supplementation on muscle quality and circulating muscle growth and degradation factors of institutionalized elderly women: the Vienna Active Ageing Study (VAAS). *European Journal of Applied Physiology*, 116: 885-897.
22. Holland, G.J., Tanaka, K., Shigematsu, R., & Nakagaichi, M. (2002). Flexibility and physical functions of older adults: a review. *Journal of Aging and Physical Activity*, 10: 169-206.
23. Irez, G.B., Ozdemir, R.A., Evin, R. Irez, S.G., & Korkusuz, F. (2011). Integrating pilates exercise into an exercise program for 65+ year-old women to reduce falls. *Journal of Sports Science and Medicine*, 10: 105-111.
24. Jablonski, K.L., Donato, A.J., Fleenor, B.S., Nowlan, M.J. Waker, A.E., Kaplon, R.E., Ballak, D.B., Seals, D.R. (2015). Reduced large elastic artery stiffness with regular aerobic exercise in middle-aged and older adults: potential role of suppressed nuclear factor x B signaling. *Journal of Hypertension*, 33(12): 2477-2482.
25. Jeter, P.E., Slutsky, J., Singh, N., & Khalsa, S.B.S. (2015). Yoga as a therapeutic intervention. *Journal of Alternative and Complementary Medicine*, 21(10): 586-592.
26. Kuh, D., Karunanathan, S., Bergman, H., & Cooper, R. (2014). A life-course approach to healthy ageing: maintaining physical capability. *Proceedings of the Nutrition Society*, 73: 237-248
27. Laurin, L., Brurberg, K.G., Odgaard-Jensen, J., & Price, J.R. (2016). Exercise therapy for chronic fatigue syndrome. *Cochrane Database Systematic Review*, DOI: 10.1002/14651858.CD003200.pub4
28. Lee, C-W., & Cho, G-H. (2014). Effect of stationary cycle exercise on gait and balance of elderly women. *Journal of Physical Therapy Science*, 26(3): 431-433.
29. Lesinski, M., Hortobagyi, T., Muehlbauer, T., Gollhofer, A., & Granacher, U. (2015). Effect of balance training on balance performance in healthy older adults: a systematic review and meta-analysis. *Sports Medicine*, 45: 1721-1738.
30. McAlees, M. (2016). Fighting fit: How table tennis helps elderly live well with dementia. Retrieved from <http://www.carehome.co.uk/news/article.cfm/id/1576923/Fighting-fit-how-table-tennis-helps-elderly-live-well-with-dementia>
31. Merom, D., Cumming, R., Mathieu, E., Anstey, K.J., Rissel, C., Simpson, J.M., Morton, R.L., Cerin, E., Sherrington, C., & Lord, S.R. (2013). Can social dancing prevent falls in older adults? a protocol of the Dance, Aging, Cognition, Economics (DANCE) fall prevention randomized controlled trial. *BMC Public Health*, 13: 477-485.
32. Nall, R. (2015). Stability ball exercises for seniors. Retrieved from: <http://www.livestrong.com/article/103804-stability-ball-exercises-seniors/>
33. National Heart, Lung, and Blood Institute (2016). Benefits of physical activity. <https://www.nhlbi.nih.gov/health/health-topics/topics/phys/benefits>
34. National Institute on Aging (2009; Updated 2015). Exercise for all older adults: NIA guide shows and tells. Retrieved Wednesday, January 25, 2017 from: <https://www.nia.nih.gov/newsroom/features/exercise-all-older-adults-nia-guide-shows-and-tells>
35. Oesen, S., Halper, B., Hofmann, M., Jandrasits, W., Franzke, B., Strasser, E.M., Graf, A., Tschan, H., Bachl, N., Quittan, M., Wagner, K.H., & Wessner, B. (2015). Effects of elastic band resistance training and nutritional supplementation on physical performance of institutionalised elderly--A randomized controlled trial. *Experimental Gerontology*, 72: 99-108.
36. Ozturk, N., Olgar, Y., Er, H., Kucuk, M., & Ozdemir, S. (2016). Swimming exercise reverses aging-related contractile abnormalities of female heart by improving structural alterations. *Cardiology Journal*, DOI: 10.5603/CJ.a2016.0069
37. Robinson, K.R., Leighton, P., Logan, P., Gordon, A.L., Anthony, K., Harwood, R.H., Gladman, J.R.F., & Masud, T. (2014). Developing the principles of chair based exercise for older people: a modified Delphi study. *BMC Geriatrics*, 14: 65-73.
38. Schattin, A., Baur, K., Stutz, J., Wolf, P., & de Bruin, E.D. (2016). Effects of physical exercise combined with nutritional supplements on aging brain related structures and functions: a systematic review. *Frontiers in Aging Neuroscience*, doi:10.3389/fnagi.2016.00161
39. Seals, D.R., Walker, A.E., Pierce, G.L., & Lesniewski, L.A. (2009). Habitual exercise and vascular ageing, *Journal of Physiology*, 587.23: 5541-5549. DOI: 10.1113/jphysiol.2009.178822

40. Stathokostas, L., McDonald, M.W., Little, R.M.D., & Paterson, D.H. (2013). Flexibility of older adults aged 55-86 years and the influence of physical activity. *Journal of Aging Research*, Article ID 743843 doi.org/10.1155/2013/743843
41. Tanaka, H., DeSouza, C.A., & Seals, D.R. (1998). Absence of age-related increase in central arterial stiffness in physically active women. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 18:127-132.
42. Therien, S. (2015). What are the benefits of good flexibility? Retrieved from: <http://www.livestrong.com/article/332519-what-are-the-benefits-of-good-flexibility/>
43. Toraman, A., & Yildirim, N.U. (2010). The falling risk and physical fitness in older people. *Archives of Gerontology and Geriatrics*, 51(2): 222-226. doi: 10.1016/j.archger.2009.10.012.
44. Tunney, R.J., Allen, H.A., Bonardi, C., & Blake, H. (). The effects of ageing and exercise on recollection and familiarity based memory processes. In Chapter 9: Memory and exercise. http://www.psychology.nottingham.ac.uk/staff/rjt/Home/Publications_files/Tunney%20MANUSCRIPT%20R1%20FINAL.pdf
45. Vamvakis, A. Gkaliagkousi, E., Triantafyllou, A., Gavriilaki, E., & Douma, S. (2017). Beneficial effects of nonpharmacological intervention in the management of essential hypertension. *Journal of the Royal Society of Medicine Cardiovascular Disease*, 6: 1-6.
46. Voss, M.W., Erickson, K.I., Prakash, R.S., Chaddock, L., Kimb, J.S., Alves, H., Szabo, A. (2013). Neurobiological markers of exercise-related brain plasticity in older adults. *Brain, Behavior, and Immunity*, 28: 90-99.
47. Walker, A.E., Kaplon, R.E., Pierce, G.L., Nowlan, M.J., & Seals, D.R. (2014). Prevention of age-related endothelial dysfunction by habitual aerobic exercise in healthy humans: Possible role of nuclear factor- κ B
48. Wang, M.Y., Greendale, G.A., Yu, S.S-Y, & Salem, G.J. (2016). Physical-performance outcomes and biomechanical correlates from the 32-week yoga: empower seniors study. *Evidence-Based Complementary and Alternative Medicine*, Article ID 6921689, <http://dx.doi.org/10.1155/2016/6921689>
49. Warden, S.J., Roosa, S.M.M. (2014). Physical activity completed when young has residual bone benefits at 94 years of age: a within-subject controlled case study. *Journal of Musculoskeletal Neuronal Interaction*, 14(2): 239-243.
50. Warden, S.J., Roosa, S.M.M., Kersh, M.E., Hurd, A.L., Fleisig, G.S., Pandy, M.G., & Fuchs, R.K. (2014). Physical activity when young provides lifelong benefits to cortical bone size and strength in men. *PNAS*, 111(14): 5337-5342. This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1321605111/-/DCSupplemental.