Chapter 11

Muscle Fitness: Basic Principles and Strength

Chapter Overview

CHAPTER SUMMARY
This chapter describes the health and wellness benefits of having good muscle fitness. It explains the difference between strength and muscular endurance, and includes activities for assessing and developing the two. The physiology of muscle structure and how it relates to the building of strength and muscular endurance is explored. Different types of muscular training are presented in this chapter and how they relate to improving muscle fitness. This chapter also discusses how and why strength training for preteens and teens differs from weight training for adults, and it clears up some of the common misconceptions about strength training. It includes instruction in the application of the fitness principles and the FIT formula for improving muscle fitness. Lastly, this chapter provides strategies for starting and, more importantly, sticking with a muscular fitness program.

CHAPTER RESOURCES

Activity: Partner Resistance Exercises
- Activity Cards 111-118
- Partner Resistance Exercises (PA 11-1)

Class: Muscle Fitness Basics (11.1)
- Vocabulary Cards 102-115
- OTM 11-A: Some Major Muscle Groups (CR 11-2)
- OTM 11-B: Strength/Endurance Continuum (CR 11-3)
- OTM 11-C: Repetitions and Sets (CR 11-4)
- OTM 11-D: How Muscles Apply Force to Bones (CR 11-5)

Activity: Self-Assessment 11: Determining Your Modified 1RM and Grip Strength
- Determining Your Modified 1RM and Grip Strength Worksheet (SW 11-1)

Class: Building Strength (11.2)
- Vocabulary Cards 116-117
- OTM 11-E: Strength Exercises (CR 11-6)
- OTM 11-F: Fitness Target Zones for Strength (CR 11-7)
- OTM 11-G: Resistance Machines Versus Free Weights (CR 11-8)
- Taking Charge 11: Preventing Relapse (TC 11-1)
- Application 11: Strength Training (CR 11-9)
- Reinforcement 11: Strength Word Scramble (CR 11-10)
- Personal Project 11: Logging and Planning Resistance Training Exercises for Strength (CR 11-11)

Activity: Fundamentals of Weight and Resistance Training
- Activity Cards 119-129
- Fundamentals of Weight and Resistance Training Worksheet (SW 11-2)

Ancillaries
- Fitness for Life DVD Series: Lifelong Fitness and Wellness
- CD-ROM: Fitness for Life Presentation Package
- Audio CD: Physical Education Sound Tracks Volumes 1 and 2
Activity 11.1: Partner Resistance Exercises

LESSON OBJECTIVES
Students perform exercises with a partner to build strength and muscular endurance.

EQUIPMENT NEEDED
Bath towels (1 per 2 students), mats, benches, CD player and Physical Education Sound Tracks Volumes 1 and 2, Activity Cards 111-118

ADVANCED PREPARATION
- Gather the necessary equipment and prepare each station.
- Print out Activity Cards 111-118 from the Activity and Vocabulary Cards CD-ROM. Place the cards in the area where the students will be doing the activity.
- Print out copies of the Partner Resistance Exercises Worksheet (PA 11-1) from the Teacher Resources and Materials CD-ROM. Print one copy for each student.

PROCEDURE
1. Have students do a warm-up before starting the resistance exercises.
2. After the warm-up, have students choose a partner that is of a similar size and strength.
3. Distribute copies of the Partner Resistance Exercises Worksheet.
4. Ask for volunteers to help demonstrate each exercise.
5. Have students follow the directions on the worksheets. Observe and correct technique.
6. Have students do a cool-down after the exercises.

EMPHASIZE
For endurance, use less resistance and more reps; for strength, use more resistance and fewer reps.
Lesson 11.1: Muscle Fitness Basics

LESSON OBJECTIVES

1. Explain the difference between strength and muscular endurance.

2. Describe some of the health benefits of muscle fitness.

3. Describe the various types of muscles and muscle fibers.

4. Describe some of the methods of progressive resistance exercise used to improve muscle fitness.

VOCABULARY

absolute strength, calisthenics, fast-twitch muscle fibers, hypertrophy, intermediate muscle fibers, isokinetic exercise, isometric contraction, isotonic contraction, one repetition maximum (1RM), progressive resistance exercise (PRE), relative strength, reps, set, slow-twitch muscle fibers

LESSON OPENER

Show students the Physical Activity Pyramid off the Teacher Resources and Materials CD-ROM. Find the muscle fitness section of the pyramid. Ask students to describe some of the health benefits of muscle fitness. Ask them what type of activities they think require muscular endurance and muscular strength.

DISCUSSION GUIDING QUESTIONS

- What is muscular endurance? (the ability to contract muscles many times without tiring or to hold a muscle contraction for a long time)
- What is strength? (the amount of force a muscle can exert)
- How do you develop muscular endurance and strength? (progressive resistance exercise)
- In Activity 11.1 you used your partner’s body weight to provide resistance. What else could you use to provide resistance? (your own body weight, free weights, machines, etc.)
**DISCUSSION GUIDING QUESTIONS**

- What is hypertrophy? *(increase in muscle size)*

- Why can a continuum be used to represent the relation between muscle strength and muscle endurance? *(because exercises for both differ only in the number of reps and amount of resistance)*

- What is the difference in the exercise prescription for building muscle strength versus muscular endurance? *(You can develop strength by using high resistance with few reps and muscular endurance by using low resistance with high numbers of reps.)*

- Can you explain the terms reps and sets used in designing a PRE program? *(Reps are the number of lifts in a set; sets are one group of reps.)*

Fitness exercises using PRE from level 3 of the Physical Activity Pyramid.

Strength and endurance use resistance in different ways. Strength is developed by doing an exercise for only a few times, but with a lot of resistance. The girl lifting the boxes needs strength. Muscular endurance is developed by doing an exercise many times, but with less resistance, such as the light backpack the girl is wearing in the picture.

Strength training tends to increase the size of muscles as they become stronger. This increase in muscle size is called hypertrophy. Because muscular endurance training uses less weight, endurance training does not cause as much hypertrophy.

**The Muscular Endurance–Strength Continuum**

Exercises used to develop muscular endurance and strength differ only in the number of repetitions and the amount of resistance. The relationship between endurance and strength can be illustrated by a continuum. The continuum shown here represents pounds of resistance on one edge and number of repetitions on the other edge.

The girl lifting boxes (left) uses strength while the girl wearing the light backpack (right) uses muscular endurance.

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**Muscle Fitness Terminology**

You probably hear the terms *reps* and *sets* in relation to muscular endurance exercises. The diagram on the next page can help you understand these terms. Repetitions, or *reps*, are the number of consecutive times you...
Muscle Fitness: Basic Principles and Strength

DISCUSSION GUIDING QUESTIONS

- What are the three types of body muscles? (smooth, cardiac, skeletal)
- How does skeletal muscle differ from smooth and cardiac muscle? (Smooth and cardiac muscles are involuntary muscles, because you can’t consciously control their movements. Skeletal muscles are voluntary muscles because you control them.)
- How do muscles make bones move? (When the skeletal muscles that are attached to bones contract, they pull on the bones, causing movement.)
- What is an isotonic contraction? (A muscle contracts and changes length—gets shorter or longer, producing movement of body parts.)
- What are concentric and eccentric isotonic contractions? (In a concentric contraction, the muscle shortens under tension. For example, curling a dumbbell toward the shoulder concentrically contracts the biceps. In an eccentric contraction, the muscle lengthens under tension. For example, lowering a dumbbell away from the shoulder eccentrically contracts the biceps.)
- What is an isometric contraction? (A muscle contraction in which muscles contract and pull with equal force in opposite directions so that no movement—lengthening or shortening of the muscle—occurs.)
- What are the different types of fibers in skeletal muscle called? (fast-twitch, slow-twitch, and intermediate)
DISCUSSION GUIDING QUESTION

▶ How can you define the difference between fast-twitch, slow-twitch, and intermediate muscle fibers? (Fast-twitch muscle fibers contract at a fast rate and have great strength but very little endurance. Slow-twitch muscle fibers contract at a slow rate and have great endurance. Intermediate muscle fibers have characteristics of both slow-and fast-twitch fibers.)


Muscles work together to move bones to apply force.


Applying Physics Knowledge

Here is a chance to help students apply their knowledge of physics and reinforce physics vocabulary.
DISCUSSION GUIDING QUESTIONS

- What factors influence the strength of a muscle? (how well trained a person is, the speed of the movement being performed, the angle of the joint during a specific lift, age, sex, and heredity—the types of muscle fibers you have)

- What is the difference between weight training and circuit weight training? (Weight training is done to improve muscular strength and endurance; circuit weight training also develops aerobic endurance.)

- Can you describe how training programs would differ for the following: weightlifting, powerlifting, bodybuilding? (Training programs for weightlifting and powerlifting involve heavy weight, low reps. Bodybuilders train with more reps than weightlifters and powerlifters.)

- A friend in the weight room challenges you in lifting to see who can lift the most weight. What are some concerns about this situation?

Using Application and Critical-Thinking Skills

The Discussion Guiding Questions are open-ended questions that require students to explain their answers. This open-ended format requires application and critical thinking, which are important skills for success in all subject areas.
DISCUSSION GUIDING QUESTIONS

- How are strength and endurance usually assessed? (A one repetition maximum test is considered to be the best test for strength. Calisthenics exercises, like push-ups and curl-ups, are typically used to assess endurance.)

- What is the difference between absolute and relative strength? (Absolute strength is a term for the total amount of weight you can lift or resistance you can overcome regardless of your body weight. Relative strength is the amount of weight or resistance you can overcome for each pound of body weight.)

- Why do you need special devices to perform isokinetic exercises? (The devices keep the speed of movement of a body part constant and provide a constant force throughout range of motion.)

CLOSING

Review how muscle fitness can be characterized by muscle endurance and muscle strength. Remind students that to improve either area of muscle fitness a specific program of sets and repetitions is required. Highlight the fact that each type of program will give benefits for sports and good health. Provide examples of movements that are concentric and eccentric. Finish with emphasizing that muscle fitness exercises can be done using a wide range of equipment, from home-based equipment to expensive machines in fitness centers.
Self-Assessment 11: Determining Your Modified 1RM and Grip Strength

LESSON OBJECTIVES
Students perform strength self-assessments to determine 1RM and grip strength.

EQUIPMENT NEEDED
Weight training equipment, grip dynamometer

ADVANCED PREPARATION
- Gather the necessary equipment and place an identifying sign by the weight machine or free weights at each station.
- Print out copies of the Determining Your Modified 1RM and Grip Strength Worksheet (SW 11-1) from the Teacher Resources and Materials CD-ROM. Print one copy for each student.
- Read with students the introductory text for Self-Assessment 11 and give an overview of procedures for grip strength exercises and determining 1RM.

Part 1: Estimating Your 1RM
As you know, 1RM means one repetition maximum. It represents the maximum weight a group of muscles can lift one time (or resistance they can overcome). Because beginners should begin gradually (without heavy lifting), a modified method has been developed that allows you to determine your 1RM without overworking your muscles.

The results you get will allow you to see how strong you are.

The modified 1RM can be done with free weights or machines, but the instructions that follow will be for machine use. Resistance machines are recommended for these self-assessments, especially for beginners, because they are safer. Two tests are used most often, and the ones performed in this self-assessment activity are for the upper body (arm press) and the lower body (leg press). If a person performing the arm press on a resistance machine can lift 50 pounds one time, but not more than one time, this number would represent the 1RM for the arm press. Similarly, if the person could move a resistance of 150 pounds one time with the leg press, but not more than one time, 150 would be the 1RM for the leg press.

As mentioned earlier in this chapter, 1RM scores for the arm press and leg press will be estimated to avoid maximal lifting, something that is discouraged for teens.

Follow these directions for each of the two self-assessments:
- Choose a weight (resistance) that you think you can lift 5 to 10 times but is too heavy for you to lift more than 10 times. Do not use a weight that can lift fewer than 5 times.
- Using correct technique, lift the weight as many times as you possibly can. Count the number of lifts and write the number on your record sheet. If you were able to do more than 10 lifts, wait until another day before you try a heavier weight for that exercise. Go to the next muscle group exercise.
- If you can tell that you will not be able to lift the weight at least 5 times, stop and choose a lighter weight.
- If you were able to do 5 to 10 lifts and no more, then refer to table 11.1. Find the weight you lifted in the left-hand column. Now find the number of repetitions you did in the top row. Your 1RM score is the number in the box where the horizontal weight row and the vertical rep column intersect.
- Divide each of the two 1RM scores by your body weight to get a strength per pound of body weight score. The strength per pound of body weight score adjusts for body size (relative strength). For example, a person weighing 150 pounds and has a 1RM of 100 pounds on the arm press has a score of .67 pounds per pound of body weight. Use tables 11.2 and 11.3 to determine your fitness rating. Fitness ratings are only determined for the arm and leg press.
- If time allows, perform this procedure to determine your 1RM for other exercises included in the activity at the end of this chapter. Do the 1RM self-assessment for as many exercises as time allows. You do not need to determine a strength per pound of body weight score for these exercises. Use the 1RM scores to help you determine how much resistance to use for your PRE program.

Safety Tips: Proper form is essential for safety. Before you do the 1RM test, read the descriptions of the exercises and the directions that follow. Before performing the assessment, practice each of the two exercises and have a teacher check your form. During the assessment, have a partner spot you and follow the resistance training guidelines on page 189.
PROCEDURE

1. Have students do a warm-up before starting the test exercises.

2. Distribute copies of the Determining Your Modified 1RM and Grip Strength worksheet.

3. Divide the class into six groups and assign each group a station.

4. Have students read the directions and then practice the assigned exercise.

5. Have each group demonstrate their safe exercise to the class.

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<td>5 6 7 8 9 10</td>
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*Predicted 1RM Based on Reps to Fatigue.* This chart is used as modified from the Journal of Physical Education, Recreation, and Dance. January 1993, page 89. JOPERD is a publication of the American Alliance for Health, Physical Education, Recreation and Dance, 1300 Association Drive, Reston, VA 22091.

Reading and Math Skills: Interpreting Charts and Tables

This activity offers students an opportunity to practice interpreting tables.
6. Specify the number of sets and reps for each exercise.
7. Have each group return to their starting station and perform the assigned exercise.
8. Ask students to record the repetitions they performed, the weight lifted, the estimated 1RM, the calculated strength-to-weight ratio, and their fitness rating for each exercise.
9. When the signal is given, tell groups to rotate to the next station.
10. Have students estimate their 1RM on their record sheets.

**Seated Arm Press**

1. Sit on the stool of a seated press machine, the handles even with your shoulders. Grasp the handles with your palms facing away from you. Tighten your abdominal muscles.
2. Push upward on the handles, extending your arms until the elbows are straight.
3. Lower to the starting position.
4. If a seated press machine is not available, you can substitute the bench press. This exercise is described in the activity at the end of the chapter.

**Leg Press**

1. Adjust the seat distance on a leg press machine for leg length comfort. The closer the seat, the greater the range for working and the greater the intensity. Sit with your feet resting on the pedal.
2. Push the pedal until your legs are straight.
3. Slowly return to your starting position.

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This test evaluates the strength of triceps and pectoral muscles.

This test evaluates the strength of the quadriceps, the gluteals, and calf muscles.