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Exercise in Elderly: Promoting Healthy Aging Through Physical Activity

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Intended Learning Outcomes

- To identify the age- related Physiological changes in muscle functions, CV functions, Pulmonary functions, nervous system
- To understand the types of exercise recommendation for older adults.
- To understand the aerobic training for older adults.
- To describe the benefits of exercises in elderly.
- To understand the barriers to exercise training in elderly.

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Age- Related Physiological Changes

- Cardiovascular diseases
- Cerebrovascular diseases (Stroke)
- High Blood pressure (Hypertension)
- Dementia
- Chronic Obstructive Pulmonary disease (COPD)
- Osteoarthritis

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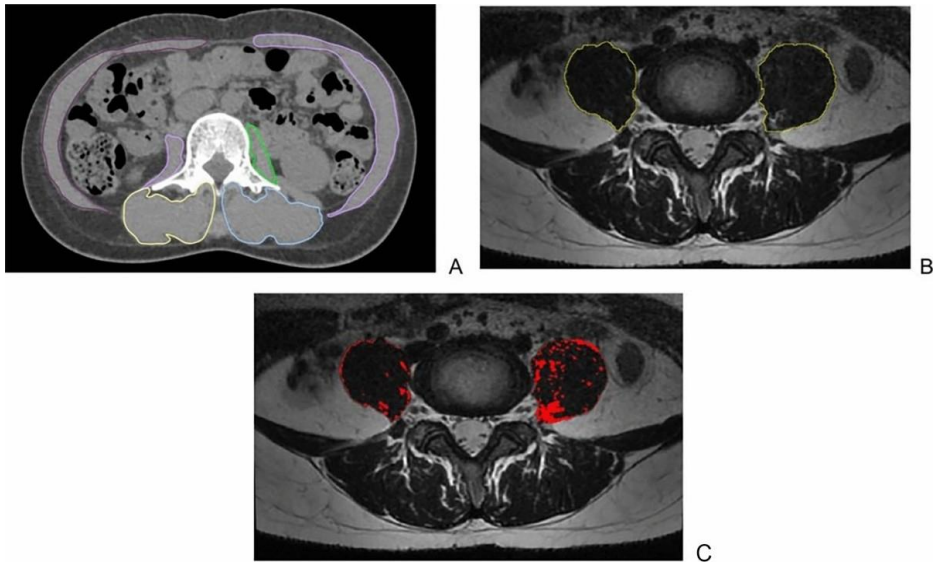
Changes in Muscle Function



Li, C., Huang, Y., Wang, H. *et al.* Application of imaging methods and the latest progress in sarcopenia. *Chin J Acad Radiol* **7**, 15–27 (2024). https://doi.org/10.1007/s42058-024-00142-3

- 1. Strength:

  Decrease due to loss of muscle mass
- 2. Muscular endurance:

  The proportion of slow twitch muscle fibres increase and fast twitch fibres decreases. Therefore, the little change in rate of decline in force during a fatiguing task.

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Changes in Cardiovascular Functions

1. Maximum Heart rate : Decrease with age (MHR= age -220)
2. Resting cardiac output: Decrease about 1% per year during adulthood.
3. Coronary arteries: cross sectional area of the lumen is reduced by 30% from young adulthood to 60 years
4. Blood flow: During exercise is less, probably due to increased peripheral resistance
5. VO2 max: Decline gradually with age

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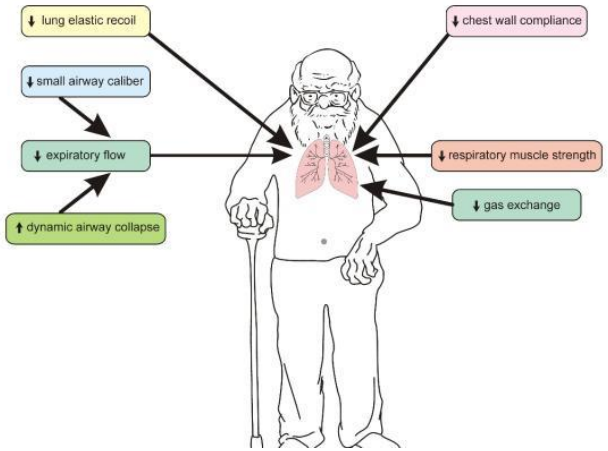
Changes In Pulmonary Functions



1. Lung volumes and capacities:
   - VC----- decrease
   - RV/TLC---- increase
   - Anatomical dead space----Increase
2. Thoracic wall compliance:

   Lung compliance increases and thoracic wall compliance decreases.
3. Pulmonary diffusion:

   decreases at rest and during exercises
4. Ventilatory mechanics in exercise:

   breathing becomes less efficient with age.

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Effect on Nervous System

- Reaction time loss
- Arteriosclerosis results in cerebral functions

Reference: Cohen RA, Porges E, Gullett JM. Neuroimaging of the Aging Brain. In: Heilman KM, Nadeau SE, eds. *Cognitive Changes and the Aging Brain*. Cambridge University Press; 2019:28-53.

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Why is Exercise Important for the Elderly?

- Aging leads to muscle loss (sarcopenia), reduced bone density, and mobility issues.
- Regular exercise can improve longevity, independence, and mental health.

- **Key Statistics:**
  - By 2050, ~22% of the global population will be over 60 (WHO).
  - Only ~30-40% of elderly adults meet recommended exercise guidelines.

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Definitions

- **Physical Activity:** Consists of any body movement produced by the musculoskeletal system resulting in increased energy expenditure.
- **Physical Exercise:** Consists of planned, structured and repetitive physical activity to maintain and/or improve physical fitness.
- **Physical Fitness:** Consists of the individual's ability to perform motor tasks with vigor and agility, conferred by cardiorespiratory fitness, muscular resistance and strength, flexibility, balance and reaction time.

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Types of Recommended Exercises

1. **Aerobic Exercise** (e.g., walking, swimming, cycling) – 150 mins/week.
2. **Strength Training** (resistance bands, light weights) – 2x/week.
3. **Balance & Flexibility** (yoga, tai chi) – Reduces fall risk.
4. **Functional Exercises** (chair stands, stair climbing) – Supports daily activities.

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Exercise for Elderly Population

Combination of aerobic and resistance exercises:

Endurance exercises		Strength exercise	Flexibility and stretch	Balance exercise
Moderate endurance	Vigorous endurance			
Brisk walking	Climbing stairs/ hills	Thera band	Shoulder/ upper back	Standing on one feet
Stationary Cycling	Jogging	Body weight	Hamstring	Walking heel to toe
Swimming	Digging holes	Low- weight Dum belled	Abdominal	Balance walk
			Neck	Wall Push-ups
				Hand and finger exercises

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SECTION ON GERIATRICS, APTA
EXERCISE RECOMMENDATIONS FOR OLDER ADULTS

The following table includes recommendations for exercise for older adults. These recommendations are based on the best available scientific evidence and consensus from experts in their respective professions including the Centers for Disease Control and Prevention, the American College of Sports Medicine, the American Geriatrics Society, the American Heart Association, the American Cancer Society, and from the National Institutes of Health- the National Institute on Aging. These recommendations provide the framework for prescribing specific exercises by listing the key elements of exercise prescription (frequency, intensity, duration, volume). Physical therapists should use these recommendations **as a starting place to design optimal and safe exercise programs.**

	Population	Intensity	Volume	Frequency
Muscle Performance	Healthy Aging	Low: 40% 1RM[1,2] Mod: 40-60% 1RM[1,2,3] High: >60% 1RM[1,2,3] 15-17 on Borg scale; 8-15RM[4] 8-12RM[6] 10RM[6] 10-12RM[7]	1set; 10-15 reps; 8-10 exercises[1,2] 1set; 8-10 reps; 8-10 exercises[1,2,3] 1set; 6-8 reps; 8-10 exercises[1,2,3] 1-2sets; 10-15reps; 8-10 exercises[9] 2sets; 8-15reps; all major muscle groups[4] 1set; 8-12reps; 8-10 exercises[5,8] 2sets; 10reps; all major muscle groups[6] 2-3sets; 10-12reps; all major muscle groups (4UE and 4LE)[7]	2-3x/ week[1,2,3,5,6,7] 2x/week[4,8,9]
	Chronic Disease	10-15RM[8] 8-15RM[9,10]	1set; 10-15reps; 8-10 exercises[8] 1-3sets; 10-15reps; 8-10 exercises[9,10]	2-3x/week[8,9,10]
	Frailty	10-15RM[5,8]	1set; 10-15reps; 8-10 exercises[8] 1-3set; 10-15reps; 8-10 exercises[5,11]	2x/week[8] 2-3x/week[5,11]
Aerobic Capacity	Healthy Aging	55/65%-90% HR_{max}; 40/50%-85%HRR[5] 40-60%VO_{2max}[3,6,12] 55-75%HR_{max} 12-14 Borg scale[2] 13 Borg scale[4] 40-60%HR_{max} 12-14 Borg scale[12]	20-60min; at least 10min bouts[2,5,12] At least 30min[3,4,6,7]	3-5x/week[5,12] 5-7x/week[3,4,6,7] 3-7x/week[2]
	Chronic Disease	50-70% HR_{max}; 40-60%HRR[10]	20-60min[10]	3-5x/week[10]
	Frailty	11-13 Borg scale; 40-60%HRR[11]	At least 20min[11]	≥ 3x/week[11]

	Population	Intensity	Volume	Frequency
Flexibility	Non-Specific	Sufficient to maintain ROM[5] Slowly into mild discomfort[2,4] Subjective sensation of resistance[1] To point of resistance or mild discomfort[7]	All major muscle groups[3,5] 3-4x/all major muscle groups with 10-30s holds[2,7] 3-5x/each major muscle group with 10-30s holds; 15-30min total[4] 3-5x/each key muscle group with 20-30s holds[1]	7x/week[5] 2-3x/week[2,5,7] 3-7x/week[3,4] 3-5x/week[1]
Balance	Non-Specific	Progressive, targeting important postural muscle groups[11] Progress by decreasing base of support[7]	Dynamic, focus on mobility. Static, focus on SLS. 4-10 different exercises.[7]	1-7x/week[7]

RM, repetition max; HRR, heart rate reserve; SLS, single leg stance

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Strength exercises for older adults..

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Aerobic Training for Older Adults

1. Intensity:

   55-90% of MHR

2. Duration:

   20 to 60 minutes a session (in a 10-minute bouts accumulated throughout the day)

3. Frequency:

   3-5 days per week.

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Benefits of Physical Exercise

Physiological	Psychological	Sociocultural
❖ Reduction of hyperglycemia levels, ❖ Improved sleep, ❖ Improved cardiovascular capacity, ❖ Increase or maintenance of muscle strength, ❖ Improved flexibility, coordination and balance, ❖ Prevention or reduction of risks associated with falls. ❖ Multisystemic effects (e.g. osteoporosis and sarcopenia, …)	Improved mood, Promotion of relaxation, Reduction of anxiety and depression, Improved mental and cognitive state, Improved motor control, Development of new learning skills.	Promotion of new functions or activities, Greater participation in society, Encouragement of new relationships.

- The World Health Organization states that the benefits of physical exercise in older adults occur in three domains: physiological, psychological, and sociocultural.

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Safety Considerations

- **Consult a doctor** before starting a new regimen (especially with chronic conditions).
- **Start slow** and progress gradually.
- **Modify exercises** for mobility limitations (e.g., seated workouts).
- **Hydrate and wear proper footwear** to prevent injuries.
- Avoid extreme environment (hot and cold)
- Group exercises

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Contraindications of Physical Exercise

Absolute contraindications are:	Relative contraindications are:
Congestive heart failure, Active myocarditis, Active inflammatory or infectious processes in exacerbation	Supraventricular arrhythmia, Aortic stenosis, Pulmonary hypertension, Cardiomegaly, Endocrinopathies

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Overcoming Barriers to Exercise

- **Common Barriers:**
  - Fear of injury
  - Lack of motivation
  - Chronic pain or fatigue
- **Solutions:**
  - Group classes for social support.
  - Home-based exercises (online videos, telehealth guidance).
  - Small, achievable goals (e.g., 10-minute walks daily).

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Case Study

Patient Profile:

- **Name:** Mr. Robert Johnson
- **Age:** 72 years
- **Medical History:**
  - Hypertension (controlled with medication)
  - Mild osteoarthritis (knees)
  - Prediabetes
  - Occasional lower back pain

Current Activity Level: Sedentary (walks occasionally but no structured exercise)

Design a general Exercise program for Mr. Robert (You may apply FITT principle)

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Summary

- Identified the **Age-Related Physiological Changes**
- Understand **types of exercise** (aerobic, resistance, balance, flexibility).
- Learn **prescription guidelines** (intensity, frequency, progression).
- Summarize **physical benefits** (mobility, fall prevention, chronic disease management).
- Identify **Barriers to Exercise in the Elderly**

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Thank You

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