

Exercise For Special Population



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DIABETES

- Metabolic disorder characterized by chronic hyperglycemia
 - Due to:
 - Defect in insulin secretion (Type 1 diabetes)
 - Defect in insulin action (Type 2 diabetes)

A major health problem and leading cause of death

- More than 20.8 million have diabetes
- Only 14.6 million are diagnosed



- **Warning signs:**

- Frequent urination/unusual thirst
- Extreme hunger
- Rapid weight loss, weakness, and fatigue
- Irritability, nausea, and vomiting

Diabetes injures and kills indirectly by causing

- blindness
- kidney disease
- Heart disease
- stroke
- peripheral vascular disease



- Type 1
 - Lack of insulin
 - Dependent on exogenous insulin
 - Develops early in life
 - Associated with viral infections
 - 5–10% diabetic population
- Type 2
 - Resistance to insulin
 - Develops later in life
 - Can occur in overweight children
 - Associated with android obesity
 - 90–95% diabetic population



Exercise and the Diabetic

- Control of blood glucose is important
 - Blood glucose close to normal
- Adequate insulin is required
 - To increase glucose uptake by muscle
- Ketosis
 - Metabolic acidosis from accumulation of ketone bodies
 - Due to excessive fat metabolism



Effect of Plasma Insulin Levels in Type 1 Diabetics During Exercise

- The **controlled diabetic** has sufficient insulin such that glucose can be taken up into muscle during exercise and can counter the normal increase in glucose release from liver
- In contrast the **diabetic with inadequate insulin** experiences only a small increase in glucose utilization by muscle, but has the normal increase in glucose release from the liver.
- This causes an elevation of the plasma glucose, resulting in hyperglycemia



Effect of Plasma Insulin Levels in Type 1 Diabetics During Exercise

- insulin-dependent diabetic starts exercise with too much insulin , the rate at which plasma glucose is used by muscle is accelerated, while glucose released from the liver is decreased. This causes a very dangerous hypoglycemic response.
- This information is crucial to understanding how to prescribe exercise for diabetics
 - **Avoid exercise if fasting glucose is >300 mg/dl**



Effect of Plasma Insulin Levels in Type 1 Diabetics During Exercise

Interaction of Exercise and Plasma Insulin in Type 1 Diabetics

Plasma insulin concentration	Liver glucose release	Glucose uptake by muscle	Blood glucose concentration
Normal or slightly decreased	↑	↑	→
Markedly decreased	↑	↑	↑
Increased	↑	↑	↓



Exercise and Type 1 Diabetes

- Exercise is part of treatment
 - Along with insulin and diet
- Graded exercise test recommended prior to starting exercise program
 - If person is at high risk for cardiovascular disease
 - Age >35 years
 - Age >25 years and
 - Type 2 diabetes for >10 years
 - Type 1 diabetes for >15 years
 - Presence of additional coronary artery disease risk factors
 - Presence of micro-vascular disease
 - Peripheral artery disease
 - Autonomic neuropathy



Exercise and Type 1 Diabetes

- Metabolic control before physical activity
 - Avoid exercise if fasting glucose is >300 mg/dl
 - >250 mg/dl with ketosis
 - Ingest carbohydrates if glucose is less than 100 mg/dl
- Blood glucose monitoring before and after exercise
 - Identify when changes in insulin or food intake are needed
 - Learn how blood glucose responds to different types of exercise
- Food intake
 - Consume carbohydrates to prevent hypoglycemia
 - Carbohydrates should be readily available during and after exercise



Exercise and Type 1 Diabetes

- Exercise 20–60 min, 3–4 days per week, 50–85% heart rate reserve
- May use non-weight bearing, low-impact activities (if weight-bearing activities are contraindicated)
- Use light weights (40–60% 1RM), 15–20 reps
 - Heavier weights for athletes
- Drink extra fluids and have carbohydrates available
- Exercise with someone in case of emergency



Summery

- A sedentary type 1 diabetic has to manage with adequate diet and insulin to achieve control of the blood glucose concentration.
- An exercise program may complicate matters, and therefore is not viewed as a primary means of achieving “control.”
- In spite of this, the diabetic is encouraged to participate in a regular exercise program to experience its health-related benefits.



- The diabetic may have to increase carbohydrate intake and/or decrease the amount of insulin *prior to* activity to maintain the glucose concentration close to normal *during* the exercise.
- The extent of these alterations is dependent of a number of factors, including the intensity and duration of the physical activity, the blood glucose concentration prior to the exercise, and the physical fitness of the individual.



Exercise and Type 2 Diabetes

- Exercise is a primary treatment
 - Help treat obesity
 - Help control blood glucose
 - Reduces insulin resistance
 - Help treat cardiovascular disease risk factors
- Combination of diet and exercise may eliminate need for drug treatment
- May need to adjust medication dosages
 - Prevent hypoglycemia during exercise



Exercise and Type 2 Diabetes

- Exercise prescription
 - Dynamic aerobic activity at 50–90% HR_{max}
 - 20–60 min
 - 4–7 times/week
 - Promote sustained increase in insulin sensitivity
 - Promote weight loss and maintenance
 - Strength training is also recommended
 - **Goal to expend a minimum of 1,000 kcal/week**



Goals for Nutrition Therapy

- Achieve and maintain:
 - Blood glucose in normal range
 - Improved lipid and lipoprotein profile
 - Blood pressure in the normal range
- Prevent and treat chronic diabetes complications
 - By modifying nutrient intake and lifestyle
- Address individual nutritional needs
 - Personal and cultural preferences
- Limit food choices when indicated by scientific evidence



In Summary

- Type 2 diabetics have a variety of risk factors in addition to their diabetes, including hypertension, high cholesterol, obesity, and inactivity.
- An exercise prescription emphasizing low-intensity, long-duration activity that is done almost every day will maximize the benefits related to insulin sensitivity and weight loss.
- The dietary recommendation is for a low-fat diet, similar to what is recommended for all Americans for good health, with the additional goals of achieving normal serum glucose and lipid levels.



Asthma

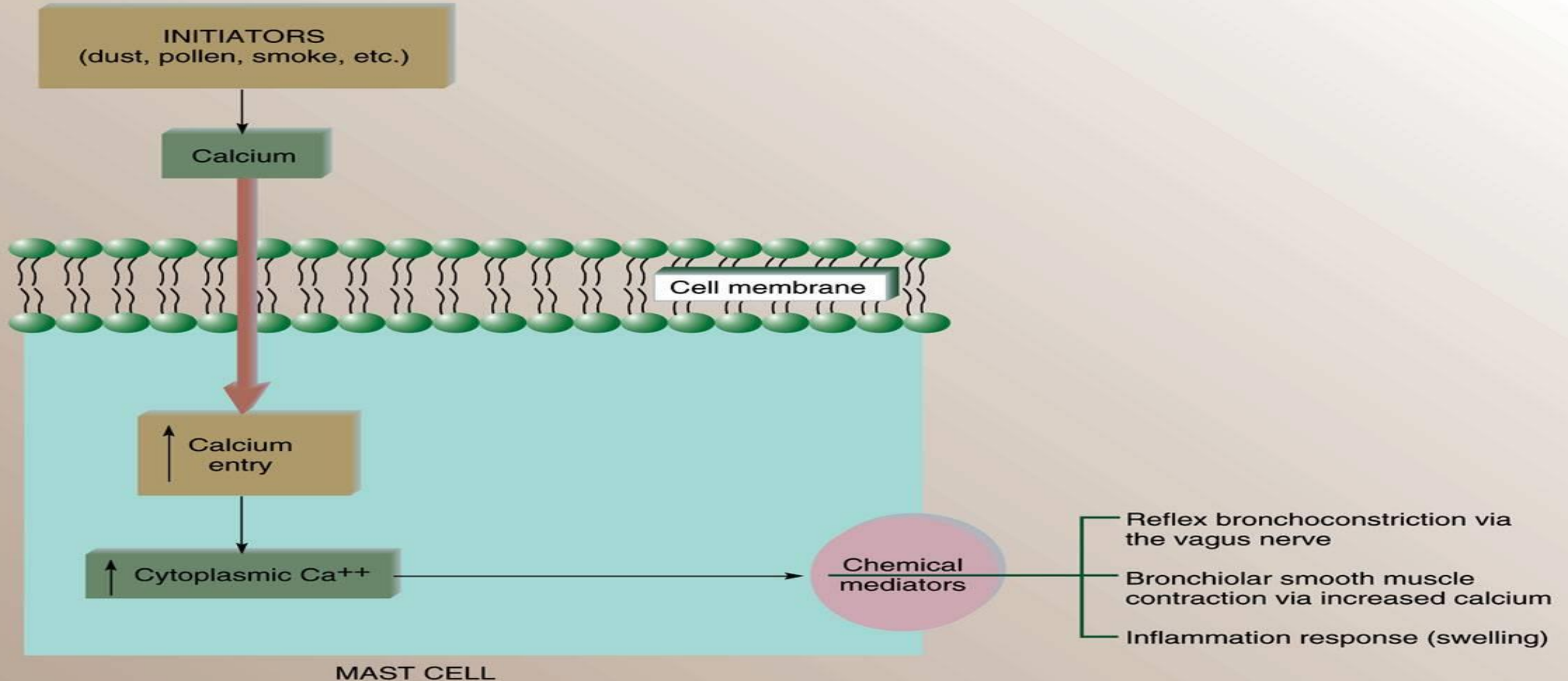
- A respiratory problem characterized by a shortness of breath accompanied by a wheezing sound
- Due to:
 - Contraction of smooth muscle of airways
 - Swelling of mucosal cells
 - Hyper-secretion of mucus
- 20 million are affected by asthma
 - 1.9 million emergency room visits
 - 4,000 deaths
 - Direct and indirect costs of \$16.1 billion



Asthma: Diagnosis and Causes

- Diagnosed using pulmonary-function testing
 - Low maximal expiratory flow rate
- Triggers
 - allergic reaction, exercise , dust, pollutants, and emotion
- Causes influx of Ca^{+2} into mast cells
 - Release of chemical mediators that cause:
 - Increased smooth muscle contraction leading to bronchoconstriction
 - Bronchoconstrictor reflex via vagus nerve
 - Inflammatory response

Proposed Mechanism by Which an Asthma Attack Is Initiated





Prevention of Asthma

- Avoidance of allergens
- Immunotherapy
 - Makes person less sensitive to the allergen



Relief of Asthma

- Medications
 - Cromolyn sodium
 - Inhibits Ca^{+2} influx into mast cell
 - β_2 -agonists
 - Cause relaxation of bronchiolar smooth muscle
 - Theophylline
 - Smooth muscle relaxation by Inhibits phosphodiesterase
 - Corticosteroids and leukotriene inhibitors
 - Reduce the inflammatory response

Screening for Asthma in Children

- In children, asthma is the
 - Leading cause of chronic illness
 - Most common respiratory disorder
- Can be diagnosed with a field test
 - Measure peak expiratory flow before and after an all-out run
 - Decrease in $FEV_1 \geq 15\%$ indicates asthma
- Asthmatic children can still exercise safely
 - Increase cardiorespiratory fitness





Exercise-Induced Asthma

- More common in asthmatics
- Caused by drying of respiratory tract
 - Triggers Ca^{+2} influx and airway narrowing
- Does not necessarily impair performance if controlled
- Diagnosed by exercise challenge
 - Strenuous running at 85–90% of max HR
 - $\geq 10\%$ decrease in FEV_1 indicates EIA



Exercise-Induced Asthma

- Reducing the chance of an attack
 - Warm up
 - Short-duration exercise
 - Use scarf or face mask in cold weather
- Treatment
 - β -agonist in case of attack during exercise
 - Other medications to prevent attack
- Performance
 - Inhaled β_2 -agonists do not improve performance
 - Ingested salbutamol (β_2 -agonist) does improve strength, anaerobic power, and endurance
 - At 10–20x inhaled dose

In Summary

- An asthmatic attack is brought on when an agent causes an increased influx of Ca^{+2} into a mast cell in the respiratory tract, which, in turn, triggers the release of chemical mediators. These chemical mediators cause a reflex and calcium-mediated constriction of bronchiolar smooth muscle along with an increase in secretions into the airways.
- Cromolyn sodium and β -adrenergic agonists act to prevent this by preventing the entry of Ca^{+2} into the mast cell, and by increasing the level of cyclic AMP in the mast and smooth muscle cells, respectively.



In Summary

- Drying of the respiratory tract leads to an increase in the osmolarity of the fluid on the surface of the mast cell. This event is believed to be the central factor in the initiation of the asthmatic attack during exercise. Exercise of short duration, preceded by a warm-up, appears to reduce the chance of an attack. Drugs should be used prior to exercise to prevent an attack, and β -adrenergic agonists should be carried along in case one occurs.



Chronic Obstructive Pulmonary Disease (COPD)

- Cause a reduction in airflow that can *have* a dramatic effect on daily activities.
- include chronic bronchitis , emphysema, and bronchial asthma, either alone or in combination.
 - Can create irreversible changes in the lung
 - Can severely limit normal activities



- Chronic bronchitis is characterized by persistent production of sputum primarily due to a thickened bronchial wall with excess secretions.
- In emphysema, the elastic recoil of alveoli and bronchioles is reduced and those pulmonary structures are enlarged



- In COPD there is decrease ability to exhale ,with wheeze.
- Leading to disturbance in routine work
- Inability to perform ADLS leads to stress and anxiety.
- Depending on the severity of symptoms ,there is change in work and retirement.
- Help of Psychologist , Counselling for both patient and family is part of patient care



- Testing for COPD

- FEV₁

- Graded exercise test

- VO₂ max

- Maximal exercise ventilation

- Changes in arterial PO₂ and PCO₂

- GRADING FOR DISABILITY

- ✓ Grade 1-4

- Grade 4 there is dyspnea with only little exertion etc.



- A wide range of exercises(e.g ., walking, cycling, swimming, games, resistance training, breathing exercises) can be used to improve the patient's functional capacity
- Supplemental O₂ may be needed to maintain Oxyhemoglobin saturation >90%



Treatment of COPD

- Goals:
 - Reduced reliance on O₂ and medications
 - Improved ability to complete daily activities
- Outcomes:
 - Increased exercise tolerance without dyspnea
 - Increased sense of well-being



Treatment of COPD

- Medications
 - Long-acting bronchodilators
 - Supplemental O₂
 - 28% O₂ and 72% He reduces work of breathing
- Inspiratory pressure support
 - Reduces work of inspiratory muscles
- Inspiratory muscle training
 - Improves muscle endurance
- Interval training
 - Allows higher intensity exercise
- Resistance training
- ❖ Generally COPD Patients achieve exercise tolerance but without reversal of disease process.



In Summary

- Chronic obstructive pulmonary disease (COPD) includes chronic asthma, emphysema, and bronchitis. These latter two diseases create changes in the lung that are irreversible and result in a gradual deterioration of function.
- Rehabilitation is a multidisciplinary approach involving medication, breathing exercises, dietary therapy, exercise, and counseling. The programs are individually designed due to the severity of the illness, and the goals are very pragmatic in terms of the events of daily living and work.



Hypertension

- Classification
 - Normal
 - Systolic BP <120 and diastolic BP <80 mmHg
 - Prehypertension
 - Systolic BP 120–139 or diastolic BP 80–89 mmHg
 - Hypertension (stage 1)
 - Systolic BP 140–159 or diastolic BP 90–99 mmHg
- Prevalence
 - 50 million US adults
 - Majority have stage 1 hypertension



Non pharmacological approaches for mild or borderline hypertension

- DASH (Dietary Approaches to Stop Hypertension) and exercise
- Diet
 - Reduction in sodium
 - Reduction in BP: 5 mmHg systolic, 3 mmHg diastolic
 - Reduction in caloric intake
 - 1 kg weight loss = -1.6 mmHg systolic, -1.3 mmHg diastolic
- Exercise
 - 10 mmHg reduction in resting BP



Exercise for Hypertension

Recommendations

- Moderate Intensity Ex
- 40%-60% of heart rate reserve(HRR)
- 30 min/ All days a week
- ❖ Goal of expending 700–2000 kcal/week
 - ACSM recommendation for improving VO_2 max can also be followed
- Precautions
 - Blood pressure should be monitored for those on medications



Hypertension Treatment

- Additional recommendations
 - Lose weight if overweight
 - Limit alcohol intake
 - Reduce sodium intake
 - Maintain adequate dietary K^+ , Ca^{+2} , Mg^{+2}
 - Stop smoking
 - Reduce dietary fat, saturated fat, and cholesterol intake



In Summary

- Exercise can be used as a non-pharmacological intervention for those with hypertension. Exercise recommendations include light to vigorous activity (40–60% VO_2 max), done three or more days per week, and for twenty to 60 minutes per session. For those on medication, blood pressure should be checked frequently.



Cardiac .Patient Population

- Those who have or have had:
 - Angina pectoris
 - Chest pain due to ischemia
 - Myocardial infarction (MI)
 - Heart damage due to coronary artery occlusion
 - Coronary artery bypass graft surgery (CABGS)
 - Bypass one or more blocked coronary arteries using saphenous vein or internal mammary artery
 - Angioplasty (PTCA)
 - Balloon-tipped catheter used to open occluded arteries
 - May insert a stent to keep artery open



- β -blockers
 - Reduce HR and/or BP
 - Reduce work of the heart
- Anti-arrhythmia medications
 - Control dangerous heart rhythms
- Nitroglycerin
 - Relax smooth muscle in veins to reduce venous return
 - Reduce angina symptoms



- Graded Exercise Testing
- ECG monitoring (12-lead)
 - Heart rate and rhythm
 - Signs of ischemia
 - ST segment depression
- Blood pressure
- Rating of perceived exertion (RPE)



Exercise Programs

- Phase I
 - Inpatient exercise program
- Phase II
 - Outpatient exercise, close supervision
- Phase III
 - Less supervision, may be home-based
- Exercise prescription
 - Based on GXT results
 - MET level, heart rate, signs/symptoms
 - Whole-body, dynamic exercise
 - Intensity, duration, and frequency based on severity of disease



- Improved cardiovascular function
 - Higher VO_2 max
 - Higher work rate without ischemia
 - Greater capacity for prolonged exercise
- Improved risk factor profile
 - Lower total cholesterol
- Secondary prevention programs
 - Reduce risk of subsequent cardiac event



In Summary

- Cardiac rehabilitation programs include a wide variety of patients, including those having angina pectoris, bypass surgery, myocardial infarctions, and angioplasty. These patients may be taking nitroglycerin to control angina symptoms, β -blockers to reduce the work of the heart, or anti-arrhythmia medications to control dangerous heart rhythms.
- The exercise tests for CHD patients include a 12-lead ECG and are used for referral to other tests. Exercise programs bring about large changes in functional capacity in these populations due to their low starting point. The programs are gradual and are based on their entry-level exercise tests and other clinical findings.



Exercise For Older Adults

- VO_2 max declines ~1% per year
- Osteoporosis
- Risk of fall
- Benefits of participation
 - Improved risk factor profile
 - Increased strength and VO_2 max
 - Increased bone mass
- Recommendations
 - Similar to younger subjects
 - Medical exam and risk factor screening is essential



Osteoporosis

- Reduced bone mineral density and increased fracture risk
 - More common in women over fifty due to lack of estrogen
- Prevention and treatment
 - Dietary calcium
 - >1000 mg/day through food and supplements
 - Vitamin D
 - 800 IU/day
 - Hormone replacement therapy (HRT)
 - Prevents bone loss and reduces fracture risk
 - May increase risk of cardiovascular disease and cancers
 - Exercise



Exercise for Bone Health

- Mode
 - Weight-bearing endurance activities
 - Activities that involve jumping
 - Resistance training
- Intensity
 - Moderate to high
- Frequency
 - Weight-bearing activities 3–5 times/week
 - Resistance exercise 2–3 times/week
- Duration
 - 30–60 minutes/day



Exercise in Elderly People: The Training Effect

- Older, endurance-trained individuals have:
 - Higher VO_2 max
 - Higher HDL; lower triglycerides, total, and LDL cholesterol
 - Enhanced glucose tolerance and insulin sensitivity
 - Greater strength, quicker reaction time, lower risk of falling
- Endurance training results in:
 - Increases in VO_2 max
 - Favorable changes in CHD risk factors
 - Increased or maintained strength and bone density



Exercise in Elderly People: The Training Effect

- ACSM exercise recommendations
 - Aerobic (endurance) activity
 - Moderate intensity, ≥ 30 min on five days per week
 - Vigorous intensity, ≥ 20 minutes on three days per week
 - Or both
 - Strengthening exercises
 - 8–10 exercises (major muscle groups), two days per week
 - 10–15 repetitions per exercise
 - One day per week may be sufficient for strength gains in those >65 years of age
 - Flexibility exercises
 - 10 minutes on at least two days per week
 - Maintain or improve balance to prevent falls



In Summary

- The “normal” deterioration of physiological function with age can be attenuated or reversed with regular endurance and strength training. The benefits of participation in a regular exercise program include an improved risk factor profile (e.g., higher HDL and lower LDL cholesterol, improved insulin sensitivity, higher VO_2 max, and lower blood pressure), but the training effects may take longer to realize.
- The guidelines for exercise training programs for older adults are similar to those for younger people, emphasizing the need for a medical exam and screening for risk factors. The effort required to bring about the training effect may be less than that for younger individuals.



Exercise During Pregnancy

- Major adaptations to pregnancy
 - Blood volume increases 40–50%
 - Oxygen uptake and heart rate are higher at rest and during exercise
 - Cardiac output is higher at rest and during exercise in first two trimesters
 - Lower in third trimester



Exercise During Pregnancy

- Regular endurance exercise poses little risk to the fetus and is beneficial for the mother
 - Reduced risk of gestational diabetes and preeclampsia
- Pregnant women should consult their physician prior to beginning any exercise program
 - Absolute and relative contraindications
- Effect of exercise training
 - VO_2 max is increased or maintained



- Follow ACSM recommendation
 - 30 min/day of moderate-intensity activity on most, preferably all, days
- Intensity determined by:
 - Heart rate
 - May not be the best method
 - Rating of perceived exertion
 - “Talk test”
- No supine exercise after first trimester



- ❑ Less than 20 years old, 140 to 155 b/min,
- ❑ 20 to 29 years old, 135 to 150 b/min,
- ❑ 30 to 39 years old, 130 to 145 b/min,
- ❑ 40 years or older, 125 to 140 b/min.



In Summary

- A pregnant woman should consult with her physician before starting an exercise program
- Endurance exercise can be done without complication to mother or fetus.

Exercise For Special Population



Thank You!