

Exercise Prescription in Health & Disease

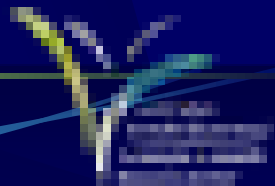
Workshop

Hazzaa M. Al-Hazzaa, PhD, FACSM, FECSS

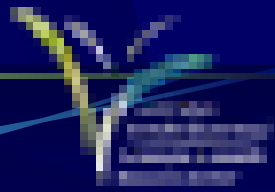
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LHRC-HSRC, March 25, 2019

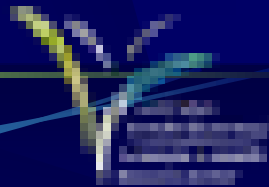


**45 slides are shown
Of 182 slides**



Major Outlines

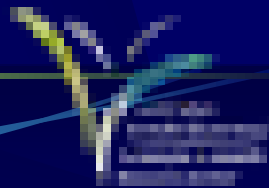
- Basic concepts & definition in physical activity science.
- Discussion of evidence-based physical activity that promotes health and prevent disease/excess weight?
- Safety and health screening before engaging in structured exercise or physical activity.
- Principle and components of exercise prescription.
- Calculating exercise intensity using heart rate reserve.
- Metabolic calculation of energy expenditures during exercise.
- Exercise prescription for obese and diabetic patients, with varieties of case studies.



Learning objectives (1)

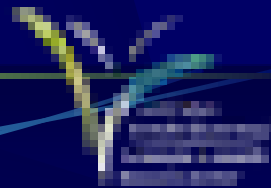
Upon successful completion of this workshop, the participants should be able to:

- Describe the basic definitions and concepts of physical activity science as they relate to exercise prescription.
- Recognize the benefits & implications of engaging in the recommended amount of physical activity with particular reference to diabetes & obesity.
- Know the current recommendations for the amount of health-enhancing physical activity especially for diabetic and obese patients.



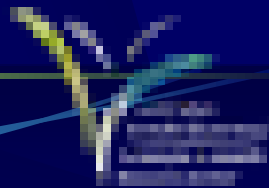
Learning objectives (2)

- Appreciate the enormous scientific evidences pointing to the role of physical activity in the prevention and management of numerous diseases, especially diabetes mellitus.
- Employ the metabolic and heart rate calculations needed for computing exercise intensity and energy exponents during a variety of physical activities and exercise prescription situations.
- Apply the principles of exercise prescription and the skills of energy expenditure calculations in a variety of case studies as related to diabetes and obesity.



1

**Basic concepts & definitions
in physical activity science**



Definitions

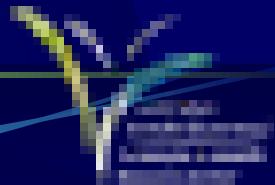
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Physical Activity A behavior (something you do)

- Any bodily movement produced by the skeletal muscles resulting in energy expenditure above resting state.

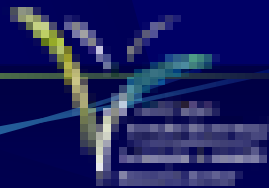
Physical Fitness Something you acquire

- A set of attributes that people have or achieve, which relates to the ability to perform physical activity.



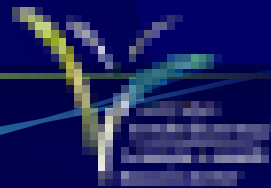
Exercise

- Exercise is a form of physical activity that is planned, structured, repetitive, and performed with the goal of improving health or fitness.
- Although all exercise is physical activity, not all physical activity is exercise.



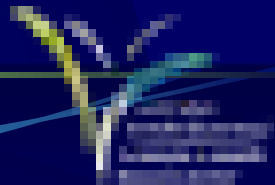
Metabolic Equivalent of Task (MET)

- The amount of energy expended during exercise relative to the energy expenditure during rest.
- Energy expenditure during rest = 1 MET
 - = *3.5 ml of O₂ / kg. min*
 - = *1 kcal / kg. hr*



Classification of Exercise

- **Aerobic exercise:**
Endurance type exercise, rhythmic, sustained for sometimes. Example: Walking, jogging, running, cycling, swimming, etc...
- **Strength (Resistance) exercise:**
Weight training with free weight, machine, elastic rope, calisthenics, etc...
- **Flexibility exercise:**
Stretching exercise.
- **Balance exercise for the Elderly**



What is the Amount of Physical Activity that Promotes Optimal Health?

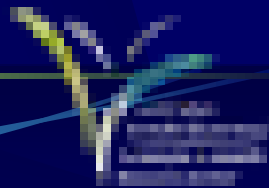
- Moderate Intensity Physical Activity.
- Energy Expenditure = 3 - < 6 MET
- That is: ≥ 30 min/day, ≥ 5 days/week.
- ≥ 150 min. per week.

OR: 75 min/week of vigorous PA

ACSM, 2000; CDC, 1996, PA Guidelines for Americans, 2008; WHO, 2010

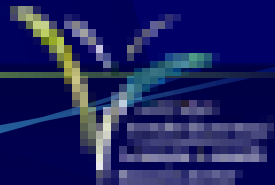
- ≥ 1000 k. calories/week.

Drygas, et al., 2000; Fletcher, et al., 1996; Lee, et al., 2000



Exercise Prescription for CV Fitness

- **Type: Aerobic exercise** (brisk walking, jogging, running, swimming, bicycling, etc.)
- **Duration: 20-60 minutes.**
- **Frequency: 3-5 times per week.**
- **Intensity: 50-85% of $\dot{V}O_2$ max, or**
50-85% of heart rate reserve
65-90% of maximal heart rate

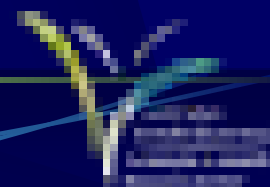


Physical Activity Patterns and Mortality: The Weekend Warrior (1 or 2 d/wk) & Activity Bouts

- ❖ Adults (N = 3438; 40 yrs & older) who wore an accelerometer (ActiGraph 7164) were from the longitudinal follow-up of the National Health and Nutritional Examination Survey (2003-2006)
- ❖ Over a follow-up of 77.4 months, 394 deaths occurred.
- ❖ Compared to participants with < 37.5 min of MVPA /week, those with greater amounts of activity had a 60% to 69% mortality rate reduction after adjusting for covariables.

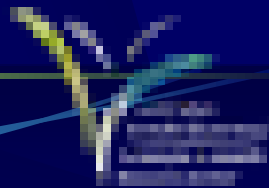
Conclusion

Physical activity is associated with decreased mortality rate, even among those who are active 1 or 2 d/wk.



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Safety of Exercise Prescription & Health Screening



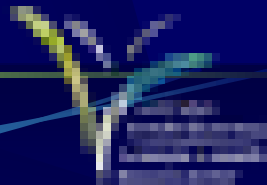
Practical Session (1)

Simple Assessment of Overall Physical Activity & Sedentary behaviors

استمارة قياس مستوى نشاطك البدني

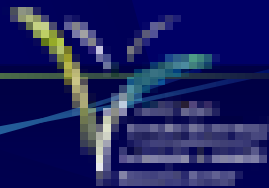
ملحق رقم (1)

Appendix- 1



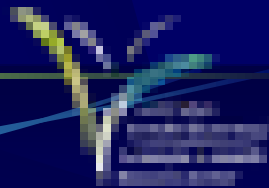
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Components & Principles of Exercise Prescription

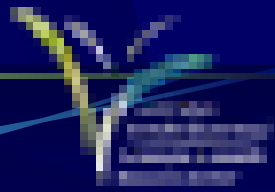


Components of Exercise Prescription

- ❖ **Mode** (Type of exercise)
- ❖ **Duration** (Time)
- ❖ **Frequency**
- ❖ **Intensity**
- ❖ **Progression of Exercise Program**
- ❖ **Safety/precaution**



**Classification of Exercise
Intensity based on % of
Heart Rate max or Heart
Rate Reserve**

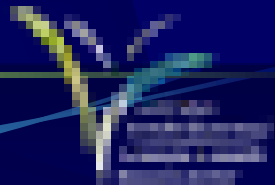


Patients using Beta Blockers



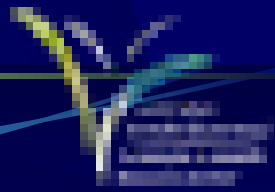
Previous equations are not suitable for them. Drugs affecting Beta receptors lower heart rate at rest, submaximal & maximal exercise.

Rate of Perceived Exertion Scale (RPE)



Practical Session (2)

**Calculating Exercise
Intensity using
Percentages of Heart Rate
Max & Heart Rate Reserve**



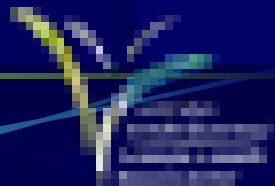
Self Test - HRR

Q- What is the heart rate reserve for a person 40 years old and his resting heart rate is 80 bpm?

A-

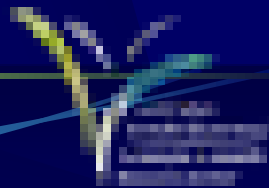
- 100 bpm
- 220 bpm
- 140 bpm
- 120 bpm

20 sec



4

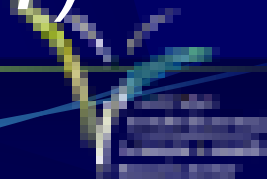
**Exercise Prescription
for Obese People**



Physical Activity and Obesity Management

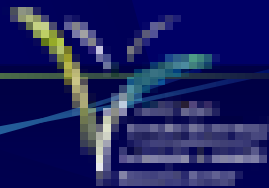
All relevant Health Organizations & Medical Societies do recommend PA for the prevention & management of Obesity; these are some of them:

- *National Heart, Lung, and Blood Institute (NHLBI)*
- *Centers for Disease Control (CDC)*
- *World Health Organization (WHO)*
- *American College of Sports Medicine (ACSM)*
- *American Heart Association (AHA)*
- *American Medical Association (AMA)*
- *American Academy of Family Physicians (AAFP)*



ACSM's Position Stand Conclusion

- Weight maintenance compared to weight gain seems to protect against an increase in chronic disease risk factors.
- Weight loss as little as 3% has been associated with favorable changes in chronic disease risk factors.
- A dose effect of PA likely exists, with greater weight loss and enhanced prevention of weight regained with doses of PA approximate 250 to 300 min/**week** (about 2000 kcal/week) of moderate intensity PA.



Role of Exercise in Weight Control

■ Increases fat oxidation

Tremblay, et al., Metabolism, 94

■ Minimizes loss of lean mass

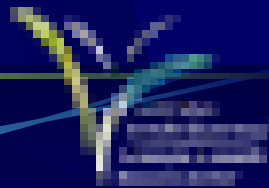
Hunter, et al., Int J Obesity, 98

■ Reduces the drop in **RMR** as a result of dieting.

Hunter, et al., Int J Obesity, 98

■ Combined with diet, produces better long term weight loss than diet alone.

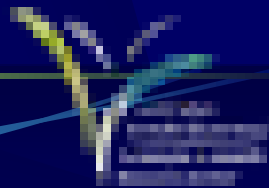
Pronk, et al., Obesity Res, 94



Exercise Prescription in Obesity

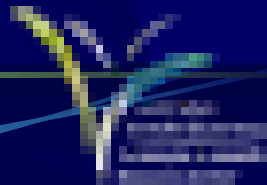
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- **Low impact moderate-intensity aerobic activity** (walking, cycling, swimming, recumbent exercise).
- **Gradually increase exercise duration to reach 60 min each day.**
- **Gradually increase exercise frequency to reach 5 days or more each week.**
- **Exercise duration and frequency are more important than intensity of exercise.**



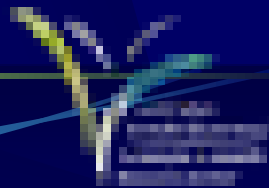
What is the Amount of Exercise Needed to Prevent Weight Regain?

كمية النشاط البدني اللازمة لمنع استعادة الوزن المفقود



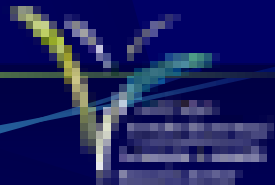
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**Exercise
and
Diabetes**

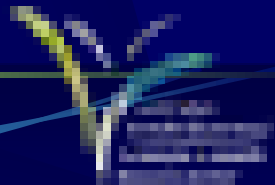


Can Exercise Prevent or Delay Diabetes ?

*Evidences from
Randomized Clinical Trials*

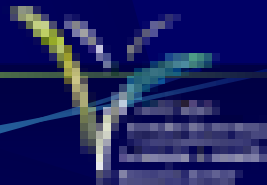


Exercise in the Management of Diabetes



Exercise Effects on Type 2 Diabetes

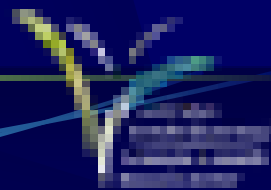
- Improves physical fitness & reduces fat %.
- Improves CV function & CHD risk profile.
- Increases self confidence.
- Improves glucose control:
 - Improving CHO metabolism.
 - Improving insulin sensitivity.
 - Increasing Glu T4 (glucose transporters).



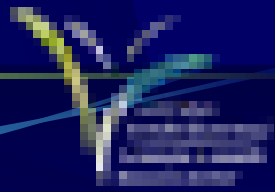
High-intensity interval training (HIIT) versus continuous training

- ❖ Participants at risk of or with type 2 diabetes experienced reductions in fasting glucose after high-intensity interval training (-0.92 mmol /L, -1.22 to -0.62, $p < 0.001$) higher than the reduction after continuous training.
- ❖ HIIT appears effective at improving metabolic health, particularly in those at risk of or with type 2 diabetes.

Jelleyman C, et al. The effects of high-intensity interval training on glucose regulation and insulin resistance: a meta-analysis. Obes Rev 2015; 16: 942–961.



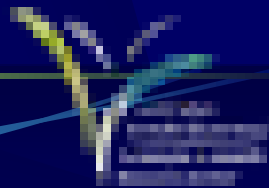
Exercise Prescription for Diabetic Patients



Exercise Prescription for Diabetic

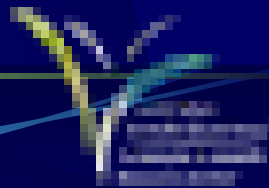
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- **Aerobic activity for 30 min. extended (gradually) to 60 min. every day or most days/week.**
- **HR during activity should be gradually increased to reach 60 – 70% of HR max.**
- **Exercise session should include 5-10 min. of warm-up and a 5 min of cool-down.**
- **Exercise must involve most major muscles in both lower and upper parts of the body.**



Exercise Prescription for Special Cases

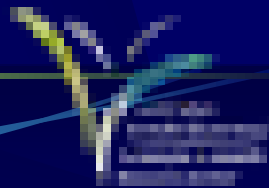
- ❖ **Diabetic with Peripheral Neuropathy**
- ❖ **Diabetic with Autonomic Neuropathy**
- ❖ **Diabetic with Retinopathy**



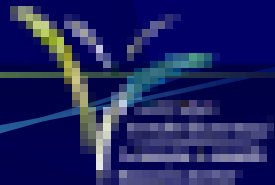
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Exercise Prescription for Elderly Population

Exercise Prescription for Special Population

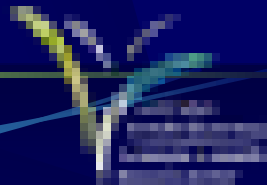


How to Calculate Energy Expenditure during **Brisk** Walking!



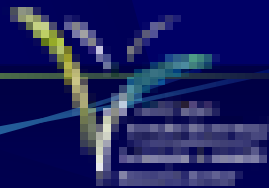
Practical Session (3)

Energy Expenditure Calculation



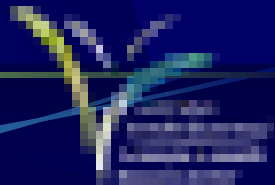
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CASE STUDIES



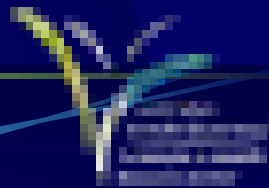
Case Study 1 (Q-1)

- An obese women, 42 years of age, her weight = 94 kg & height = 172 cm. She has high BP and has pre-diabetes. Nothing else remarkable.
- Prescribe a physical activity program for her, so she could increase her energy expenditure through brisk walking by 1400 K. calories per week.
- Will this increase in her activity is enough to reduce her weight as well as to improve her CHD risk factors?



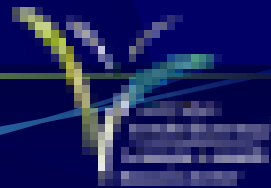
Case Study 2 (Q-1)

- **An obese man, 48 years of age, his weight = 90 kg, & height = 170 cm. He is hypertensive and has diabetes. He also complains from moderate pain in his knee (osteoarthritis).**
- **Prescribe a physical activity program for him, so he could reduce his weight as well as to improve his blood sugar control and hypertension, assuming an energy expenditure from physical activity of 1600 K. calories per week?**



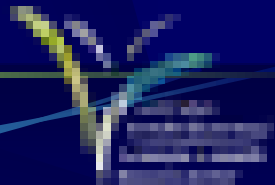
Case Study 2 (Q-2) continued

- **In his case, what is the right type of physical activity?**
- **If his target body weight is 75 kg, and assuming that 25% of the energy deficit can come from increased energy expenditure through physical activity, how many weeks needed for him to loose those 15 kg of excess body weight, through exercise and diet?**



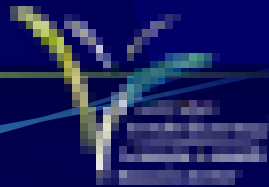
Case Study 3 (Q)

- **An obese sedentary women, her age = 55 yrs, weight = 80 kg, height = 158 cm. She has type 2 diabetes for 6 years, and BP under control with medication. Otherwise she is OK.**
- **Prescribe diet and physical activity to reduce her weight as well as to control her diabetes and hypertension, targeting energy expenditure with exercise of 1400 K. calories per week?**
- **Assuming a target body wt. of 70 kg, what is her daily energy needs (requirement) at this weight?**



Case Study 3 (A-1)

- **BMI = $80 / (1.58 * 1.58) = 32.1 \text{ kg/m}^2$**
- **Brisk Walking: $0.07 \text{ K.calorie/kg. min.}$**
- **Energy cost of walking: $80 * 0.07 = 5.6 \text{ k. cal. min.}$**
- **Net energy cost of walking: $5.6 - 1.33 = 4.27 \text{ kcal/min}$**
- **Time needed to expend 1400 k. cal. per week =
 $1400 / 4.27 = 328 \text{ minutes};$
 $328 / 5 \text{ days} = 66 \text{ min. per day}$
OR approx. 82 min a day for 4 days per week**



النشاط البدني مداواة Exercise is Medicine

Using the Five A's Framework:

1

قيّم (Assess)

معارف المريض
واتجاهاته وقناعاته
واختياراته حول
النشاط البدني
وشعوره في أن يصبح
نشطاً بدنياً

2

قدم المشورة (Advise)

قدم المشورة والنصح
والمعلومات عن
أهمية النشاط البدني
لصحة المريض

3

أتفق (Agree)

أعدّ إتفاق مع
المريض على
مشاركة في
برنامج نشاط بدني

4

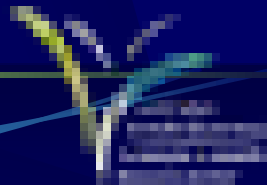
ساعد (Assist)

المريض في أن يصبح
نشطاً بدنياً وأكسبه
الثقة بنفسه من أجل
تغيير سلوكه الخامل
إلى نشط

5

قم بالترتيبات (Arrange)

اللازمة ليصبح
المريض نشطاً، بدء
من اختيار النشاط
والمكان المناسبين،
بما في ذلك تحويله
متخصص مجاز في
النشط البدني



Case Study 5 (Name: A. H.)

2

Patient information: *Male*

Age: 54 yrs. Weight: 88 kg height: 174 cm

WC: 98 cm BP: 155/90 mm/Hg Smoking: no

Diabetic (for 5 years; HbA 1c: 8.0; with no evidence of peripheral neuropathy or retinopathy).

Lifestyle: sedentary Diet: high in fats & sugar

■ Name disease/condition for A. H. risk is increased?

- Ischaemic heart disease
- Stroke
 - T2DM
 - Colon cancer
 - Osteoarthritis
 - Sleep apnea

