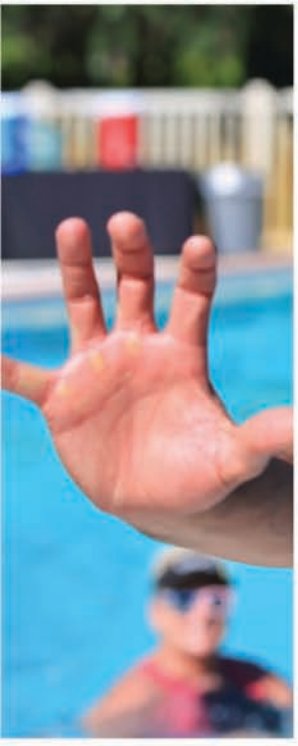

AEA Aquatic Exercise Association

Aquatic Fitness Professional Manual

The comprehensive resource for all aquatic fitness instructors and AEA certification

Seventh Edition

Aquatic Fitness Professional Manual

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Human Kinetics
P.O. Box 5076
Champaign, IL 61825-5076
Website: www.HumanKinetics.com

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AEA Mission Statement and Purpose

Our Mission

The Aquatic Exercise Association (AEA) is a nonprofit organization committed to the advancement of aquatic fitness, health and wellness worldwide.

Our Purpose

AEA is committed to increasing awareness, education, and networking opportunities to benefit professionals as well as the general public. With AEA, achieving healthy lifestyles through aquatic fitness is a global team effort.

AEA desires to embrace cultural diversity in our industry to assure that individuals worldwide can enjoy and employ the benefits of aquatic fitness program regardless of age, ability, goals, or interests.

Purpose of Certification

The aquatic fitness professional certification was developed to increase public health, safety, and confidence in aquatic fitness programming led by certified professionals.

The aquatic fitness professional certification is designed to test a standard level of theoretical and practical competence and skill for aquatic fitness professionals to assure the highest level of programming and implementation to a wide range of participants.

The aquatic fitness professional certification offers certified professionals confidence and security through superior standards and current research implementation.

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Acknowledgments

The Aquatic Exercise Association (AEA) acknowledges that education is a continuous process. Additionally, knowledge must be shared for it to expand and develop. Fitness is a dynamic field that is ever-changing, and thus requires an open mind and a willingness to continue learning.

This manual is dedicated to aquatic fitness professionals in every country who continue to share their time, talent, and passion to achieve the common goal of global health and quality of life through aquatic exercise.

AEA thanks everyone who has supported aquatic fitness, especially those who have been instrumental in making this educational manual possible.

Introduction

Welcome to the field of aquatic fitness—a vast array of programming options to enhance health and well-being for all ages and abilities. Although water exercise can encompass a wide variety of activities, this manual specifically targets vertical exercise in both shallow and deep water.

Exciting trends continue to emerge in the fitness industry, and aquatic fitness is at the forefront with reduced-impact yet challenging options for group exercise, small-group fitness, and personal training. The properties of water further enhance the benefits of many popular fitness formats, such as cycling, equipment-specific training, circuits, intervals (including HIIT), boot camp training, martial arts, yoga, Pilates, muscle conditioning, walking and jogging, functional fitness, and programs specific for various chronic conditions. Aquatic fitness no longer targets just the senior population. Safe and effective programs can be found for all age groups, including infants, children, teens, young adults, and, of course, the baby boomers.

This manual provides an excellent resource for fitness professionals and students seeking knowledge in aquatic fitness applications, education, and training. AEA sincerely hopes that the following pages inspire you to review, learn, and update those skills necessary to share the benefits of aquatic fitness with others effectively. As an association comprised of aquatic fitness professionals, therapists, personal trainers, athletic trainers, coaches, facility directors and managers, and aquatic fitness participants – may we all work together in the pursuit of a healthier global community.

Part I

Foundations of Fitness and Exercise

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Chapter 1

Physical Fitness

Introduction

This chapter highlights the components of physical fitness. Physical fitness describes physical activity with a purpose: the desire to maintain or improve functional capacity or a predetermined fitness level. Guidelines are outlined for the recommended quantity and quality of exercise for developing and maintaining overall fitness in healthy adults. The benefits of regular exercise and moderate-intensity physical activity are discussed as well as their effect on overall health and prevention of chronic disease.

Key Chapter Concepts

- Understand the differences between physical activity, exercise, and physical fitness.
- Define the major health-related components of physical fitness.
- Understand the 2018 American College of Sports Medicine guidelines regarding frequency, intensity, time, type, volume, and progression (FITT-VP) of exercise.
- Understand common methods for monitoring exercise intensity, including rating of perceived exertion and the application of the Kruel Aquatic Heart Rate Deduction.
- Explain the differences between continuous, interval, and circuit training formats.
- Recognize the physiological and psychological benefits of regular exercise as well as the specific benefits associated with aquatic-based exercise.

Physical Activity, Exercise, and Physical Fitness

The **American College of Sports Medicine (ACSM)** defines **physical activity** as movements of the body created by skeletal muscle contractions that result in a substantial increase of energy expenditure compared to resting levels. **Exercise** is a type of physical activity consisting of repetitive movement that is planned and structured to maintain or improve one or more fitness components. **Physical fitness** is a specific set of health-related and skill-related traits associated with the ability to perform physical activity.

Lack of physical activity is considered the fourth leading risk factor for global mortality (6% of deaths) following high blood pressure, the use of tobacco, and elevated blood **glucose** levels (WHO 2009). The U.S. Department of Health and Human Services' 2008 *Physical Activity Guidelines for Americans* describe the major research findings on the health benefits of physical activity:

- Regular physical activity reduces the risk of many adverse health outcomes.
- Some physical activity is better than none.
- For most health outcomes, additional benefits occur as the amount of physical activity increases through higher intensity, greater frequency, or longer duration.
- Most health benefits occur with at least 150 minutes (2 hours and 30 minutes) a week of moderate intensity physical activity, such as brisk walking. Additional benefits occur with more physical activity.
- Both aerobic (endurance) and muscle-strengthening (resistance) physical activities are beneficial.
- Health benefits occur for children and adolescents, young and middle-aged adults, older adults, and those in every studied racial and ethnic group.
- The health benefits of physical activity occur for people with disabilities.
- The benefits of physical activity far outweigh the possibility of adverse outcomes.

According to the Centers for Disease Control and Prevention (CDC), only about one in five American adults are meeting these physical activity guidelines (CDC 2014). However, evidence shows a relationship between increased physical activity and decreased risk for premature death, **stroke**, **hypertension**, type 2 diabetes, falls, and some types of **cancer**, as well as improvements in cognitive function, depression, and functional health (ACSM 2018). Organizations such as the American Cancer Society (ACS), American Heart Association (AHA), and National Heart, Lung, and Blood Institute (NHLBI) also support the importance of physical activity.

Health-Related Components of Physical Fitness

When designing a program to improve physical fitness and health, consider including aerobic, resistance, **flexibility**, and neuromotor exercise training (ACSM 2018). The ACSM exercise guidelines are the recommended targets based on scientific evidence that will provide benefits to most people. Some participants may not be able to include all of the components at the recommended levels.

Major health-related components of physical fitness:

- Cardiorespiratory endurance
- Muscular strength
- Muscular endurance
- Flexibility
- Body composition
- Neuromotor exercise

A fitness instructor must understand all the components that affect a person's fitness level

and must be able to design a program that promotes or enhances all components.

Cardiorespiratory Endurance

Cardiorespiratory endurance is defined as the capacity of the cardiovascular and respiratory systems to deliver oxygen to the working muscles for sustained periods of energy production. **Cardiorespiratory fitness** describes the body's physical capacity to supply fuel and eliminate waste in order to perform large muscle movement over a prolonged period of time.. Cardiorespiratory fitness is often termed **aerobic fitness**.

Muscular Strength

Muscular strength is defined as the maximum force that can be exerted by a muscle or muscle group against a resistance in a single effort, referred to as **one-repetition maximum** (one-rep max or 1RM). Added resistance is needed for training for muscular strength; generally, this is achieved by adding equipment. In the water, resistance is influenced by the amount of **buoyancy**, **drag**, or weight being moved as well as the velocity or speed at which the movement is performed.

Training for strength involves greater resistance with fewer repetitions. Although no optimal number of sets and repetitions has been found to elicit maximal strength gains, the accepted range indicated by research for land-based exercise appears to be somewhere between two and five sets of 2 to 10 repetitions at an all-out effort (Fleck and Kraemer 2003). Aquatic resistance training has been found to elicit strength improvements in both genders and various age groups (Pöyhönen et al. 2002; Tsourlou et al. 2006; Colado et al. 2009).

Muscle **hypertrophy** is the term used to describe an increase in the size or girth of muscle tissue. Muscle **atrophy** is the term used to describe the loss or wasting of muscle tissue through lack of use or disease. Both hypertrophy and atrophy can be addressed through proper training unless an underlying clinical condition exists. Muscular hypertrophy can be enhanced and atrophy can be slowed or halted.

Muscular Endurance

Muscular endurance is defined as the capacity of a muscle to exert force repeatedly or to hold a fixed or static contraction over time. Muscular endurance is assessed by measuring the length of time the muscle can hold a contraction or by counting the number of contractions performed in a given length of time.

Once again, there is no optimal number of sets and repetitions for building muscular endurance. As with strength gains, training programs should be individualized and varied to achieve the best results. When focusing on endurance gains, multiple repetitions are usually recommended in sets of 12 to 20 repetitions or more (Van Roden and Gladwin 2002; Coburn and Malek 2012). These sets differ in intensity from the all-out effort in strength training because the goal is to gradually fatigue the muscle over the course of multiple repetitions.

Using the resistance of the water is an excellent way to promote and maintain muscular endurance. Resistance can be progressively increased by applying more force against the water's resistance, increasing the surface area or lever length, or by adding equipment.

> Although it is possible to train specifically for muscular strength or endurance, these two components of fitness are not independent of each other.

Flexibility

Flexibility is defined as the ability of limbs to move at the joints through a complete **range of motion (ROM)**. Flexibility is important in the reduction of the risk of injury as well as for general body mobility. A decrease in flexibility can lead to impaired movement and

an inability to perform **activities of daily living (ADLs)**. Loss of flexibility occurs as a natural part of the aging process or as the result of sedentary lifestyles, trauma, injury, or surgery. In order to maintain flexibility, the joints must be taken through their full range of motion on a regular basis.

Immediately following an exercise program is the best time to stretch to maintain and improve flexibility because the muscles are warm and pliable and filled with oxygenated blood. Stretching after exercise is critical for every type of exercise program, including aquatic fitness programs. It is also imperative to stretch correctly.

Ballistic stretching uses momentum of the body part to create the stretch. This type of stretching is generally not recommended for a general fitness class, but may have applications to individuals who engage in activities that require ballistic movements. Ballistic stretching activates the **muscle spindles**, specialized receptors in the muscle that monitor muscle length change and the speed of length change. Muscle spindles stimulate a muscle contraction to prevent overstretching, which might damage the muscle fibers; this is referred to as the **stretch reflex**. Ballistic stretching can oppose the desired effect of stretching by tightening rather than lengthening the muscle.

Static stretching involves slowly stretching to the point of tightness or mild discomfort and holding the elongated position for a period of time. Static stretching is the preferred method for enhancing flexibility for the general population. When performed properly, static stretching does not activate the stretch reflex; therefore, muscles relax and lengthen. Although generally recommended as a safe and effective option, intense static stretching has been shown to reduce maximum force production for up to one hour after the static stretch (Evetovich, Nauman, Conley, and Todd 2003; Young and Behm 2003). Thus, static stretching prior to training or competition might hinder athletic performance in activities that require maximum power, although it would remain acceptable after exercise.

Rhythmic or dynamic stretching involves moving body parts through the full range of motion in a slow, controlled manner. Instead of stopping and holding a static stretch, you may pause briefly in an extended or stretched position before continuing through the full range of motion. For example, a slow front kick with a pause in front will help to lengthen the gluteal and hamstring muscles. Each individual must recognize and respect the normal range of motion and not overstretch to avoid activating the stretch reflex. Rhythmic stretching is generally preferred over static stretching prior to the main segment of the workout. In the pool, adequate heat can be generated during rhythmic stretching to keep participants comfortable and maintain warmth in muscle tissue during the warm-up stage of the workout.

Body Composition

Body composition is defined as the body's relative percentage of fat as compared to lean tissue (bones, muscles, and organs). It is desirable to build and maintain a reasonable level of lean muscle tissue. Adequate levels of muscle tissue increase stamina and strength and boost metabolism. Having too high a relative percentage of fat increases your risk of heart disease, cancer, and other metabolic diseases. Storing excess subcutaneous fat can also impair physical performance and inhibit quality of life.

The aquatic environment can help develop both a favorable body composition and overall physical fitness. Aerobic exercise in the aquatic environment promotes fat loss while working against the three-dimensional resistance of the water builds lean tissue or muscle mass (Colado et al. 2009, Kieres and Plowman 1991, Kravitz and Mayo 1997).

Neuromotor Exercise or Functional Fitness Training

Neuromotor exercise, also referred to as functional fitness training, might include activities to target skill-related components of agility, balance, and coordination; gait

training; proprioceptive exercises; and multifaceted activities such as Tai Chi. Though it is comprised of many of the skill-related components of fitness (see next section), neuromotor exercise is different in its goal and how that goal is trained. The primary goal is function, or the ability to perform normal, everyday tasks. The purpose is to allow the body to adapt to daily scenarios that involve movement diversity while having to think through the movement strategy, provide a movement focus, or adjust the movement due to an external stimulus. Various targeted skills are trained simultaneously (instead of targeting one specific skill at a time) to provide more complex activities that challenge physical ability and mental agility at the same time.

Neuromotor exercises have been shown to reduce the risk of falls as well as the fear of falling among older adults. Although the effectiveness of neuromotor exercise training for younger and middle-aged adults has not been established through research, there is probable benefit, especially for individuals who participate in specific activities and sports that require balance, agility, and other motor skills (ACSM 2014). Tai Chi, Ai Chi, Pilates, and yoga are programming options that focus on neuromuscular skills. Incorporating more complex activities of daily living into existing workout routines may also benefit these fitness parameters. (See chapter 11 for more information on Tai Chi, Ai Chi, Pilates and yoga.)

The aquatic environment can offer a comfortable and safe environment for neuromotor exercises, as the risk for falls is lessened while the body is immersed in the water due to buoyancy and reduced gravity (Douris, et al. 2003; Arnold and Faulkner, 2010; Arnold, et al. 2008; Avelar, et al. 2010).

Skill-Related Components of Physical Fitness

In addition to the major health-related components of physical fitness, there are also several **skill-related components of fitness**. These include agility, balance, coordination, power, reaction time, and speed (Sova 2000, The President's Council on Physical Fitness and Sports 2000).

Agility is the ability to change body positioning in space rapidly, quickly, and accurately. **Balance** is the maintenance of equilibrium while stationary (static balance) or moving (dynamic balance). **Coordination** integrates the senses (such as hearing and vision) with movements of the body to smoothly and accurately perform motor tasks. **Power**, a function of strength and speed is the ability to transfer energy into force at a quick rate. The amount of time elapsed between stimulation and acting on the stimulus is **reaction time**, and **speed** is the rate at which a movement or activity can be performed.

Athletes train for these skill-related components primarily to enhance performance in their sport; yet the same components are also important aspects of everyday life. Many of these components are included within an aquatic fitness class, during transitions, in tempo changes, with one-footed moves and so on, and are developed and improved through practice and repetition.

Guidelines for Exercise

Lifestyle diseases have become prevalent in many developed countries due to the population becoming more sedentary and physically inactive, adopting poor eating habits, and being exposed to more environmental hazards. Since the 1940s, long-term or epidemiological research has been conducted in the United States in order to discover which lifestyle factors increase or decrease the risk of various diseases. These types of studies continue to be conducted today. One of the most famous epidemiological studies is the Framingham Study, in which several generations of families in the town of Framingham, Massachusetts, have been studied to monitor risk factors for disease—cardiovascular disease, in particular. A sedentary lifestyle, or physical inactivity, was determined to elevate risk for cardiovascular disease and cancer as

well as contribute to elevating risk for many other diseases.

Following the Framingham study, studies were conducted in which researchers collected metabolic and other data to determine the amount and type of exercise necessary to significantly lower risk of disease. The ACSM 2018 recommendations on the quantity and quality of exercise for adults, consistent with the recommendations found in the 2008 Physical Activity Guidelines for Americans (US Department of Health and Human Services), indicate the need for adults to engage in at least 150 minutes of moderate-intensity exercise each week. ACSM points out that it is also important to monitor how much time the individual is sedentary during the day, such as watching television or sitting at a desk.

The 10th edition of ACSM's Guidelines for Exercise Testing and Prescription (2018) designed as a primary resource for professionals that conduct exercise testing and design exercise programs. These guidelines will assist health and fitness professionals in exercise programming through recommendations for the quantity and quality of training needed to develop and maintain cardiorespiratory endurance, muscular strength and endurance, flexibility, and neuromotor exercise in the healthy adult. These recommendations include frequency, intensity, time, and type of exercise as well as recommendations for exercise volume and progression – referred to as the FITT-VP principle.

Frequency

Frequency is how often you exercise or train.

- **Cardiorespiratory Endurance.** Moderate-intensity cardiovascular exercise at least five days a week, or vigorous-intensity training at least three days per week, or a weekly combination of three to five days a week blending moderate and vigorous activities.
- **Muscular Strength and Endurance.** Two to three days per week for each major muscle group. Additionally, at least 48 hours should separate the training sessions for each muscle group to allow adequate recovery and muscle development.
- **Flexibility.** At least two to three days per week is recommended, with the greatest benefits seen with daily stretching. Stretching is most effective when muscles are warm.
- **Neuromotor Exercise.** At least two to three days per week is recommended.

Intensity

Intensity is how hard you exercise.

- **Cardiorespiratory Endurance.** Moderate or vigorous-intensity exercise is recommended for most adults, although deconditioned individuals may benefit from light to moderate intensity exercise.
- **Muscular Strength and Endurance.** Intensity of training will vary based upon the individual's experience with resistance training, age, ability levels and overall goals (endurance, strength or power). For strength gains, two to four sets of 8-12 repetitions (resistance equivalent to 60-80% 1RM) are recommended for most adults. A single set of 10-15 repetitions (resistance equivalent to 40-50% 1RM) is recommended for strength improvements in deconditioned and older adults who are beginning an exercise program. For endurance training, two or more sets of 15-25 repetitions with an intensity that should not exceed resistance equivalent to 50% 1RM are recommended.
- **Flexibility.** Stretching exercises should be performed to the point of mild discomfort within the individual's range of motion. This is generally perceived as the point of tightness.
- **Neuromotor Exercise.** An effective intensity has not been determined.

Time

Time refers to duration, or how long you exercise.

- **Cardiorespiratory Endurance.** Accumulate 30-60 minutes per day of moderate intensity exercise to accumulate a weekly total of at least 150 minutes, or 20-60 minutes per day of vigorous intensity exercise to accumulate a weekly total of at least 75 minutes, or a combination of moderate and vigorous exercise to achieve the recommended target volumes of exercise. Recommended durations can be achieved through one continuous session or bouts of exercise (10 minutes or more) throughout the day. Individuals unable to perform the recommended duration of exercise may still benefit from a shorter duration.
- **Muscular Strength and Endurance.** No specific length of time for training has been determined for optimum effectiveness.
- **Flexibility.** Hold static stretches 10-30 seconds for most adults; 30-60 seconds may be more beneficial for older adults. Perform each stretch 2-4 times to achieve approximately 60 seconds per joint. Note, in the pool both static and dynamic stretches may be used based upon environmental concerns.
- **Neuromotor Exercise.** 20-30 minutes or more per week is currently suggested.

Type

Type describes the mode of exercise being performed.

- **Cardiorespiratory Endurance.** Rhythmic activities that use large muscle groups and can be maintained continuously (aerobic). Aerobic activities are varied and aquatic options include swimming, deep-water running, many shallow-water exercise programs (e.g., kickboxing, martial arts, and aquatic dance formats), aquatic cycling, and walking (shallow water and underwater treadmills). Selected activities should reflect the individual's interests and goals, and be chosen to accommodate the level of fitness and skill.
- **Muscular Strength and Endurance.** All adults should participate in a resistance-training program that includes a combination of multi-joint exercises (involving more than one muscle group) and single-joint exercises. Various types of resistance equipment can be used; aquatic options include drag, buoyancy, weighted, and rubberized (bands, loops and tubing). Aquatic equipment is discussed in more detail in chapter 4 and appendix C.
- **Flexibility.** A series of flexibility exercises targeting the major muscles using a variety of techniques is suggested to improve joint ROM. Environmental considerations of the pool, in particular water and air temperatures, can influence the choice of stretching techniques used.
- **Neuromotor Exercise.** Specific exercises that involve balance, agility, coordination, gait training, or proprioception skills provide neuromotor exercises. Examples include multifaceted activities such as Tai Chi and yoga.

Volume

The **volume** of exercise is based on the total amount of exercise achieved during one week. The volume for cardiovascular and flexibility exercise is the recommended duration or time listed above. The volume for muscular strength and endurance exercises is the sets and reps listed above. According to ACSM, the volume for neuromotor exercise has not yet been determined.

Progression

Progression refers to the rate of advancement of exercise and is dependent upon the individual's health, fitness level, training responses and exercise goals. Progression can be achieved by increasing frequency, intensity, time and type of exercise. The recommended progression for cardiovascular exercise is