

Clinical Exercise Physiology

Activity and Fitness: Health Benefits

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Presentation Content

- Health benefits of physical activity and fitness
- Relationships among physical activity, fitness, and health
- Mechanisms of lowering the risk and severity of chronic diseases such as heart disease, diabetes, and some cancers, through physical activity.
- Role of activity in arthritis, osteoporosis, and lower back problems
- Compare your current level of activity with recommended values
- Activity amount determination for health benefits to occur.

“Exercise is Medicine”

- Initiative launched in 2007 by American College of Sports Medicine (ACSM) and the American Medical Association (AMA)
 - The initiative acknowledges that physical activity is crucial to the prevention, management, and treatment of numerous chronic conditions, including heart disease, type 2 diabetes, obesity, high blood pressure, and some cancers.
 - Exercise has minimal side effects.
 - Exercise is more effective than any drug!
 - It is cost effective.

www.exerciseismedicine.org

Research Definitions

- Epidemiology – the study of epidemics
- Morbidity – sickness
- Mortality – death
- Retrospective studies – looking back in time to determine current outcomes
- Cross-sectional studies – looking at a current cross section of a population
- Prospective studies – following a group into the future to see what happens

More on Research

- We learn from all studies, but the best way to determine cause and effect is with prospective studies that have random assignments of participants to different interventions.
- Risk Ratio – Risk of developing a disease for an at-risk group compared to a population norm.

Example: In a prospective study of Harvard alumni, those with the least activity had 78.8 cardiovascular deaths per year per 10,000 study participants versus 43.0 for the most active, yielding a risk ratio of 54 percent.

(43.0 divided by 78.8 equals .54)

Coronary Artery Disease (CAD) is the #1 Killer of American Men and Women

- Heart attacks generally result from CAD.
- CAD is more correctly called *atherosclerosis*, a gradual narrowing of the coronary arteries due to plaque build-up.
- CAD begins during childhood and is accelerated by a number of primary risk factors.
- Eventually the narrowed coronary arteries cause reduced blood flow and the heart becomes *ischemic*, or short of oxygen.

Figure 1 CAD Risk Factors

Positively influenced by physical activity	May be influenced by physical activity	Not influenced by physical activity
Overweight and obesity High blood glucose Elevated blood lipids High blood pressure Physical inactivity	Electrocardiographic abnormalities Elevated uric acid and C-reactive protein Abnormalities in pulmonary (lung) function Some cancers Personality or behavior patterns (being hard driving, time conscious, aggressive, competitive, hostile) Psychic reactivity (reaction to stress)	Family history of heart disease Sex (men at greater risk until age 55) Cigarette smoking Poor food choices

Adapted from Sharkey 1974.

Exercise and Heart Attacks

- During exercise the heart needs greater blood flow to deliver adequate oxygen.
- In individuals with CAD, the heart becomes ischemic during exercise, which can provoke heart arrhythmias and a heart attack.

Exercise and Heart Attacks *(continued)*

- Heart attacks are more likely during any minute of exercise compared to non-exercise time. BUT
 - inactive people are 50 times more likely to have a heart attack during exercise, and
 - normally active people are only 5 times more likely to have a heart attack during exercise than when not exercising, and they are already at lower risk when they are not exercising than inactive individuals.

Inactivity and CAD

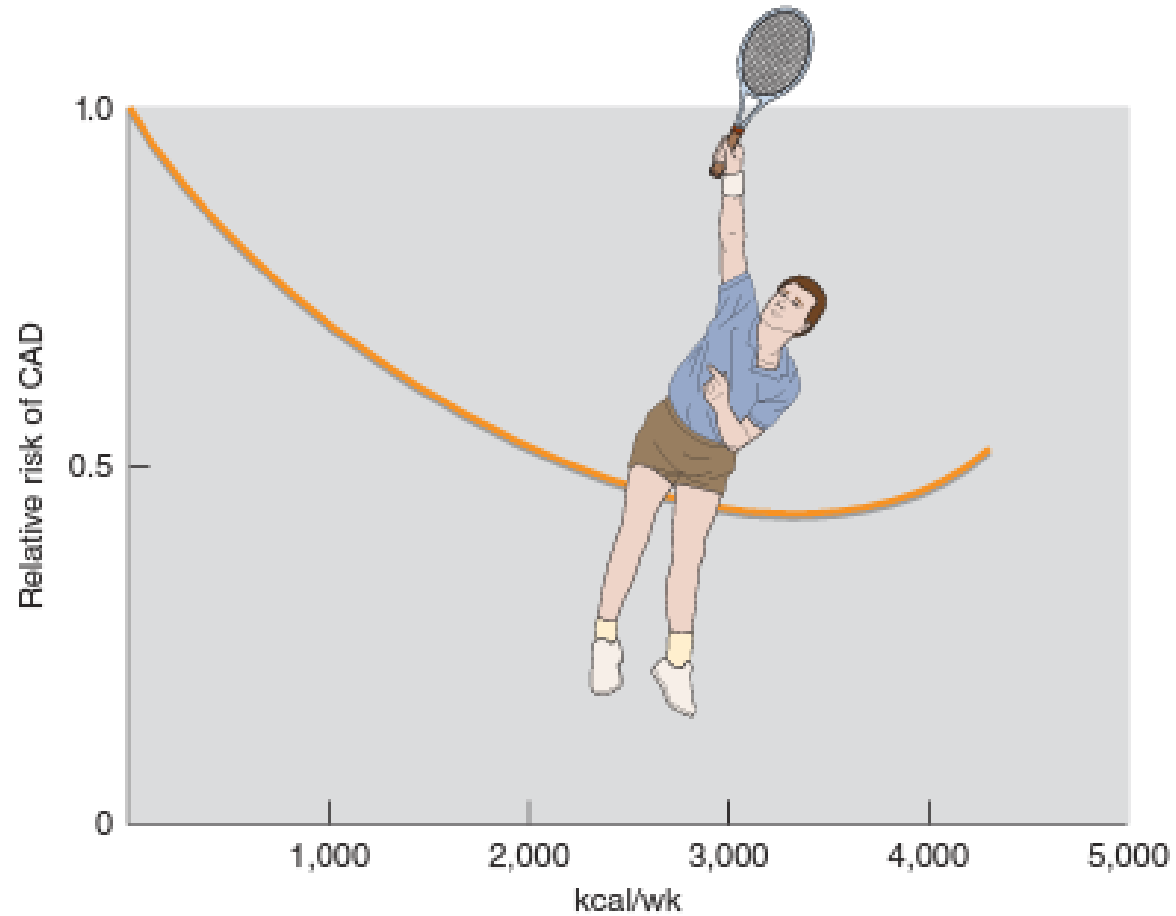
- London bus driver study – first big study

Active conductors had 30% lower incidence of CAD than did the inactive (sitting) drivers.

- Harvard alumni study – began in 1986 and still going

Individuals burning fewer than 1,000 calories a week in exercise had a 54% higher mortality or morbidity rate than the more active individuals, those who burned more than 1,000 calories a week.

Inactivity and CAD



Inactivity and CAD

- The Nurses Health Study is another large ongoing prospective study.

Women who exercised regularly (30 minutes of brisk walking or more a day) and who practiced other healthy behaviors and maintained a normal weight had a relative risk for CAD about 18% below the population average.

Clinical Considerations

- *Nutritional calorie* is the equivalent of a kilocalorie in normal energy terms.

Kilocalorie = amount of heat required to raise 1 kilogram of water (1 liter) 1 degree centigrade.

- The term *calorie* is used to refer to a *nutritional calorie* because it is the common usage, the one that one observes on food labels or diet books.

Energy Cost of Walking

- The average 150 lb person will burn about 100 nutritional calories for each mile walked.

Later in the book you will learn that the caloric cost of walking is about 100 calories x $\frac{2}{3}$ rd your weight in lbs.

- Every activity has a caloric cost, with more intense activities requiring more calories per minute.

Physical Activity Versus Fitness

- Physical fitness: In future chapters we will define this term, but for now accept that fitness is a result of both physical training and heredity.
- Thus, among sedentary individuals, there is a range of fitness from very poor to quite good. The same is true for more active individuals.
- In general, more active individuals have overall higher fitness than sedentary individuals.

Table 1

Table 1.1 Physical Activity Versus Fitness: Age-Adjusted Death Rates per 10,000 Men

Fitness group	Lowest	2	3	4	Highest
Sedentary (inactive) men	74	31	35	28	33
Active men*	13	8	14	16	13

*While the death rates for the active men vary slightly between fitness levels, there is no significant difference. Within the sedentary men, the lowest fitness group had twice the death rate compared to the other sedentary men. Remaining active reduces your overall mortality risk to one-third that of inactive people (Blair and Kohl 1988).

Discussion

- Does table 1 show that physical fitness is not associated with better health? In fact, when the sedentary and active subjects were analyzed together, the following data were obtained:

Fitness level	Death rate*	Relative risk
1 Lowest	64.0	1.0
2	25.5	.40
3 Medium	27.1	.42
4	21.7	.34
5 Highest	18.6	.29

(continued)

Discussion *(continued)*

- Moving from the lowest fitness level to some fitness confers the greatest health benefits.
- Becoming more fit continues to improve health (gradually lower the all-cause mortality rate).
- Studies show that moderate physical activity is necessary for achieving most health gains and that a large segment of the population can attain protection from many chronic diseases.

Exercise Cardioprotective Mechanisms

- Heart reduced workload
- Improved contractility of the cardiac muscle
- Increased blood volume
- Lower resting and exercise heart rates
- Higher stroke volume
- Slight increases in the concentration of aerobic enzymes

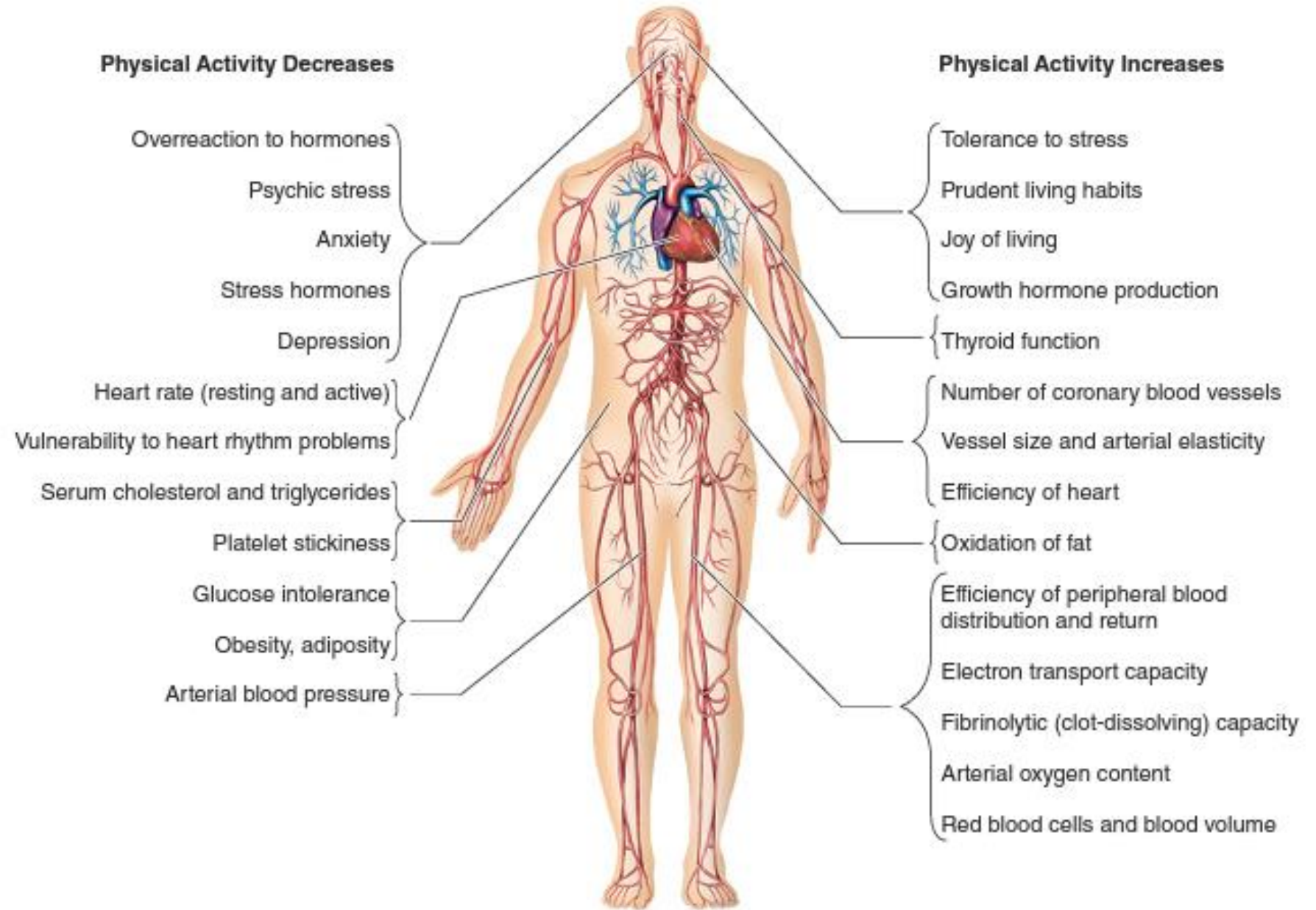
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Exercise Cardioprotective Mechanisms *(continued)*

- Increase in arterial diameters
- Increase in number of arterioles/capillaries
- Decrease in plaque formation
- Maintains elasticity of coronary arteries
- Increases the metabolism of fat
- Reduces circulating fat in the blood such as fatty acids and cholesterol

Exercise

Cardioprotective Mechanisms



Other Exercise Health Benefits

- Decreased blood clotting
- Attenuates age-associated decreases in arterial compliance (elasticity).
- Reduced blood pressure
- Improved blood distribution
- Increased blood volume

(continued)

Other Exercise Health Benefits *(continued)*

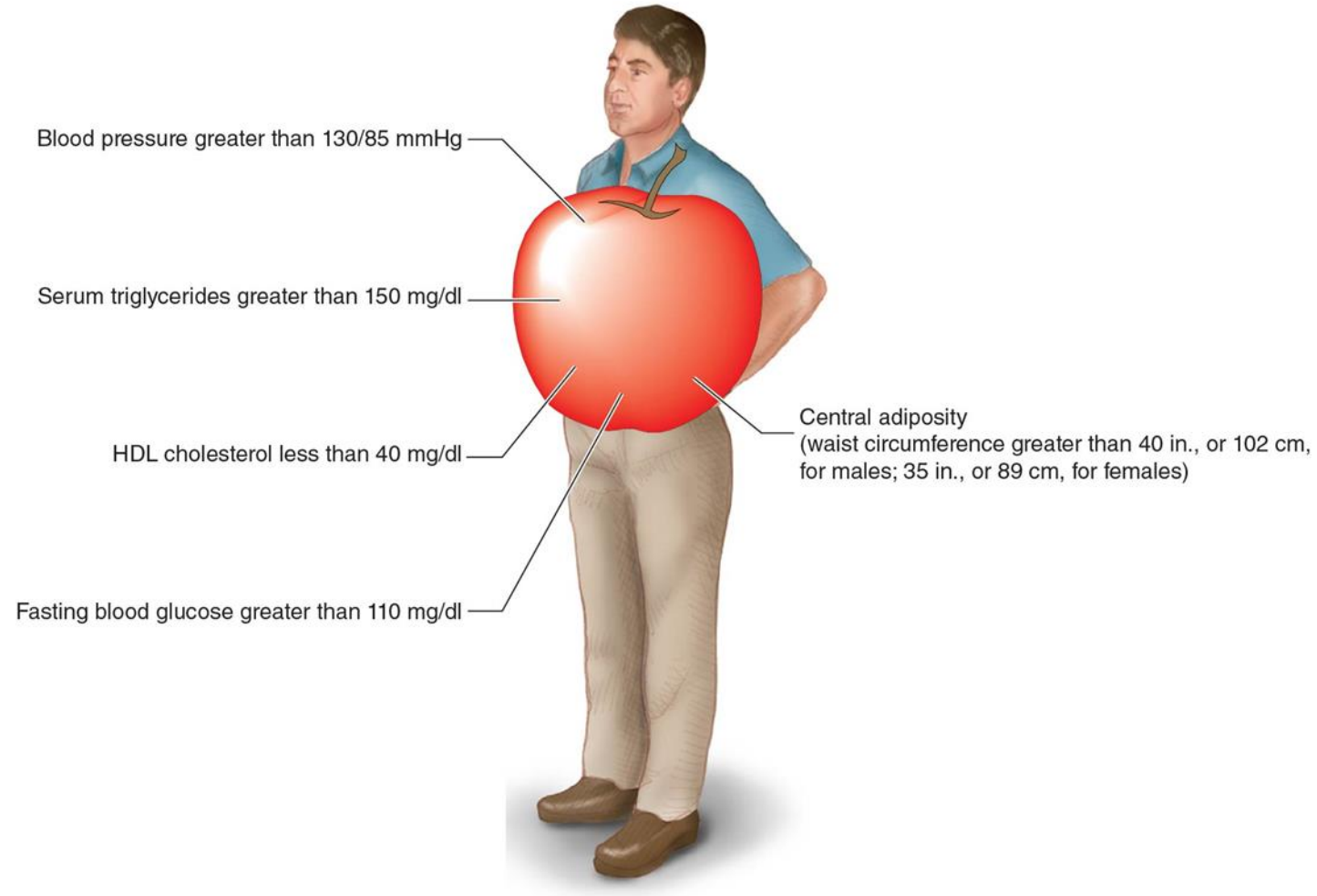
- Helps maintain normal body weight
- Improves ratio of total cholesterol to HDL cholesterol
- Improved insulin sensitivity and increased glucose tolerance resulting in reduced blood glucose
- Improved electrolyte balance

Activity and Other Chronic Disease

- Reduced hypertension
- Reduced strokes
- Decreased metabolic syndrome
- Decreases in some cancers
 - Colon, prostate, and breast are best documented decreases

(continued)

Figure 1 Metabolic Syndrome



Activity and Other Chronic Disease *(continued)*

- Reduces type 2 diabetes and controls the disease for those afflicted
- Improves bone density to reduce osteoporosis
- Essential in treatment of some arthritis
- Core exercises often the cure for back pain

Summary

- Many studies have shown the large benefits of physical activity, including reduction and control of many common chronic diseases.
- “Exercise is Medicine” shows many health benefits – far more than any one or even group of modern medical drugs.