

Applied Exercise and Sport Physiology, with Labs, 4e

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Chapter 11 – Study Guide Answers

What are the important physiological properties of muscles?

- Contractility
- Irritability
- Conductivity

How do muscle contractions differ in the laboratory setting and in the human body?

- In the lab, all the nerve fibers of the whole muscle are stimulated simultaneously. The stimulation of normal muscle is asynchronous.
- In the lab, muscle twitch is in response to a single shock. In the body, muscle is stimulated by volleys of nerve impulses.

Does the summation of twitches increase or decrease force production?

Increase

When does tetanus occur?

The excised muscle is stimulated too frequently and muscle tension becomes prolonged

What effect do heating and cooling have on muscle contraction?

- Heating causes a muscle to contract and relax more rapidly.
- Cooling causes a muscle to contract and relax more slowly.

What is the relationship between muscle temperature and injury?

When a muscle is cooled, the relaxation phase slows two to three times as much as the contraction phase, which can contribute to muscle injury.

Explain the all-or-none law of muscle contraction.

Stimulation of a muscle fiber by impulses much larger than threshold value will change neither the amount of shortening nor the force of the contraction.

How does the nervous system cause gradations in the force of contractions of whole muscles?

- Recruitment—varying the number of motor units activated
- Rate coding—increasing or decreasing the rate of firing for the motor units involved

What two factors contribute to the external force that a muscle can produce? How?

- Angle of pull—when a muscle pulls at right angles to the bone, all the muscle's internal force is available to do external work. At all other angles, less force is available.
- Length of muscle—when a muscle is stretched too far, there is little overlap between the actin and myosin filaments and little tension can be produced. At resting length, the overlap is optimal and maximal tension can be produced.

How can the bilateral deficit be decreased?

Training should use exercises that emphasize concurrent contractions of the same muscle groups on both sides of the body.

Why are isometric exercises not particularly well suited to sports training?

Most sports are characterized by movement, but isometric exercises are static.

Name some examples of exercises that involve DCER muscle actions?

- Free weights
- Resistance training machines

What is isokinetic training commonly used for?

Physical therapists and trainers use isokinetic testing and training in rehabilitation

The biceps curl (forearm flexion) is an example of what type of muscle action?

Concentric

Lowering a barbell from full flexion to full extension is an example of what type of muscle action?

Eccentric

Does concentric strength increase or decrease as velocity of movement increases?

Decrease

Does eccentric strength increase or decrease as the velocity of movement increases?

Neither, it stays the same

What factors account for the increase in muscle strength that accompanies resistance training?

- Hypertrophy
- Neural adaptation

What are the health implications for cross-education?

In situations where one limb cannot be exercised, cross-education makes it possible to maintain muscle integrity through resistance training of the contralateral limb. This can reduce the amount of time necessary for rehabilitation when the affected limb can again be used.

What are some benefits of strength training?

- Increased bone mineral density
- Favorable changes in body composition
- Increased functional strength for daily living
- Improved insulin sensitivity
- Increased basal metabolic rate
- Decreased diastolic blood pressure

- Reduced risk of low back pain
- Decreased risk of injury during physical activity
- Improved blood lipid profiles

What would be a safe strength training regimen for health-related outcomes?

- 2 to 4 sets of 8 to 12 repetitions exercises, at least one exercise for each major muscle group
- 8 to 12 RM (repetitions) load that is equal to approximately 60 to 70% of 1 RM
- 2 to 3 days a week
- A gradual progression of greater resistance and more repetitions per set and/or increasing frequency

Name five ways in which resistance training can improve athletic performance.

1. Increases muscle power, muscle endurance, and the rate of force production
2. Improves flexibility
3. Modifies body composition
4. Reduces the risk of injury
5. Strengthens muscles following injury or surgery, aiding in return to practice and competition

What are the basic principles of resistance training for athletes?

- Specificity
- Overload
- Progression
- Periodization

What does it mean to overload the muscle? Why is it necessary?

To overload the muscle is to demand more of it than it normally performs. Unless it is taxed, it will not adapt with increases in strength and size.

Why is progression necessary to a resistance training program?

The volume of training must be increased periodically to maintain an overload and continue to see adaptations.

What are the benefits of periodization?

- Minimizes boredom and encourages the athlete to stick with the program
- Results in greater and more consistent strength gains than non-periodized programs

What are the three primary periodization models?

1. linear
2. reverse linear
3. nonlinear

What are some of the NSCA guidelines for the resistance training of athletes?

- Schedule training at least three days a week, with a minimum of 24 hours of rest between sessions
- Design programs so that all the major muscle groups are targeted
- Take into account appropriate muscle balance across joints, as well as both the upper- and lower-body muscle groups.
- Periodize training to vary volume and intensity

- Plan recovery periods to help avoid overtraining
- Require no more than two exercises per body part; however, different exercises per body part may be used throughout the week
- Specific large-muscle group exercises should be limited to two times per week
- Use warm-up sets that involve very light resistance
- Allow adequate recovery for muscle groups during a training week
- Perform large-muscle group exercises first in a workout
- Allow rest between sets depending on the goals of the program
- Using a four-day-per-week training protocol, divide the selected lifts into two groups: (a) chest and shoulders and (b) back and legs
- Make use of multi-joint and Olympic-style lifts with free weights as well as isolated movements on resistance machines to promote targeted muscle hypertrophy

When training female athletes for strength, coaches should keep in mind what considerations?

- To use the similar methodologies, programs, and types of exercise used with male athletes
- To keep in mind that there may be more differences between individuals of the same gender than there are between males and females
- To assess the needs of the athletes individually and train them accordingly

What precautions should a pregnant woman take during strength training?

- After the first trimester she should be cautious when performing heavy multi-joint free weight exercise because of the increase in relaxin, which softens tendons and ligaments.
- Pay attention to dress and environment to avoid becoming overheated.

What can coaches do to compensate for a woman's narrow shoulder width in overhead lifts?

Pay attention to hand spacing and to the carrying angle at the elbow

What can coaches suggest if they are concerned about the effects of a woman's Q-angle on weight lifting?

Tell female weight trainers to squat with a toe forward stance

What is plyometric training most useful for?

Plyometric training is beneficial for athletes who compete in sports requiring a high level of explosive power, such as track and field, football, volleyball, basketball, and Olympic style weight lifting.

Name six factors that contribute to overtraining.

1. Overly frequent competitions
2. Pre-existing illnesses
3. Dietary inadequacies
4. Psychological stress
5. Heavy time demands
6. Inadequate sleep

Name some of the symptoms of overtraining.

- A plateau followed by a decrease in strength gains
- Increased resting diastolic blood pressure

- Increased resting heart rate
- Sleep disturbances
- Decreased lean body weight
- Decreased appetite
- Persistent cold or flu-like symptoms
- Loss of interest in training
- Feelings of fatigue when rising
- Excessive muscle soreness

What is the most effective treatment to cure overtraining? How can it be prevented?

- Rest
- Periodizing the resistance training program is the best way to avoid overtraining

Vibration training has been shown to result in improvements in muscular strength, vertical jump height, and mechanical power. How long do these effects typically last?

They are short-lived, disappearing 60 minutes after the treatment; thus, they may provide a critical edge if utilized immediately prior to performance in athletic events of relatively short duration.