Chapter 8

MUSCULAR FLEXIBILITY

Objectives

- Explain the importance of muscular flexibility to adequate fitness.
- Identify the factors that affect muscular flexibility.
- Explain the health-fitness benefits of stretching.
- Become familiar with a battery of tests to assess overall body flexibility.
- Be able to interpret flexibility test results according to health-fitness and physical-fitness standards.
- Learn the principles that govern development of muscular flexibility.
- List some exercises that may cause injury.
- Become familiar with a program for preventing and rehabilitating low-back pain.
- Create your own personal flexibility profile.

Flexibility

- **Defined**: Achievable range of motion at a joint or group of joints without causing injury

- Benefits of good flexibility and regular stretching
  - Enhanced quality of life
  - Greater freedom of movement
  - Increases circulation to muscles being stretched
  - Prevents low-back and other spinal column problems
  - Improves postural alignment
  - Improves self-image and appearance
Flexibility

- Lack of flexibility or improper stretching leads to muscular/skeletal problems and injuries
  - Usually occur when a tight muscle is abruptly forced beyond its achievable range of motion
- 80% of all low back problems in the U.S. are a result of improper spinal alignment due to muscle weakness and inflexibility
- Has been prescribed to treat general neuromuscular tension, trigger points, and psychological stress.

Range of motion is very important for older adults

- Decreased flexibility may keep older adults from bending forward or turning
- Lack of good range of motion can severely hamper mobility
- Lack of flexibility can cause falls and other injuries
- A simple stretching program can alleviate or prevent this problem and help people return to an exercise program and normal ADLs

Factors Affecting Flexibility

- Genetic factors
- Physical activity
- Joint structure (shape of the bones)
- Joint cartilage
- Ligaments
- Body temperature
- Tendons
- Muscles
- Skin
- Tissue injury
- Adipose tissue (fat)
- Age
- Gender

All influence range of motion about a joint
Factors Affecting Flexibility

- Greater range of motion can be attained through plastic and elastic elongation
  - **Plastic elongation**
    Permanent lengthening of soft tissue achieved through stretching exercises
  - **Elastic elongation**
    Temporary lengthening of soft tissue allowing for extensibility — stretching of the muscles

Assessment of flexibility

- Flexibility is joint specific, so multiple tests are best
- These tests assess flexibility needed for everyday movements
  1. Sit-and-Reach Test
  2. Total Body Rotation Test (Score independently)
  3. Shoulder Rotation Test (not conducted in class)
- Fitness categories based on performance for each test are provided in the text beginning with Table 8.1

Procedure for the Modified Sit-and-Reach Test

To perform this test, you will need the Ausiliare™ Sit and Reach™ Flexibility Test. As you may simply place a palmstick on top of a box 10” high.

1. Sit against the edge of the box with your back, hips, and head against the wall. Stretch your arms and legs fully extended, and the palms of your hands resting on the wall next to your ears. The thumbs should face forward, and you should be seated against the wall.
2. Place the palmstick one on top of the other on your head and touch them with your fingers. You should be as close to the wall as possible.
3. Slowly lean forward from the waist, pushing your body into the wall until you feel a stretch in your lower back.
4. While you are bending over, place your palms on the wall, and try to touch your toes with your forehead. You should bend forward as far as possible while maintaining your head in a neutral position.
5. The score for this test is the distance in inches from the wall to your fingertips.

You are allowed two trials, and an average of the two scores is used as the final test score. The respective percentile ranks and fitness categories for this test are given in Table A in Chapter 8.
Procedure for Total Body Rotation Test

An AcuL的土地Rotation Test is a measuring technique that assesses the range of motion in the pelvic region. The test is performed by placing a measuring tape at the level of the iliac crest on the right and left of the body. The test is considered as a measure of flexibility and is used to identify areas of limitation. The test is performed by placing the measuring tape at the level of the iliac crest on the right and left of the body. The test is considered as a measure of flexibility and is used to identify areas of limitation.

Interpreting Flexibility Test Results

- Using your percentile score from Table 8.2, determine the fitness category for each flexibility test using guidelines in Table 8.4.
- Look up the number of points assigned for each fitness category in this table.
- The overall flexible fitness category is obtained by totaling the number of points from all three tests and using the ratings in Table 8.5.

<table>
<thead>
<tr>
<th>Percentile Rank</th>
<th>Fitness Category</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;90</td>
<td>Excellent</td>
<td>5</td>
</tr>
<tr>
<td>70-89</td>
<td>Good</td>
<td>4</td>
</tr>
<tr>
<td>50-69</td>
<td>Fair</td>
<td>3</td>
</tr>
<tr>
<td>30-49</td>
<td>Poor</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Points</th>
<th>Flexibility Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;13</td>
<td>Excellent</td>
</tr>
<tr>
<td>10-12</td>
<td>Good</td>
</tr>
<tr>
<td>7-9</td>
<td>Average</td>
</tr>
<tr>
<td>4-6</td>
<td>Fair</td>
</tr>
<tr>
<td>&lt;3</td>
<td>Poor</td>
</tr>
</tbody>
</table>

Evaluating Body Posture

- Good posture enhances
  - Personal appearance
  - Self-image
  - Confidence
  - Improves balance and endurance
  - Protects against misalignment-related aches and pains
  - Prevents falls
  - Enhances overall sense of well-being
Evaluating Body Posture

- As posture improves from recommended exercise, you may become motivated to improve muscular strength, flexibility, and decrease body fat.
- Posture tests are used to detect deviations from normal body alignment and prescribe corrective exercises (Lab 8B).
- Analyses are best conducted early in life because some postural deviations are difficult to correct in older people.

Principles of Muscular Flexibility Prescription

- Range of joint mobility can be increased and maintained through a regular comprehensive stretching program.
  - Overload and specificity of training principles also apply to muscular flexibility.
  - FITT also can be used to design stretching programs.
Principles of Muscular Flexibility Prescription
Modes of Training

- Static stretching
  - Lengthen the muscle tissue gradually through a joint’s complete range of motion and hold the final position for a few seconds.
  - Causes little pain and has a low risk for injury.
  - The most frequently used and recommended.

- Passive stretching
  - Muscles are relaxed.
  - External force is applied to increase joint range of motion.
  - Associated with some decrease of strength and power.

- Dynamic stretching
  - Uses movement speed, momentum, and muscular effort to increase joint range of motion.
  - Not associated with loss of strength and power.
  - Preferably completed prior to competition

- Ballistic stretching
  - Jerky, rapid, and bouncy movements that force the muscle to lengthen.
  - Effective, but at the cost of muscle damage when performed too fast.
  - If excessive, plastic elongation and the accompanying loss of joint stability may result.

- Controlled ballistic stretching
  - Slow, gentle, and controlled-ballistic stretching is effective and safer than standard ballistic stretching.
Principles of Muscular Flexibility Prescription
Modes of Training

- Proprioceptive Neuromuscular Facilitation (PNF)
  - Stretching technique that uses reflexes and neuromuscular principles to relax the muscles being stretched
  - Based on a "contract-and-relax" method
  - Benefits of PNF
    - More effective than slow-sustained stretching.
    - An increase in strength of the muscle(s) being stretched.
  - Disadvantages of PNF
    - More pain.
    - Need for a second person to assist.
    - Need for more time to conduct each session.

PNF stretching technique:
(a) isometric phase (b) stretching phase

Proprioceptors protect muscles from injury

- Muscle spindle
  Located in the muscle. Respond to overstretching by creating muscular contraction.
  - Explains why injury rates are higher during ballistic stretching
- Golgi apparatus
  Located where muscle fibers attach to muscle tendon. Respond to stretching by inhibiting muscular contraction
  - Explains effectiveness of PNF
**Principles of Muscular Flexibility Prescription**

- **Intensity**
  - The degree of stretch should be to only a point of mild discomfort or tightness at the end of the range of motion.
  - The muscle should be relaxed as much as possible along with relatively slow stretching movements.

- **Repetitions**
  - Holding the final position of each rep for 10 to 30 seconds.
  - Each exercise should be done 2 to 4 times.
  - Cumulative time of 60 seconds
  - As flexibility increases, a person can gradually increase the time each repetition is held to a maximum of 60 seconds.
  - Total stretching duration should be a minimum of about 15 minutes.

- **Frequency**
  - Minimum of 2 to 3 days per week
  - Ideally 5 to 7 days per week
  - After 6–8 weeks of training, flexibility can be maintained with only 2–3 sessions each week.

- **Mode:** Slow-sustained (static), ballistic (dynamic), or proprioceptive neuromuscular facilitation (PNF) stretching to include all major muscle/band groups of the body
- **Intensity:** To the point of mild tension or limits of discomfort
- **Repetitions:** Repeat each exercise 4 times, holding the final position between 15 and 60 seconds
- **Frequency:** At least 2 or 3 days per week
  - Ideal: 5 to 7 days per week
Flexibility Exercises

- Subject each muscle group to at least one stretching exercise.
  - A complete set of exercises for developing muscular flexibility is presented on pages 314-321.
  - Perform each exercise through the joint’s full range of motion.
  - A complete workout lasts 15–30 minutes.

- Use safety when performing stretching exercises
- Preexisting muscle or joint conditions can increase risk for injury.

Preventing & Rehabilitating Low-Back Pain

- Low-back pain is prevalent in 60–80% of the population.
- Greater than 95% relates to muscle/tendon injury.
- About 1–5 percent relates to intervertebral disk damage.
- It is considered chronic if it persists longer than three months.
Preventing & Rehabilitation Low-Back Pain

- Backache syndrome is preventable
  - About 80% of low-back pain is due to preventable problems.
    - Lack of physical activity
    - Excessive sitting weakens abs and shortens hip flexors
    - Faulty posture
    - Figure 8.7 provides proper body mechanics that promote back health
    - Excessive body weight and/or psychological stress
    - Common among smokers

Incorrect and Correct Pelvic Alignment

- Deterioration or weakening of the abdominal and gluteal muscles along with tightening of the lower back muscles due to excessive sitting; brings about an unnatural forward tilt of the pelvis
- This tilt puts extra pressure on the spinal vertebrae, causing pain in the lower back.
- Accumulation of fat around the midsection of the body contributes to the forward tilt of the pelvis.

Behavior Modification Planning: Tips to Prevent Low-Back Pain (page 310)

- Be physically active
- Stretch often
- Regularly strengthen your core
- Lift objects properly
- Avoid sitting/standing in one position too long
- Maintain correct posture
- Sleep in a proper position
- Select a mattress carefully
- Warm up before exercise
- Practice stress management

Journal Question
List how many of these actions you do regularly. What would be necessary for you to incorporate them all in your lifestyle?
Preventing & Rehabilitating Low-Back Pain

- If the pain is severe and persists even at rest, see a physician:
  - Rule out any disc problems
  - May prescribe proper bed rest, using several pillows under the knees for leg support (Figure 8.7).
  - May prescribe a muscle relaxant or anti-inflammatory medication (or both) and some type of physical therapy.
  - Take over-the-counter pain medication.
  - Stay active to avoid further weakening of the back muscles.
    - Low-impact activities such as walking, swimming, water aerobics, and cycling are recommended.

Preventing & Rehabilitating Low-Back Pain

- Chiropractic (spinal manipulation) if there is no indication of disease or injury (such as leg numbness or pain), a herniated disc, or fractures.
- Aerobic exercise, muscular flexibility, and muscular strength-endurance training that include specific exercises that strengthen the spine-stabilizing muscles.
  - Several exercises for preventing and rehabilitating the backache syndrome are given on pages 317-321.
  - Iyengar Yoga has been found to enhance flexibility and relieve chronic low-back pain.

When to seek medical attention for low-back pain

- Numbness in the legs
- Trouble urinating
- Leg weakness
- Fever
- Unintentional weight loss
- Permanent severe pain even at rest

*Always seek a second opinion if surgery is recommended. Aggressive physical therapy can eliminate the need for surgery*
Effects of Stress

- Excessive stress causes muscles to contract
- Frequent tightening of the muscles can throw the back out of alignment and constrict blood vessels that supply oxygen and nutrients to the back
- Chronic stress releases hormones linked to muscle and tendon injuries
- People under stress forget about proper body mechanics, increasing risk for injury
- Proper stress management should be in your back care program