Physiological Changes During Aging

The human body experiences functional declines from the normal aging process.

Adults with a sedentary lifestyle experience quicker degradation of physiological functions and face a greater risk of premature death than adults who exercise regularly (Hurley, Hanson & Sheaff 2011; Bryant & Green 2009; Taylor & Johnson 2008).

Physiological Change	Description	Outcome
functions totally lost	hearing	Loss of auditory ability occurs at certain frequencies or volumes.
	menstrual cycle	A component of menopause, this loss is a normal biological change for women, altering the function of the endocrine system and the production of various hormones.
structural changes	sarcopenia—loss of muscle mass	After age 30, decreases in muscle cross-sectional area produce a strength loss of 10% per decade.
	osteoporosis—loss of bone mineral density	There is an increased risk of bone fractures, affecting both women and men.
	increase in inelastic collagen fibers	Collagen binds between layers of fascia and connective tissue, reducing muscle extensibility and limiting joint range of motion.
	thickening of heart's left ventricle and increasing stiffness of vascular structures	Resting stroke volume can decline 30% between 25 and 85 years old. Cardiac output and cardiorespiratory function decline. VO_2max can fall 8%–10% per decade after age 30.
reduced efficiency of normal physiological function	reduced conduction velocity in nerve fibers	There is a loss of neural control, specifically affecting the precision and timing of coordinated movements.
	loss of muscular strength and power	Muscle atrophy occurs due to underuse, specifically affecting type II fast-twitch fibers, which are responsible for force production.

The table shows how aging affects the human body. While aging is unavoidable, exercise can mitigate its effects and may actually promote healthier, more youthful physiological functions (Kraemer, Fleck & Deschenes 2012; Candow et al. 2011; Hurley, Hanson & Sheaff 2011; Taylor & Johnson 2008).

We were all taught that a well-rounded exercise program includes three components:

- cardiorespiratory exercise
- resistance training, for muscular strength
- stretching, to increase flexibility

Just being physically active is important, but following a program that includes all three components of exercise provides the greatest benefits.

Strength Training

Weightlifting is popular in the 35-44 and 45-54 age groups but drops off significantly beyond age 55. The National Strength and Conditioning Association suggests that strength training can improve strength and power for adults of all ages, given that the benefits of this type of exercise include preserving muscle mass and metabolic function (Baechle & Earle 2008).

Research comparing younger men to older men performing the same resistance training programs has found that the older men do experience strength gains and other benefits similar to those of the younger men (Candow et al. 2011; Hurley, Hanson & Sheaff 2011; McCrory et al. 2009; Baker et al. 2006; Harris et al. 2004). As one author suggests, "Resistance training may be the secret to keeping aging muscles young and aging adults functional and independent" (Kraemer, Fleck & Deschenes 2012).

Most adults have probably heard about these benefits, but many don't know how to start or participate in a program. Personal trainers who can effectively communicate the benefits of resistance training and incorporate it into fun, engaging exercise programs for adults over 35 can provide tangible fitness solutions for their clients.

Cardiorespiratory Training

~~It is nice to see from Table 2 that~~ many over-35 adults participate in aerobic exercise, which can improve cardiorespiratory function (by increasing stroke volume and cardiac output, a combination of stroke volume and heart rate), increase mitochondrial density and enhance the ability to extract oxygen from blood in the working muscles--all functions that degrade with age when people are not physically active (Bryant & Green 2009; Taylor & Johnson 2008).

Encouraging clients to challenge all three energy pathways--aerobic, glycolytic and ATP-PC--can yield benefits much more quickly. A gradual progression of exercise intensity toward high-intensity interval training (HIIT) featuring work intervals using the ATP-PC energy pathway and recovery intervals using the aerobic pathway is safe when done correctly and can provide many benefits, such as improving VO2max and aerobic efficiency in a shorter workout period.

Research has found that performing only a few minutes of high-intensity work intervals can yield improvements similar to those gained from longer periods of lower-intensity cardiorespiratory exercise (Bayati et al. 2011; Burgomaster et al. 2008; Helgerud et al. 2007; Laursen 2010). Owing to its strenuous workload, HIIT is not a recommended starting point, but it can be a goal to work toward for many masters athletes.

Flexibility Training

Flexibility is important to ensure that aging muscle, fascia and connective tissue remain pliable and elastic so that joints can articulate through their full ranges of motion. Lack of dynamic, multidirectional movement or overuse of repetitive movements can lead to the development of collagen cross-links, which limit muscle extensibility and ultimately inhibit range of motion in mobile joints. If muscle and fascia lose extensibility, they also lose the ability to lengthen rapidly and to store potential energy; as a result, the likelihood of a muscle straåin increases.

With masters athletes, exercises that involve dynamic flexibility (the ability to control joint motion through multiplanar movements) can generate the greatest results. Dynamic flexibility occurs throughout the range of motion of any exercise involving concentric and eccentric muscle actions (Schleip et al. 2012; Herman & Smith 2008). As agonist muscles contract concentrically, antagonists must eccentrically lengthen to allow motion to occur; this is the optimal type of flexibility exercise for all stages of the aging process.

It is also important to use a variety of movement speeds to ensure that muscle and fascia maintain or improve the ability to rapidly lengthen and store mechanical energy. Following a progression of plyometric exercises that maximize mechanical energy from a muscle can improve the function of fascia and connective tissues. If applied regularly, exercise loading that includes high-velocity movements can induce a more youthful collagen architecture, which also produces a significant increase in elastic storage capacity (Schleip et al. 2012; Myers 2011; Sayers & Gibson 2010).