

Introduction to Fitness and Training and Its Importance in Adventure Sports

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Lecture 4 Outline

Recap



Muscular Fitness

RECAP: Components of Fitness



Muscular Fitness



What is it?



Why is it important for Adventure Sport?



How do we improve it?

What is Muscular Fitness?



Muscular Strength - maximal force that can be generated by single or group of muscles



Muscular Endurance - ability of muscle or group of muscles to sustain repeated contractions or maintain static contraction over a prolonged period of time without fatigue.



Muscular Power – ability of muscle or group of muscles to generate force rapidly, combining both speed and strength to produce explosive movements.

Why is Muscular Fitness important for Adventure Sport?



Strength and Power - Performers require strength to perform jumps, lifts, and dynamic movements. Muscular strength ensures explosive power, stability during transitions, and resilience against fatigue.



Endurance – Adventure sports can last for extended periods. Muscular endurance allows performers to maintain energy and perform consistently without losing technique or precision.



Injury Prevention - Strong muscles help stabilize joints and improve alignment, reducing the risk of injuries like strains, sprains, or overuse conditions common in adventure sports.



Balance and Control: - Muscular fitness enhances core strength, which is vital for balance, posture, and fluid movement. This is crucial for complex footwork, and turns.

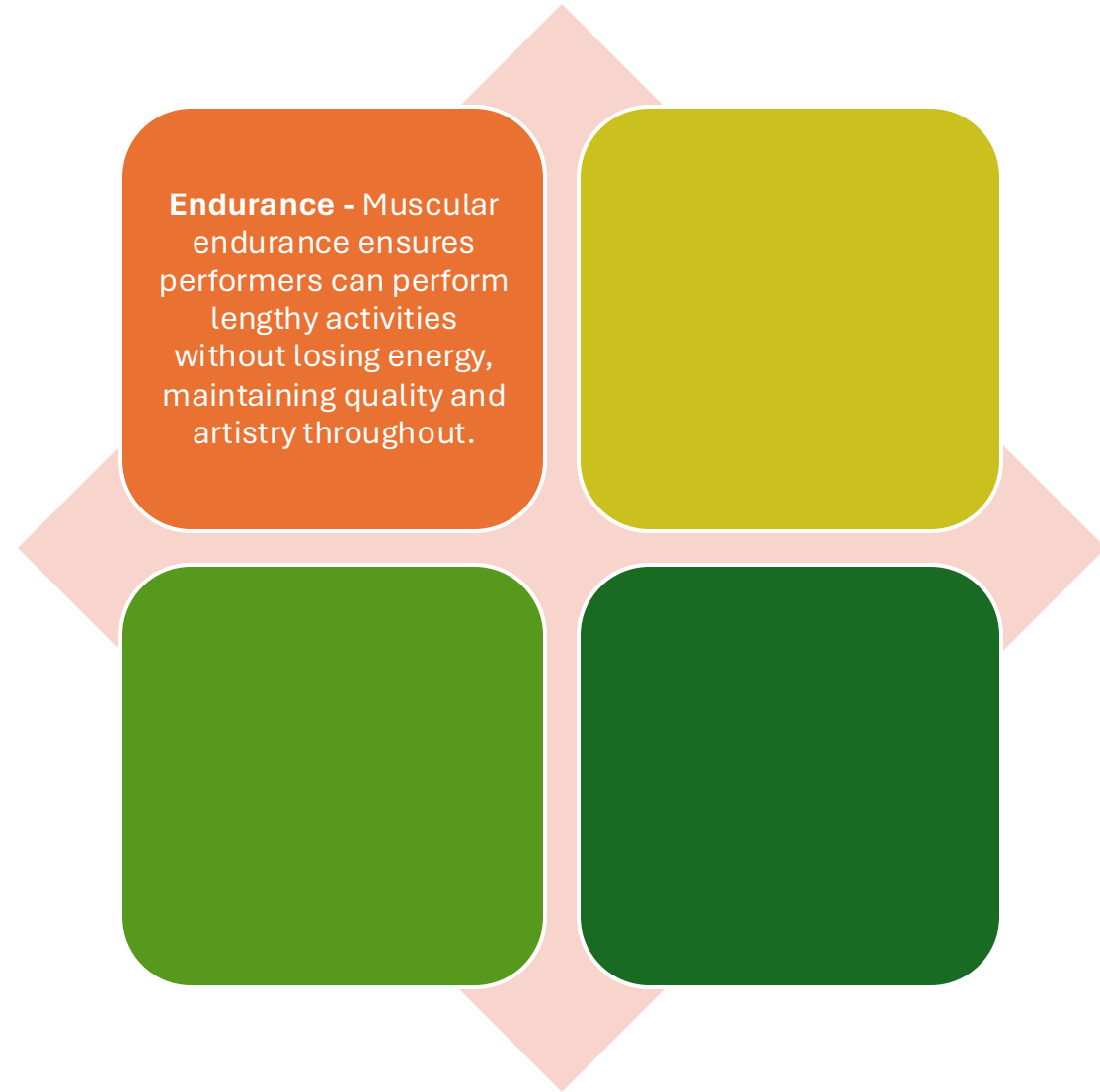


Flexibility and Range of Motion: - While flexibility is crucial for sport, it works best in tandem with strong muscles. Strength ensures that movements are executed safely and with control.



Aesthetic Execution - Muscular fitness improves precision, allowing performers to execute movements with clarity, grace, and power, enhancing the overall performance.

What are the benefits of higher levels of Muscular fitness for Adventure Sport?





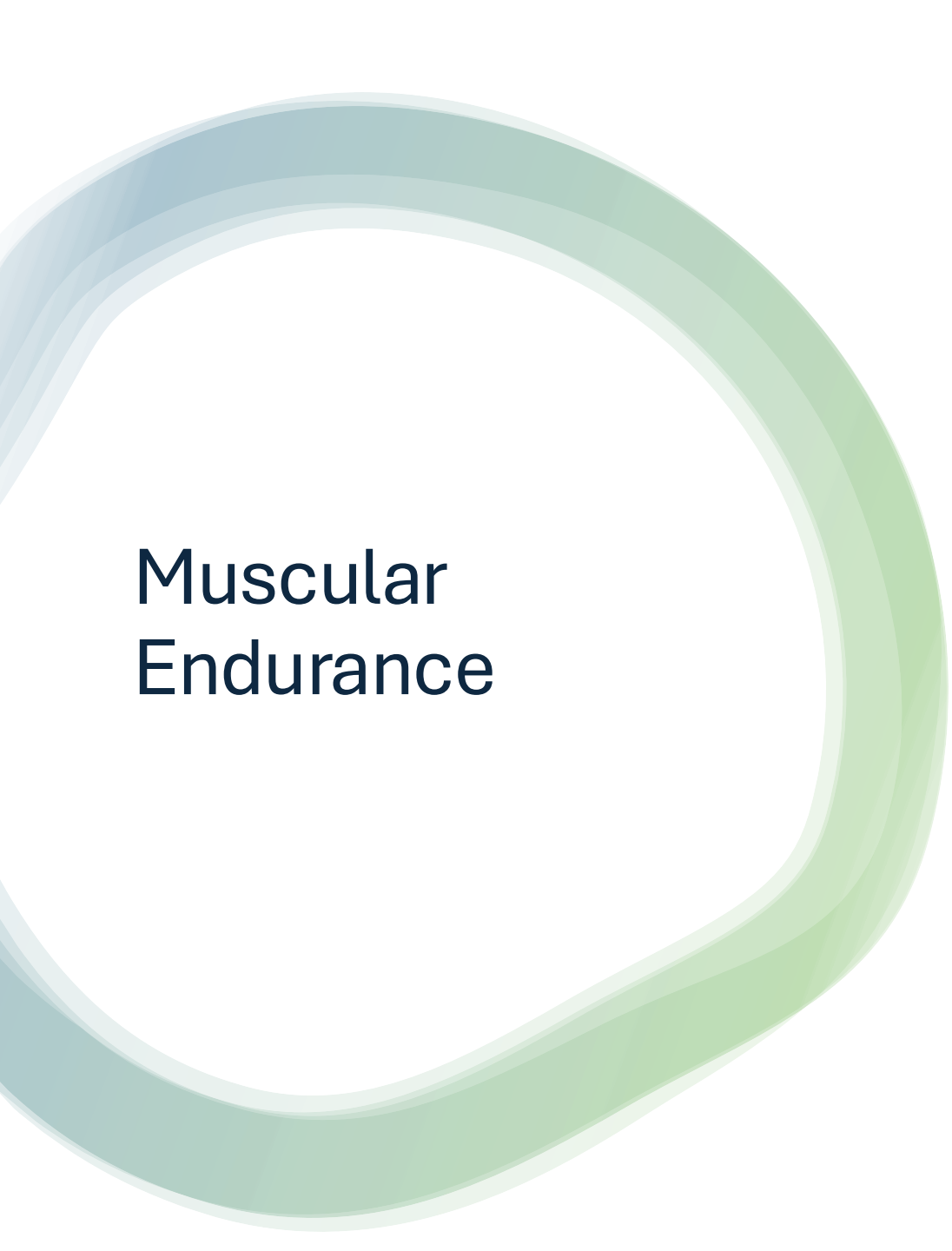
Strength

- Maximum muscular strength (low-speed strength)
 - Related to the force a muscle or muscle group can exert in one maximal effort
 - Generally tested via 1-repetition maximum (1RM) in a particular lift



Muscular Power

- Anaerobic or maximum muscular power (high-speed strength)
 - Related to the ability of muscle tissue to exert high force while contracting at a high speed (also called *maximal anaerobic muscular power* or *anaerobic power*)
 - May include vertical jump height and time to sprint up a staircase



Muscular Endurance

- Anaerobic capacity
 - Maximal rate of energy production by the combined phosphagen and anaerobic glycolytic energy systems for moderate-duration activities
- Local muscular endurance
 - Ability of certain muscles or muscle groups to perform repeated contractions against a submaximal resistance

Improve Muscular fitness through **Resistance Training**



NEEDS ANALYSIS



EXERCISE
SELECTION



TRAINING
FREQUENCY



EXERCISE ORDER



TRAINING LOAD
AND REPETITIONS



VOLUME



REST PERIODS

Step 1: Needs Analysis

- Needs analysis is a two-stage process that includes
 - An evaluation of the requirements and characteristics of the sport/activity
 - An assessment of the athlete/client

Step 1: Needs Analysis *(continued)*

- Evaluation of the sport/activity
 - Movement analysis: body and limb movement patterns and muscular involvement
 - Physiological analysis: strength, power, hypertrophy, and muscular endurance priorities
 - Injury analysis: common sites for joint and muscle injury and causative factors

Step 1: Needs Analysis *(continued)*

- Assessment of the athlete/client
 - Training status
 - Type of training program
 - Length of recent regular participation in previous training programs
 - Level of intensity involved in previous training programs
 - Degree of exercise technique experience

Step 2: Exercise Selection

- Choosing exercises for a resistance training program requires knowing
 - The movement and muscular requirements of the sport/activity
 - An athlete's exercise technique experience
 - Equipment available
 - The amount of training time available

Step 2: Exercise Selection *(continued)*

- Exercise type
 - Core exercises
 - Recruit one or more large muscle areas
 - Involve two or more primary joints
 - Receive priority because of their direct application to the sport
 - Assistance exercises
 - Recruit smaller muscle areas
 - Involve only one primary joint
 - Considered less important to improving performance

Step 2: Exercise Selection *(continued)*

- Exercise type
 - Structural exercises
 - Emphasize loading the spine directly or indirectly
 - Power exercises
 - Structural exercises that are performed very quickly or explosively

Step 2: Exercise Selection *(continued)*

- Movement analysis of the sport/activity
 - Sport-specific exercises
 - The more similar the training activity is to the actual sport movement, the greater the likelihood that there will be a positive transfer to that sport.
 - This concept is called training *specificity* or *specific adaptation to imposed demands* (SAID).

Step 2: Exercise Selection

- Movement analysis of the sport/activity
 - Muscle balance
 - *Agonist*: The muscle or muscle group actively causing the movement
 - *Antagonist*: The sometimes passive muscle or muscle group located on the opposite side of the limb
 - Exercises to promote recovery
 - Do not involve high muscular stress or high stress on the nervous system
 - Promote movement and restoration

Step 2: Exercise Selection *(continued)*

- Exercise technique experience
 - Do not assume that an athlete/client will perform an exercise correctly.
 - If there is any doubt, have the athlete/client demonstrate the exercise, and provide instruction as needed.
- Availability of resistance training equipment
- Available training time per session
 - Prioritize time-efficient exercises when time is limited.

FOUNDATIONAL MOVEMENTS

Foundation Movement	Fundamental Sports Skills	Dance Skills	Activities of daily Living
Squat	Vertical Jump, sprint, hop, dodge, side gallop	?	?
Lunge	Sprint run, skip, hop, dodge, kick, static balance, catch, side gallop	?	?
Push Up	Overarm throw, strike	?	?
Pull Up	Throw, catch, strike	?	?
Hinge	Vertical jump, overarm throw, kick, dodge	?	?
Rotation	Sprint run, overarm throw, kick	?	?
Brace	Static balance, overarm throw, kick, sprint run, dodge	?	?

Step 3: Training Frequency

- Training frequency is the number of training sessions completed in a given time period.
- For a resistance training program, a common time period is one week.

(continued)

Step 3: Training Frequency *(continued)*

- Training status
 - Training status affects the number of rest days needed between sessions.
 - A frequency of three workouts per week is recommended for many athletes to allow sufficient recovery between sessions.

**TABLE 17.4 Resistance Training Frequency
Based on Training Status**

Training status	Frequency guidelines (sessions per week)
Beginner	2-3
Intermediate	3-4
Advanced	4-7

Data from references 24, 26, 27, 28, 37, and 47.

Step 3: Training Frequency

- Training status
 - More highly resistance-trained (intermediate or advanced) athletes/clients can augment their training by using a split routine in which different muscle groups are trained on different days.

Step 3: Training Frequency

- Training load and exercise type
 - Athletes/clients who train with maximal or near-maximal loads require more recovery time before their next training session.

Step 3: Training Frequency *(continued)*

- Other training
 - Training frequency is influenced by the overall amount of physical stress.
 - Consider the effects of
 - Other aerobic or anaerobic training
 - Sport skill practice
 - Physically demanding occupations

Step 4: Exercise Order

- Exercise order is the sequence of resistance exercises performed during one training session.

Step 5: Training Load and Repetitions

- Relationship between load and repetitions
 - The heavier the load, the lower the number of repetitions that can be performed.
 - Load is commonly characterized as a percentage of a 1-repetition maximum (1RM) or as a repetition maximum (RM).

Key Terms

- load: Most simplistically refers to the amount of weight assigned to an exercise set; often characterized as the most critical aspect of a resistance training program.
- 1-repetition maximum (1RM): Greatest amount of weight that can be lifted with proper technique for only one repetition.
- repetition maximum (RM): Most weight lifted for a specified number of repetitions.

Step 5: Training Load and Repetitions

- 1RM and multiple-RM testing options
 - Testing the 1RM
 - 1RM testing requires adequate training status (intermediate or advanced) and experience with the exercises being tested.
 - Choose core exercises for 1RM testing.
 - Choose exercises that can accurately and consistently assess muscular strength and that allow the athlete to maintain correct body position throughout the testing.

Step 5: Training Load and Repetitions

- 1RM and multiple-RM testing options
 - Estimate a 1RM using a table
 - Estimate a 1RM using prediction equations
 - Equations are available to predict the 1RM from multiple-RM loads.
 - They are most accurate when based on low (≤ 10) multiple-RM testing (heavy loads).

Step 5: Training Load and Repetitions

- 1RM and multiple-RM testing options
 - Multiple-RM testing based on goal repetitions
 - Requires the strength and conditioning professional to first decide the number of repetitions (i.e., the goal repetitions) the athlete will perform in the actual program for the exercise being tested.

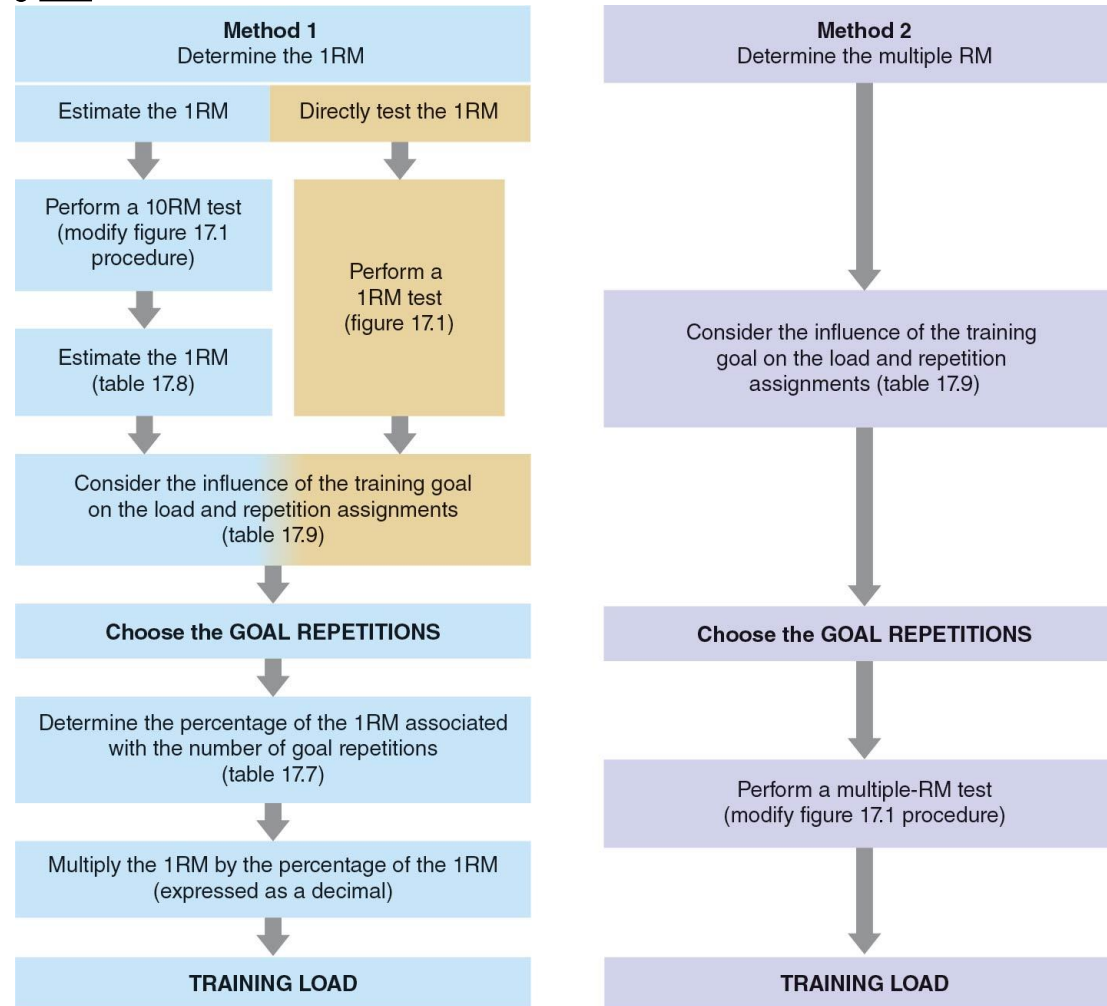
Step 5: Training Load and Repetitions *(continued)*

- Assigning load and repetitions based on the training goal
 - Once decided on, the training goal can be applied to determine specific load and repetition assignments via the RM continuum, a percentage of the 1RM, or the results of multiple-RM testing.

Assigning Training Loads and Repetitions

- Figure 17.2 (next slide)
 - Summary of testing and assigning training loads and repetitions

Figure 17.2



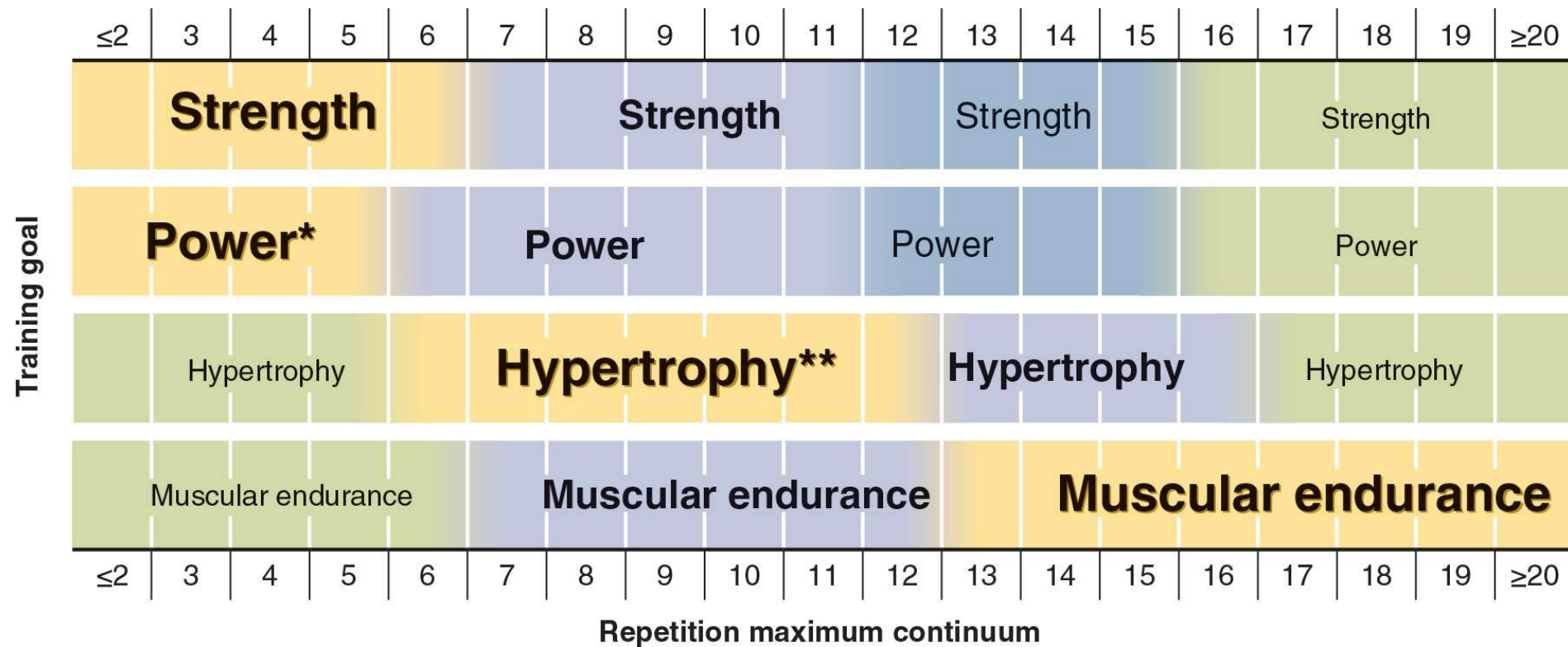
Step 5: Training Load and Repetitions

- Assigning load and repetitions based on the training goal
 - Repetition maximum continuum
 - Use relatively heavy loads if the goal is strength or power.
 - Use moderate loads for hypertrophy.
 - Use light loads for muscular endurance.
 - A certain RM emphasizes a certain outcome (indicated by the larger font sizes), but training benefits are blended at any given RM.

Repetition Maximum Continuum

- Figure 17.3 (next slide)
 - This continuum shows how RM ranges are associated with various training goals.

Figure 17.3



Step 5: Training Load and Repetitions

- Assigning load and repetitions based on the training goal
 - Percentage of the 1RM
 - The relationship between the percentage of the 1RM and the estimated number of repetitions that can be performed at that load.
 - The training goal is attained when the athlete lifts a load of a certain percentage of the 1RM for the goal number of repetitions.

Step 5: Training Load and Repetitions

- Assigning load and repetitions based on the training goal
 - Percentage of the 1RM
 - Particular load and repetition assignments are indicated for athletes training for *single-effort power events* (e.g., shot put, high jump, weightlifting) and for *multiple-effort power events* (e.g., basketball, volleyball).

(continued)

Step 5: Training Load and Repetitions *(continued)*

- Variation of the training load
 - “Heavy day” loads are designed to be full repetition maximums, the greatest resistance that can be successfully lifted for the goal number of repetitions.
 - The loads for the other training days are reduced to provide recovery after the heavy day while still maintaining sufficient training frequency and volume.

(continued)

Step 5: Training Load and Repetitions *(continued)*

- Progression of the training load
 - Timing load increases
 - As the athlete adapts to the training stimulus, loads must be increased so that improvements will continue over time.
 - Monitoring each athlete's training and response helps the strength and conditioning professional know when and to what extent loads should be increased.

Key Terms

- volume: The total amount of weight lifted in a training session.
- set: A group of repetitions sequentially performed before the athlete stops to rest.
- repetition-volume: The total number of repetitions performed during a workout session.
- volume-load: The total number of sets multiplied by the number of repetitions per set, multiplied by the weight lifted per rep.

Step 6: Volume

- Multiple versus single sets
 - Single-set training may be appropriate for untrained individuals or during the first several months of training.
 - But many studies indicate that higher volumes are necessary to promote further gains in strength, especially for intermediate and advanced resistance-trained athletes.

Step 6: Volume *(continued)*

- Training status
 - It is appropriate for an athlete to perform only one or two sets as a beginner and to add sets as he or she becomes better trained.

Step 6: Volume *(continued)*

- Primary resistance training goal
 - Training volume is directly based on the resistance training goal.

Table 17.11

TABLE 17.11 Volume Assignments Based on the Training Goal

Training goal	Goal repetitions	Sets*
Strength	≤6	2-6
**Power:		
Single-effort event	1-2	3-5
Multiple-effort event	3-5	3-5
Hypertrophy	6-12	3-6
Muscular endurance	≥12	2-3

*These assignments do not include warm-up sets and typically apply to core exercises only (2, 45).

**Based on weightlifting-derived movements (clean, snatch, and so on). The load and repetition assignments shown for power in this table are *not consistent* with the %1RM–repetition relationship. In nonexplosive movements, loads equaling about 80% of the 1RM apply to the two- to five-repetition range. Refer to the discussion of assigning percentages of the 1RM for power training for further explanation.

Data from references 20, 32, 86, 91, and 92.

Step 6: Volume

- Primary resistance training goal
 - Strength and power
 - Volume assignments for power training are typically lower than those for strength training in order to maximize the quality of exercise.

Step 6: Volume *(continued)*

- Primary resistance training goal
 - Hypertrophy
 - Increases in muscular size are associated with higher training volumes and performing three or more exercises per muscle group.
 - Muscular endurance
 - Programs for muscular endurance involve many repetitions (12 or more) per set, lighter loads, and fewer sets.

Step 7: Rest Periods

- The time dedicated to recovery between sets and exercises is called the *rest period* or *inter-set rest*.
- The length of the rest period between sets and exercises is highly dependent on the goal of training, the relative load lifted, and the athlete's training status.

Table 17.12

**TABLE 17.12 Rest Period Length Assignments
Based on the Training Goal**

Training goal*	Rest period length
Strength	2-5 min
Power: Single-effort event Multiple-effort event	2-5 min
Hypertrophy	30 s to 1.5 min
Muscular endurance	≤30 s

*Because there are occasions when the prescribed percentage of the 1RM for assistance exercises falls outside the range associated with the training goal (e.g., ≥8RM loads are recommended for assistance exercises as part of a muscular strength training program [2]), the strength and conditioning professional should examine the loads used for each exercise when assigning rest periods rather than generally applying the guidelines for a training goal.

Data from references 20, 47, 50, 86, and 96.

Step 7: Rest Periods

- Strength and power
 - Maximal or near-maximal loads require longer rest periods.
 - Guidelines range from 2 to 5 minutes.

Step 7: Rest Periods *(continued)*

- Hypertrophy
 - Short to moderate rest periods are required.
 - Typical strategies range from 30 seconds to 1.5 minutes.
- Muscular endurance
 - Very short rest periods of 30 seconds or less are required.

Principles of Anaerobic Exercise Prescription

- Resistance training program design variables
 - Needs analysis
 - Exercise selection
 - Training frequency
 - Exercise order
 - Training load and repetitions
 - Volume
 - Rest periods

Reference List

American College of Sports Medicine (ACSM). (2018). *ACSM's Guidelines for Exercise Testing and Prescription* (10th ed.). Wolters Kluwer.

Haff, G. G., & Triplett, N. T. (2015). *Essentials of Strength Training and Conditioning* (4th ed.). Human Kinetics.

Wilmore, J. H., & Costill, D. L. (2018). *Physiology of Sport and Exercise* (7th ed.). Human Kinetics.