Exercise Training & Rehabilitation – Other Chronic Diseases (Diabetes & Cancer)

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안녕하세요

Greetings from Ball State University's Human Performance Laboratory

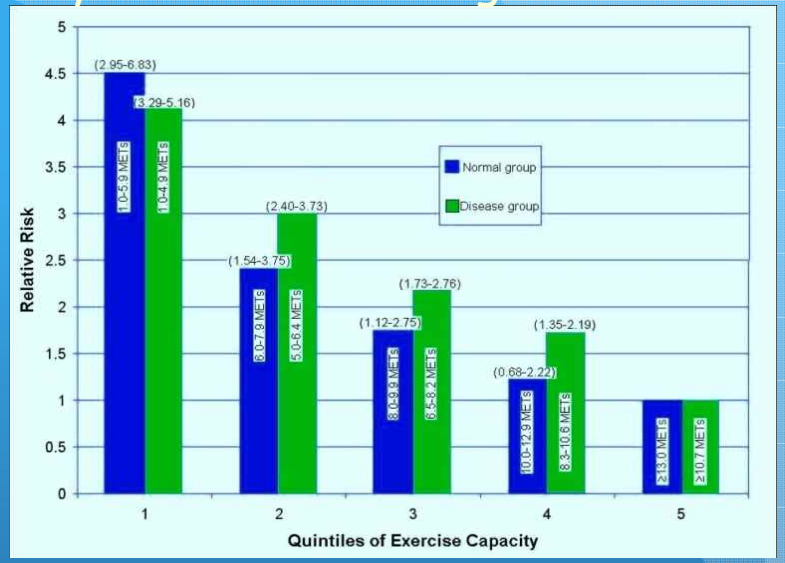
- Graduates from our Clinical Exercise Physiology Program include:
- Sung-Hee Han 1997
- Jong-Kyung Kim 1998
- Kui-Joo Lee 1999
- Won Jun Lee 2000
- Ki-Ho Hong 2005

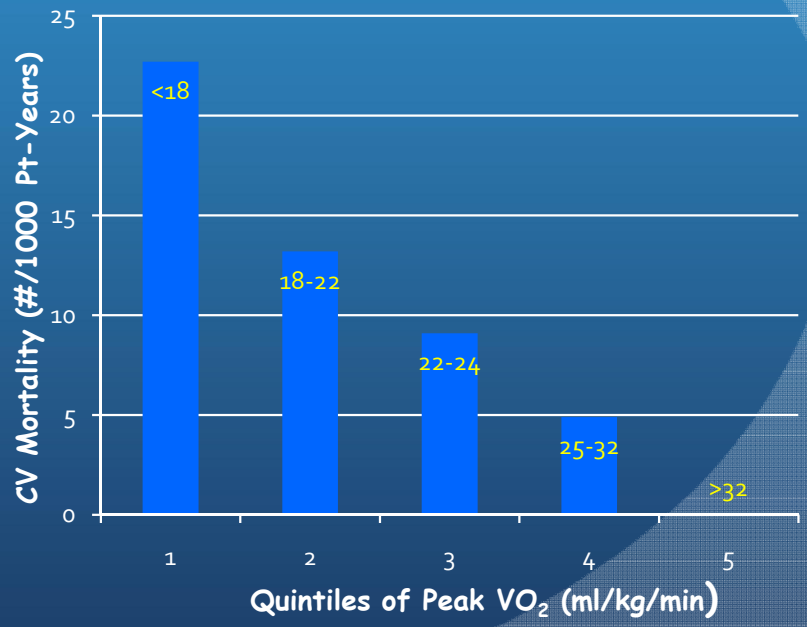
And soon: Ji-Eun Choi 2010

Why Exercise?

- Epidemiological evidence has consistently shown that physical inactivity or low functional (exercise) capacity is associated with increased morbidity and mortality for most chronic diseases and conditions
- Cost –effective
  - Note the ‘effect’ with lowest ‘dose’

Myers et al. New Engl J Med 2002





Van Hees et al. JACC 1994

Recommendations - American College of Sports Medicine

- The goal is to design the exercise program to meet the individual's needs for health and physical fitness
- Start with the general guidelines for apparently healthy adults
- Then *individually tailor* the prescription based on the unique special considerations for adults with disease or serious health conditions

Guidelines for Exercise Prescription – Apparently Healthy

- F – I – T – T
- Frequency: at least 3-5 days/week
  - ≥ 3 days/week if the intensity is vigorous
  - ≥ 5 days/week if the intensity is moderate
  - 3-5 days/week if a combination of moderate and vigorous intensity

Guidelines for Exercise Prescription – Apparently Healthy

- F –I – T – T
- Intensity: at least 40 % of maximal capacity
  - Can be determined by:
    - % VO_2R (oxygen uptake reserve)
    - % HRR (heart rate reserve)
    - RPE (rating of perceived exertion)
  - ≥ 40 - <60% VO_2R is moderate
  - ≥ 60 - <85% VO_2R is vigorous

Guidelines for Exercise Prescription - Apparently Healthy

- F -I - T - T
- Time or duration: 75-150 minutes per week
  - ≥ 75 minutes/week if the intensity is vigorous
    - i.e. at least 3 days/week for at least 25 minutes/day
  - ≥ 150 minutes/week if the intensity is moderate
    - i.e. at least 5 days/week for at least 30 minutes/day
  - Sessions can be intermittent, however bouts should be at least 10 minutes each
  - If goal is to promote or maintain weight loss the total time should total 150 (vigorous) - 300 (moderate) minutes/week

Guidelines for Exercise Prescription – Apparently Healthy

- F – I – T – T
- Type: aerobic (cardiovascular)
  - rhythmic, large-muscle group
  - Selected by preferences and availability of the individual
  - Most common are:
  - Walking / running, Cycling, Swimming
  - Machines: Elliptical, stepping, rowing
  - Dance

Applying these principles to other chronic diseses

- Diabetes
- Cancer

Prevalence of Diabetes

- Korean National Health and Nutrition Survey 2001
  - 8.1% men
  - 7.5% women
  - Kim, SM, et al. Diabetes Care, 29:226-231, 2006
- International Diabetes Federation - 2010
  - Korea: 9%
  - http://www.diabetesatlas.org/content/prevalence-estimates-diabetes-mellitus-dm-2010

Relative Risks for Mortality by Fitness Categories in Type II Diabetics

	Low fit	Moderate fit	High fit	*p* value
MET level achieved	≤5 METs	5.1–7.9 METs	≥8 METs	
Age-adjusted	1.0 (Referent)	0.62 (0.53–0.71)	0.41 (0.32–0.52)	<0.001
Multi-adjusted*	1.0 (Referent)	0.63 (0.55–0.73)	0.41 (0.33–0.53)	<0.001
Excluding deaths during first year of follow-up	1.0 (Referent)	0.63 (0.53–0.73)	0.43 (0.14–0.55)	<0.001

*Adjusted for age, BMI, beta blockers, statin use, hypertension, dyslipidemia and smoking
n=3,148, mean follow-up 7.3± 5 years

Kokkinos P, Myers J, Nylen E, et al. Diabetes Care 32:623-628, 2009

Rationale for including individuals with diabetes into a Cardio-pulmonary Rehabilitation Program

- Diabetes is considered a Coronary Heart Disease (CHD) equivalent when evaluating patient's risk
- Type II Diabetes patients typically have many 'shared' risk factors with CHD, including:
  - Upper body obesity
  - Elevated Triglycerides and Low HDL-cholesterol
  - High Blood Pressure

Recommended Treatment for Diabetes: 3 components

- 1: Medication, prescribed by a physician to help regulate blood glucose
  - Includes oral hypoglycemics and possibly insulin
- 2: Diet, typically prescribed by a registered dietitian
- 3: Exercise
  - although usually mentioned, it is often not emphasized enough

Special Considerations -Exercise with Type I Diabetes

- Significant daily challenges for patients with Type I
- Major issue is preventing hypoglycemia
- Requires modification of timing/dose of insulin
- Modification of food/beverage intake
- Monitoring Blood Glucose pre and post exercise
- Extra caution when exercising in the heat

Exercise Prescription - Type I Diabetes

- No significant differences from that for the apparently healthy population
- However, must educate patient about the special considerations
- Should carry a supply of glucose
- Should exercise with a partner
- Should wear a diabetes identification tag

Special Considerations -Exercise with Type II Diabetes

- Need to monitor for hyperglycemia
  - No exercise if glucose > 13.9 $mmol \cdot L^{-1}$ (> 250 $mg \cdot dL^{-1}$)
- If diagnosed with retinopathy – avoid vigorous intensity aerobic and high-intensity resistance training
- If diagnosed with autonomic neuropathy – be aware of blunted HR, BP, and VO_2 responses
- If diagnosed with peripheral neuropathy – be aware of exercise that can cause trauma to the feet
- If diagnosed with nephropathy – may avoid vigorous intensity aerobic and high-intensity resistance training

Exercise Prescription - Type II Diabetes

- For most, increased caloric expenditure a key goal which can be obtained by:
  - Increased Frequency (3-7 days/week)
  - Increased Time (30 -60 minute/day)
  - Remember for promotion of weight loss duration goal is >150 minutes/week if vigorous intensity and > 300 minutes/week if moderate intensity
- Intensity needs to be limited to moderate for patients with retinopathy and nephropathy
- Type (mode) – avoid feet trauma for those with peripheral neuropathy

Resistance Exercise Prescription – Type II Diabetes

- Can significantly increase insulin sensitivity:
- Frequency (2-3 days/week)
- Intensity 60-80% 1-RM [2 sets or 8-12 repetitions]
- Time (typically 20 -40 minute/day)
- Type all options (free-weights, machines, bands) available, modify according to special considerations
  - Ideally 8-10 exercises using all major muscle groups
- Limitations based on special considerations

Effects of Exercise Training in Individuals with Diabetes

- Cardiovascular
  - Increased VO_{2max}, improved BP control
- Metabolic
  - Increased insulin sensitivity (decrease HbA_{1C})
- Body Composition
  - Decreased fat mass, increased muscle mass
- Psychological
  - Improved self-esteem

Prevalence of Cancer

- 398,824 cases of cancer were newly diagnosed in Korea (from 2003 to 2005)
  - 218,856 men
  - 179,968 women
- Among men, five leading cancers were stomach, lung, liver, colon and rectum, and prostate cancer
- Among women, five leading cancers were breast, thyroid, stomach, colon and rectum, and lung cancer

Won, Y-J, et al. Cancer Res Treat. 2009 41(3): 122-131

The poster child for Cancer and Exercise

Special Considerations for Cancer Patient with Exercise

- Fatigue
- Incisions and pain with movement
- Psychological factors
- Surgical area (blood pressure)
- Post-surgery edema (measurements)
- Leukopenia caused by radiation or chemotherapy
- Bruising
- Chemotherapy Ports
- Edema --> Dehydration --> Hydration
- Lower exercise capacity - Chemotherapy patients have higher resting lactate levels
- Drug effects and Physiological Parameters
  - Concurrent cancer and heart disease medications may affect heart rate and exercise intensity prescription based on HR

Special Precautions When Prescribing Exercise for Cancer Survivors

- Hemoglobin level <8.0 g/dl -- Avoid high-intensity exercises
- Absolute neutrophil count <0.5 x 10^9 / L = avoid activities that increase risk of bacterial infection (swimming)
- Platelet Count < 50 x 10^9 / L = Avoid activities that increase risk of bleeding (contact sports)
- Fever > 38 deg. C = avoid high-intensity exercise;

  Fever > 40 deg. C = avoid all exercise
- Ataxia, dizziness = Avoid balance and coordination activities (treadmill)

Courneya KS, Mackey JR, Jones LW.
Coping with Cancer: Can exercise help? Phys Sportsmed 28:49-73,2000

Special Precautions When Prescribing Exercise for Cancer Survivors

- Severe Cachexia (loss of >35% of premorbid weight) = limit exercise to mild intensity due to loss of muscle mass
- Dyspnea, nausea, muscle weakness, fatigue = investigate cause and exercise to tolerance
- Bone metastases or pain = Avoid activities increasing risk of fracture at location (contact sports, high-impact exercises)
- Severe Lymphedema - Avoid upper extremity exercises with affected arm
- Dehydration - Ensure adequate hydration; Assume patient is dehydrated

Courneya KS, Mackey JR, Jones LW
Coping with Cancer: Can exercise help? Phys Sportsmed 28:49-73,2000

Exercise Prescription For Cancer Patients

- Aerobic Training:
- MODE
  - Walking and cycling;
  - Most important factor is individualized modification of exercise mode based on effects from cancer treatment
- FREQUENCY
  - 3-5 days/week; Daily for deconditioned patients and those performing lighter intensity or shorter duration exercises;

ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription - Fifth Edition

Exercise Prescription For Cancer Patients

- INTENSITY
  - 50-75% VO_2R, limit to moderate if side effects are severe
- DURATION
  - 20-60 minutes/day, intermittent bouts (5-10 min)for deconditioned survivors with severe side effects
- Resistance Training
  - Focus on lower resistance, higher repetitions until post-treatment

ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription - Fifth Edition

Exercise Programming Following Treatment

- 3 months: Integrate specific exercises to address persistent weaknesses

- 6 months: Diverse exercise program with increasing overload; Goal is slow and gradual progression to 3-5 days per week (i.e. the general exercise prescription guidelines should now apply)

Source: University of Northern Colorado
Rocky Mountain Cancer Rehabilitation Institute

Benefits of Exercise for Cancer Survivors

- ↑ Exercise Capacity
- ↑ Muscular Strength
- Improved Body Weight and Composition
- ↑ Flexibility
- ↓ Fatigue
- ↓ Nausea, Diarrhea
- ↓ Pain
- ↑ Physical / Functional Well-Being
- ↓ Depression, Anxiety, Anger
- ↑ Mood, Self-Esteem
- ↑ Life-Satisfaction
- ↑ Overall Quality of Life

ACSM's Resources for Clinical Exercise Physiology:

Musculoskeletal, Neuromuscular, Neoplastic, Immunologic and Hematologic Cond