

Exercise Prescription for Health & Fitness



Dr. Mustafa Qamar



Introduction

- Physical activity
 - Any form of muscular activity
 - Can reduce the risk of death from all causes
 - Physical inactivity is a primary risk factor for coronary heart disease
- Physical fitness
 - Set of attributes that relate to ability to perform physical activity
- Exercise
 - A subset of physical activity that is planned, with a goal of improving or maintain fitness

»»» In Summary

- Physical inactivity has been classified as a primary risk factor for coronary artery disease.
- Regular participation in physical activity can reduce the overall risk for those who smoke or who are hypertensive.
- Those who increase their physical activity and/or cardiorespiratory fitness have a lower death rate from all causes compared to those who remain sedentary.

»»» Dose-Response Relationships

- The effect (response) of the amount of a drug (dose)
 - Potency
 - Relatively unimportant characteristic
 - Slope
 - How much change in effect comes from a change in dose
 - Maximal effect
 - Efficacy
 - Variability
 - Effect varies between and within individuals
 - Side effect
 - Adverse effect

The Relationship Between Dose of a Drug and Effect

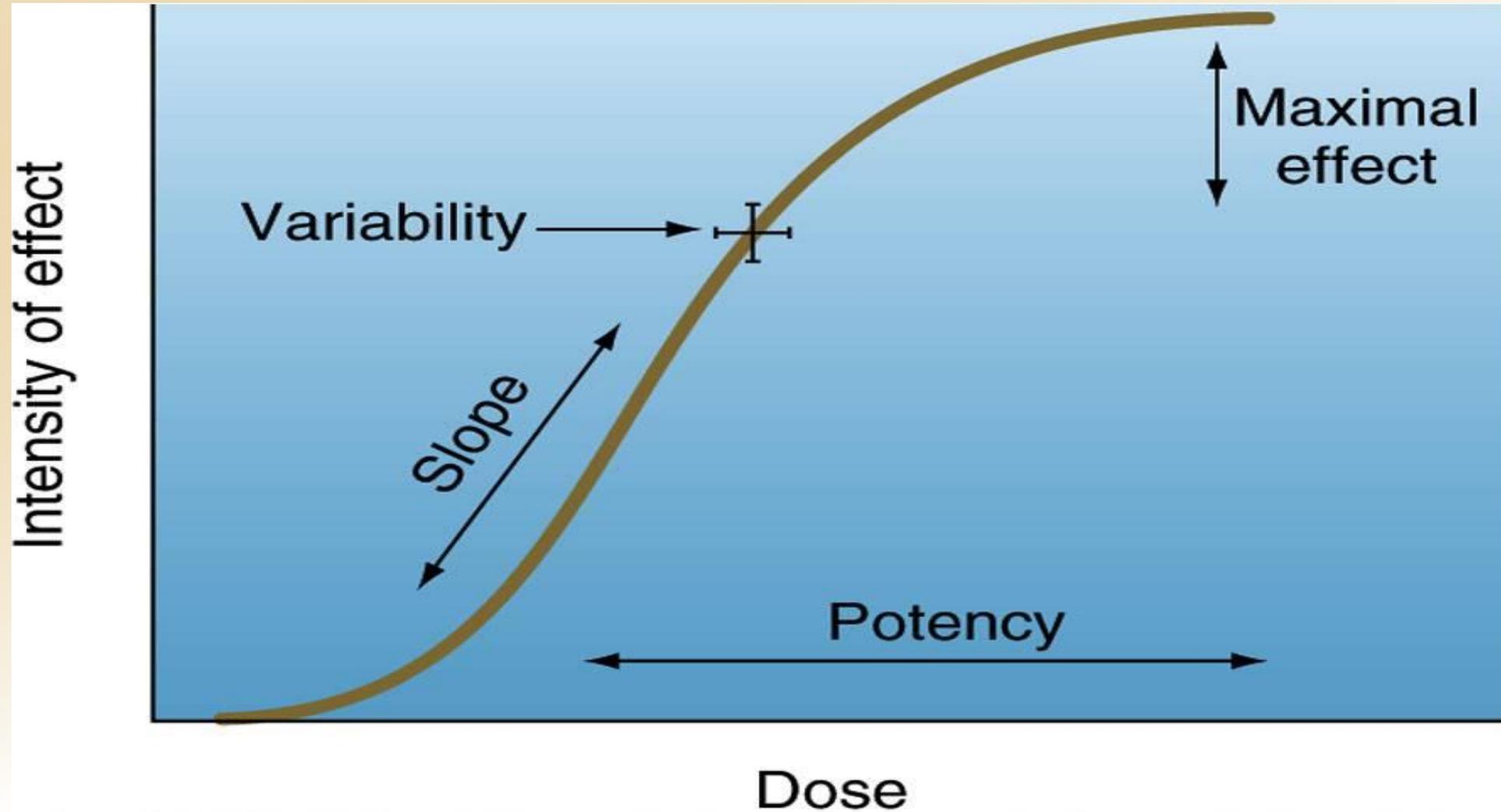


Figure 16.1



»»» Dose-Response

- Dose
 - Intensity
 - % VO_2 max
 - % maximal heart rate
 - Rating of perceived exertion
 - Lactate threshold
 - Frequency
 - Number of days per week
 - Number of times per day
 - Duration
 - Number of minutes of exercise
 - Total kcals expended
 - Total kcals expended per kilogram body weight

»»» Dose-Response

- Response
 - Specific changes
 - VO_2 max
 - Resting blood pressure
 - Insulin sensitivity
 - Body weight (% fat)
 - Depression
 - Health and Fitness changes
 - Improving fitness, leading to improved health
 - Improving fitness and health simultaneously or separately
 - Improving fitness, but not health
 - Improving health, but not fitness

»»» In Summary

- An exercise dose reflects the interaction of the intensity, frequency, and duration of exercise.
- The cause of the health-related response may be related to an improvement in $\dot{V}O_2$ max or may act through some other mechanism, making health-related outcomes and gains in $\dot{V}O_2$ max independent of each other.

Physical Activity and Health

- The ACSM recommendation (1995):
 - *“Every U.S. adult should accumulate thirty minutes or more of moderate-intensity (3–6 METs) physical activity on most, preferably all, days of the week.”*
- The ACSM recommendation (2007):
 - *“To promote and maintain health, all healthy adults aged 18 to 65 years need moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic physical activity for a minimum of 20 min on three days each week.”*
 - Included resistance training
 - 8–10 exercises, 8–12 reps, two or more non-consecutive days per week

Pattern of Responses to Exercise

- Acute response
 - Occur with one or several exercise bouts but do not improve further
- Rapid responses
 - Benefits occur early and plateau
- Linear
 - Gains are made continuously over time
- Delayed
 - Occur only after weeks of training



Dose-Response Relationship for Exercise

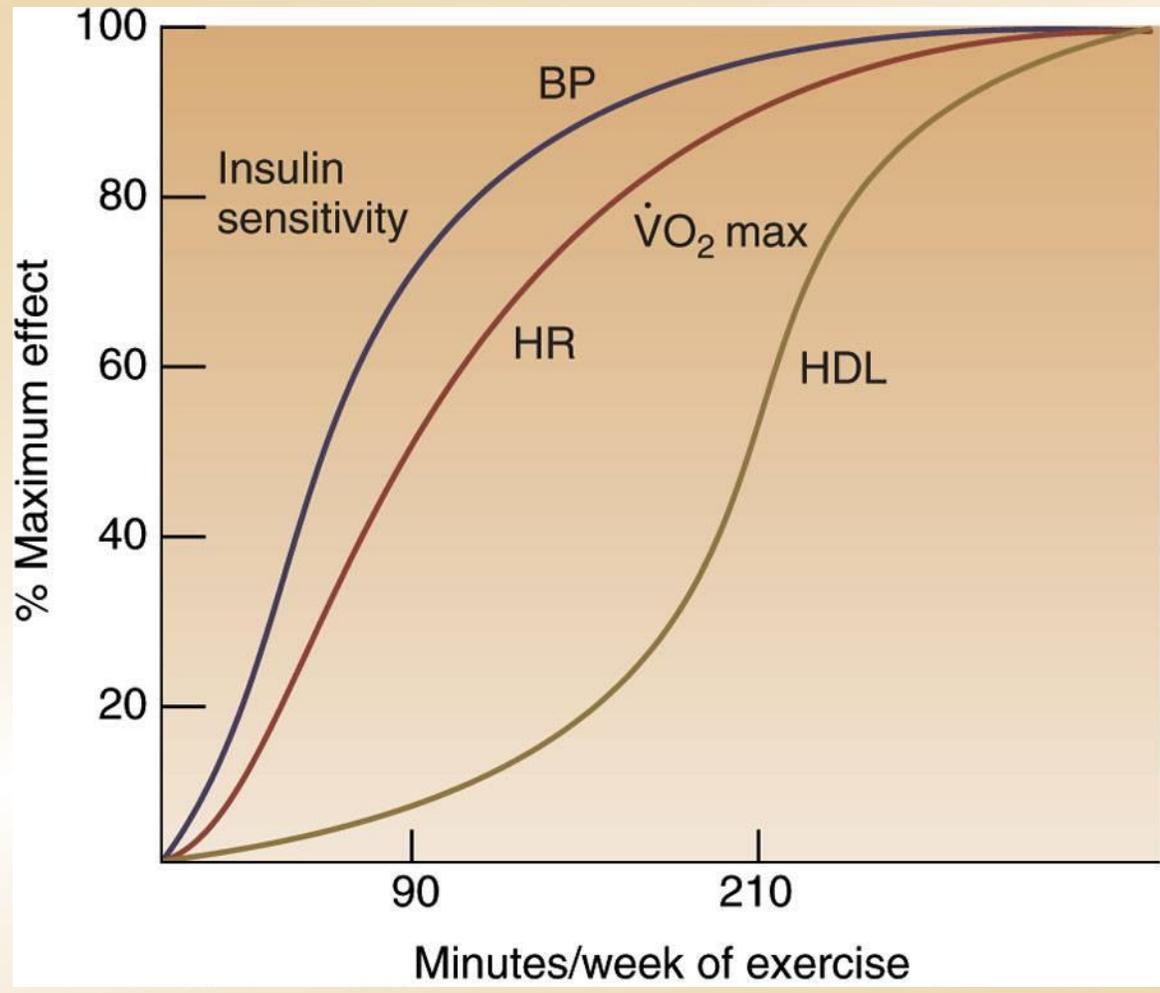


Figure 16.2

Dose-Response Relationship for Physical Activity and Health Benefit

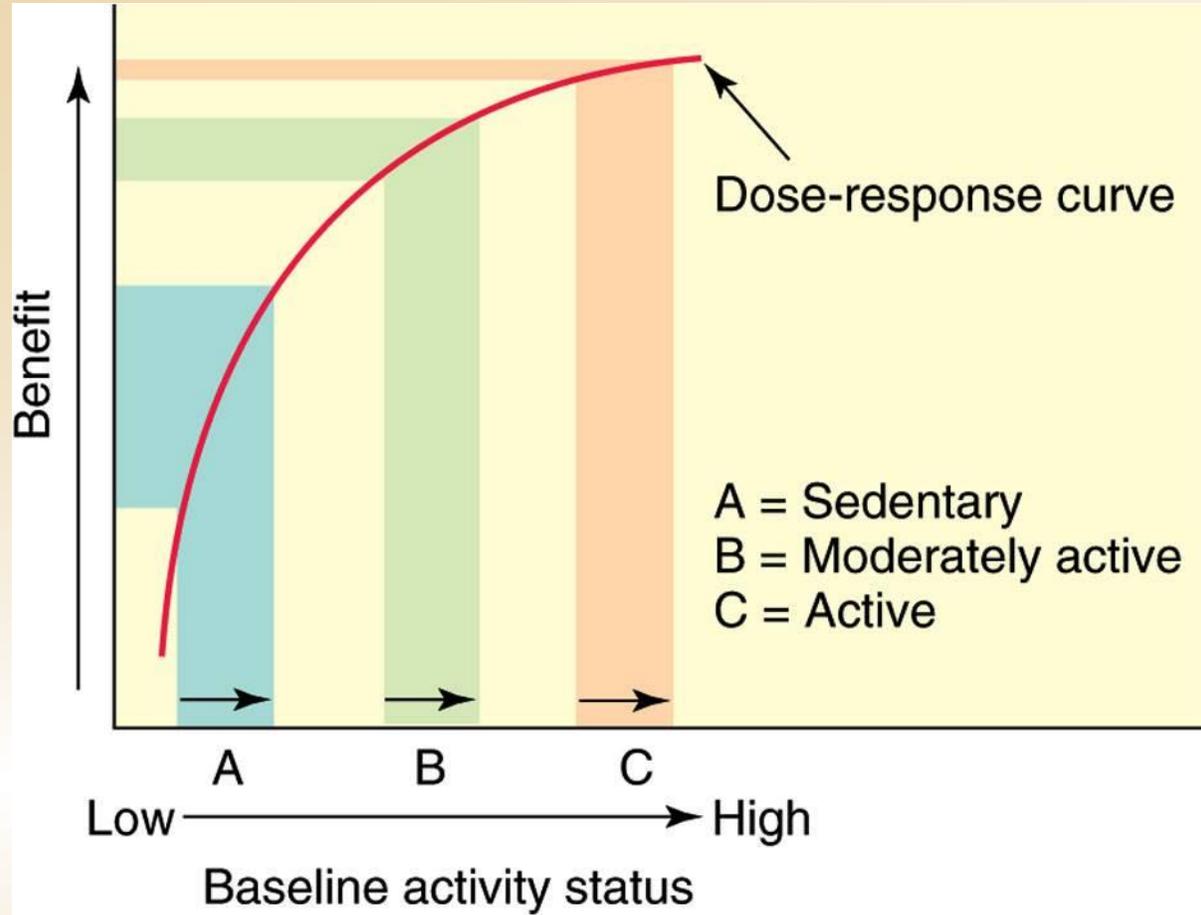


Figure 16.3



»»» Dose-Response: Physical Activity and Health

- Higher levels of physical activity associated with:
 - Lower rates of all-cause mortality, total CVD, and CHD incidence and mortality
 - Lower risk of obesity and type 2 diabetes, lower risk of mortality in those with type 2 diabetes
 - Lower risk of colon cancer and osteoporosis
 - Improved ability to complete activities of daily living
 - Reduction in depression and anxiety
 - Favorable changes in cardiovascular disease risk factors
- Clear dose-response relationship not established between physical activity and other health outcomes has not been established



Is Vigorous Exercise Better than Moderate Activity?

- Vigorous-intensity PA was associated with reduced risk of CHD compared to lower intensities
 - CHD risk factors also lower
- Vigorous-intensity PA was more beneficial for altering CHD risk factors
 - In some cases, equal to moderate-intensity PA
- Higher intensity PA associated with:
 - Greater impact on CHD risk factors
 - Less sick leave
- Moderate intensity PA
 - 3–6 METs
 - May be vigorous for deconditioned subjects

»»» In Summary

- In 2007 the ACSM and AHA updated the public health PA recommendation: To promote and maintain health, all healthy adults aged 18 to 65 years need moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic physical activity for a minimum of 20 min on three days each week.
- Resistance training (8–10 exercises, 8–12 reps, two or more non-consecutive days per week) was added as a formal part of the recommendation.



General Guidelines for Improving Fitness

- Moderate physical activity results in reducing health-related problems
 - Risk associated with PA is low
- Risk of cardiac arrest in vigorously active men
 - Higher *during* exercise
 - Lower overall (exercise + rest) risk



In Summary

- In previously sedentary subjects, small changes in physical activity result in large health benefits with only minimal risk.
- Strenuous exercise increases the risk of a heart attack during the activity, but reduces the overall (rest + exercise) risk of such an event.
- Moderate to high levels of cardiorespiratory fitness reduce the risk of death from all causes.



General Guidelines for Improving Fitness

- Screening
 - Risk of cardiovascular complications is related to degree of pre-existing cardiac disease
- Progression
 - Start with moderate-intensity activity
 - Walking 3–4 mph
 - Then increase duration and/or intensity
 - Walk→walk/jog→jog
- Warm-up, stretch and cool-down, stretch
 - Light exercise and stretching performed at beginning and end of exercise session



Exercise Prescription for CRF

- Frequency
 - 2–4 sessions per week minimum
 - 2 sessions with higher-intensity exercise
 - Gains level off after 3 to 4 sessions/week
- Duration
 - Total work per session should be 200–300 kcal
 - Must be considered with intensity
- Intensity:
 - Describes the overload needed to bring about a training effect
 - 60%–80% of VO_2 max
 - Lower in those with low initial fitness level
 - Target heart rate range

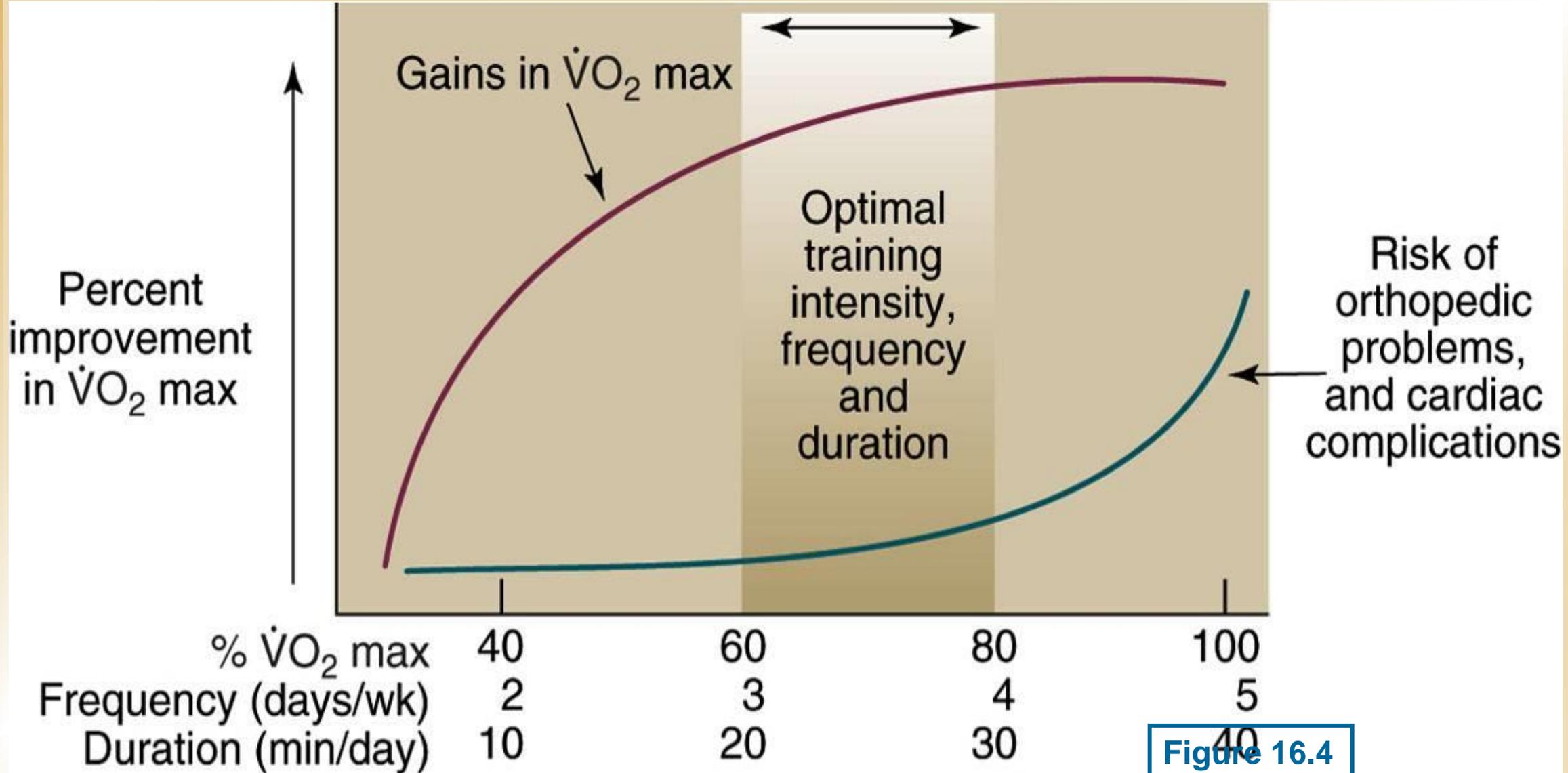


Exercise Prescription for CRF

- Dynamic, large muscle activities
 - Walking, jogging, running, swimming, cycling, rowing, dancing
- ACSM recommendation
 - 3–5 sessions per week
 - 20–60 min per session
 - Intensity of 40/50–85% HRR or VO_2R
 - Should result in expenditure of 200–300 kcal per session
 - Consistent with weight loss and reducing CHD risk factors



Intensity, Duration, and Frequency of Exercise and $\dot{V}O_2$ Max





»»» Determining Target Heart Rate Range

- Direct method
 - THR range determined from maximal GXT
 - HR at 60–80% VO_2 max
- Indirect method
 - Heart rate reserve (Karvonen) method
 - Subtract resting HR from maximal HR to obtain HRR
 - Take 60% and 80% of HRR
 - Percentage of maximal HR
 - Take 70% and 85% of maximal HR as THR range
 - Use RPE scale in addition to HR
 - RPE of 12–16 is about 40/50–85% HRR



Prescribing Exercise Intensity by the VO_2 Reserve (VO_2R) Method

- VO_2 Reserve
 - Difference between VO_2 max and resting VO_2
- % HRR more closely linked to % VO_2R than % VO_2 max
- Most useful at low fitness levels
 - Large discrepancies between % HRR and % VO_2R
- When measured maximal HR is known
 - Error is $\pm 6\%$
 - $60\% \text{ HRR} = 60 \pm 6\% \text{ VO}_2\text{R}$
- When maximal HR is estimated
 - Error in estimating maximal HR ($\pm 11 \text{ beats} \cdot \text{min}^{-1}$) is added to error in estimating % VO_2 max or % VO_2R



»»» In Summary

- A sedentary person needs to go through a screening before participating in exercise.
- Exercise programs for previously sedentary persons should start with low-intensity activities (walking), and the person should not progress until he or she can walk about four miles comfortably.
- The optimal characteristics of an exercise program are: intensity = 60–80% $\dot{V}O_2$ max; frequency = 3–4 times per week; duration = minutes needed to expend about 200–300 kcal.
- The THR range, taken as 60–80% HRR, or 70–85% of maximal HR, is a reasonable estimate of the proper



Sequence of Physical Activity



- Walking
 - Recommended activity for sedentary
 - Start at a comfortable speed for 15 minutes
 - Gradually increase duration and speed
- Jogging
 - Start by adding some running when walking
 - Gradually increase speed/duration of running
- Games and sports
 - Intermittent higher-intensity activities within THR range

An Example of a Walking Program

TABLE 16.1 Walking Program

Rules	Stage	Duration	Heart Rate	Comments
1. Start at a level that is comfortable for you.	1	15 min	_____	_____
	2	20 min	_____	_____
2. Be aware of new aches or pains.	3	25 min	_____	_____
	4	30 min	_____	_____
3. Don't progress to the next level if you are not comfortable.	5	30 min	_____	_____
	6	30 min	_____	_____
	7	35 min	_____	_____
4. Monitor your heart rate and record it.	8	40 min	_____	_____
	9	45 min	_____	_____
5. It would be healthful to walk at least every other day.	10	45 min	_____	_____
	11	45 min	_____	_____
	12	50 min	_____	_____
	13	55 min	_____	_____
	14	60 min	_____	_____
	15	60 min	_____	_____
	16	60 min	_____	_____
	17	60 min	_____	_____
	18	60 min	_____	_____
	19	60 min	_____	_____
20	60 min	_____	_____	

Reprinted, by permission, from B. D. Franks and E.T. Howley, 1989, *Fitness Leader's Handbook*, Champaign, IL: Human Kinetics Publishers, 136. This form may be copied by the fitness leader for distribution to participants.

An Example of a Jogging Program

TABLE 16.2 Jogging Program

Rules

1. Complete the Walking Program before starting this program.
2. Begin each session with walking and stretching.
3. Be aware of new aches and pains.
4. Don't progress to the next level if you are not comfortable.
5. Stay at the low end of your THR zone; record your heart rate for each session.
6. Do the program on a work-a-day, rest-a-day basis.

Stage 1 Jog 10 steps, walk 10 steps. Repeat five times and take your heart rate. Stay within THR zone by increasing or decreasing walking phase. Do 20–30 minutes of activity.

Stage 2 Jog 20 steps, walk 10 steps. Repeat five times and take your heart rate. Stay within THR zone by increasing or decreasing walking phase. Do 20–30 minutes of activity.

Stage 3 Jog 30 steps, walk 10 steps. Repeat five times and take your heart rate. Stay within THR zone by increasing or decreasing walking phase. Do 20–30 minutes of activity.

Stage 4 Jog 1 minute, walk 10 steps. Repeat three times and take your heart rate. Stay within THR zone by increasing or decreasing walking phase. Do 20–30 minutes of activity.

Stage 5 Jog 2 minutes, walk 10 steps. Repeat two times and take your heart rate. Stay within THR zone by increasing or decreasing walking phase. Do 30 minutes of activity.

Stage 6 Jog 1 lap (400 meters, or 440 yards) and check heart rate. Adjust pace during run to stay within the THR zone. If heart rate is still too high, go back to the Stage 5 schedule. Do 6 laps with a brief walk between each.

Stage 7 Jog 2 laps and check heart rate. Adjust pace during run to stay within the THR zone. If heart rate is still too high, go back to Stage 6 activity. Do 6 laps with a brief walk between each.

Stage 8 Jog 1 mile and check heart rate. Adjust pace during the run to stay within THR zone. Do 2 miles.

Stage 9 Jog 2 to 3 miles continuously. Check heart rate at the end to ensure that you were within THR zone.



Strength and Flexibility Training

- Muscular strength and flexibility are important components of a complete fitness program
 - Weight control
 - Complete activities of daily living safely
- ACSM Recommendation
 - Dynamic exercises
 - Done on routine basis



Strength Training: Single Versus Multiple Sets

- ACSM recommendation
 - One set of 8–10 exercises (major muscle groups)
 - 8–12 reps per set
 - 2–3 sessions per week
- Multiple sets more effective for improving strength
- Single set sufficient when maximal strength gain is not the primary goal
- For *maximal gains* in strength
 - Untrained: four sets at 60% 1-RM, three days/week
 - Trained: four sets at 80% 1-RM, two days/week
 - Athletes: eight sets at 85% 1-RM, two days/week

Physical Activity Pyramid

Strength and Flexibility Training

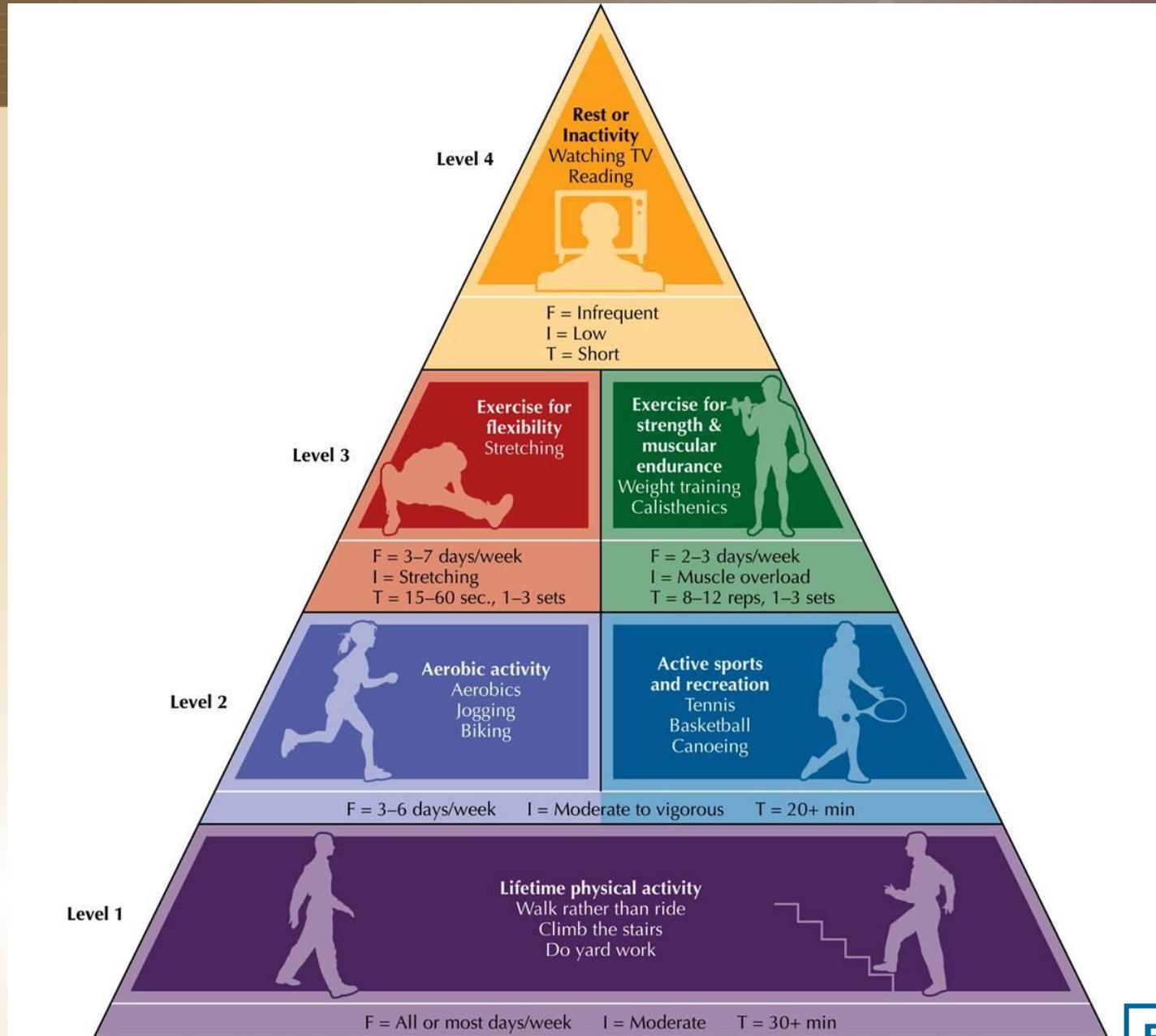


Figure 16.6



In Summary

- A logical progression of physical activities is from walking to jogging to games. The progression addresses issues of intensity, as well as the risk of injury. For many, walking may be their only aerobic activity.
- Strength and flexibility activities should be included as a regular part of an exercise program.

Environmental Concerns

- Environmental conditions can elevate exercise heart rate
 - Heat and humidity
 - Increases blood circulation to skin
 - Altitude
 - Decreases oxygen bound to hemoglobin
- Adjust exercise intensity in adverse environments
 - Use THR range as a guide for intensity
- Exercise in cold is typically safe
 - Dress appropriately
 - Avoid dangerous cold/wind conditions



In Summary

- The THR acts as a guide to adjust exercise intensity in adverse environments such as high temperature and humidity, or altitude.
- A decrease in exercise intensity will counter the effects of high environmental temperature and humidity to allow one to stay in the target HR zone.



Thank You!

