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Management of Metabolic Syndrome: need to focus on high risk abdominally obese individuals?

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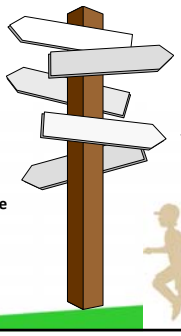
Objectives

- Cardio-metabolic Risk Factors
- Abdominal Obesity
- Definition of Metabolic Syndrome (MetS)
- MetS management
- Guidelines for exercise prescription



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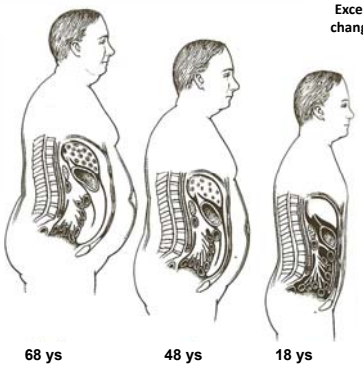
Excess of energy from any food intake changes into fat as the age progresses.



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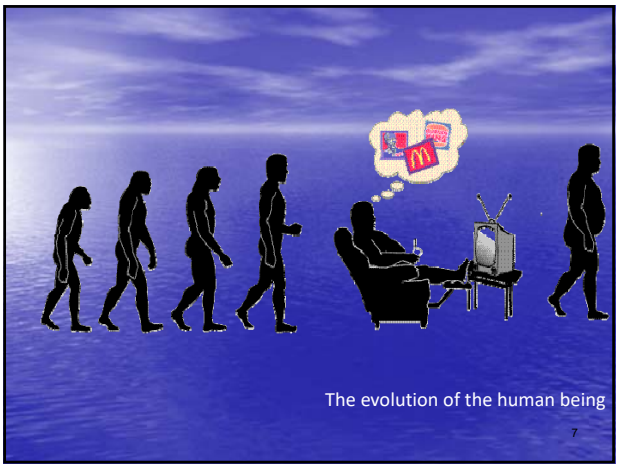
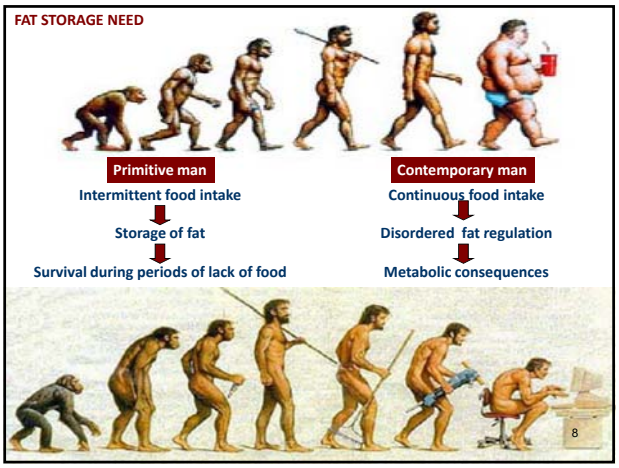
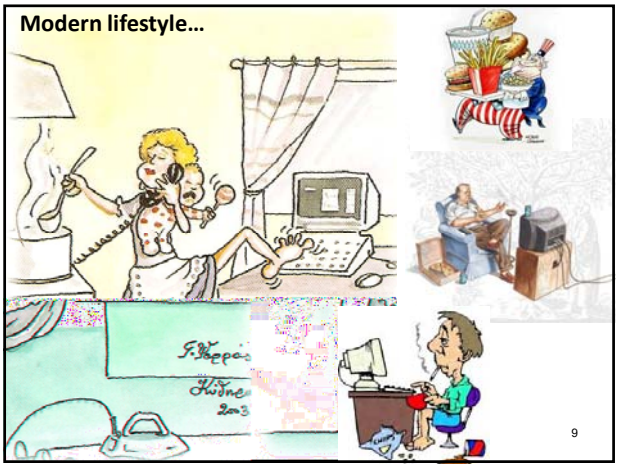
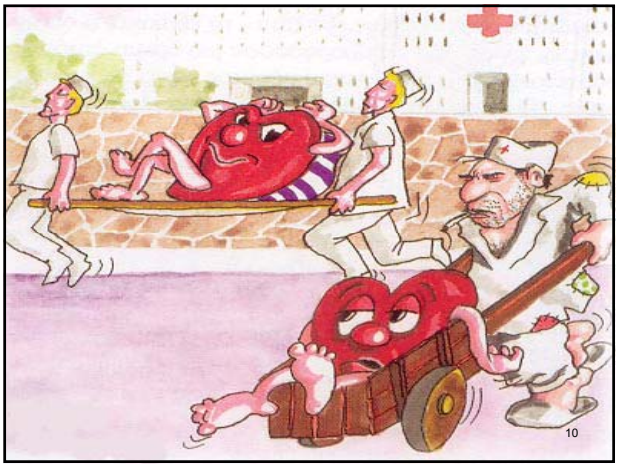

The evolution of the human being
7


FAT STORAGE NEED
Primitive man
Intermittent food intake
Storage of fat
Survival during periods of lack of food
Contemporary man
Continuous food intake
Disordered fat regulation
Metabolic consequences
8


Modern lifestyle…
9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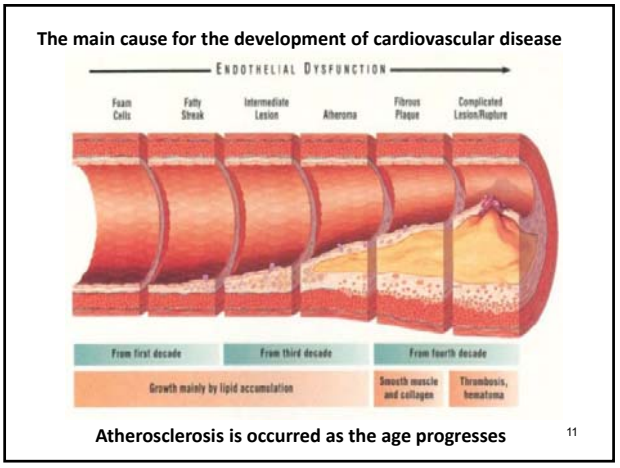
The main cause for the development of cardiovascular disease
ENDOTHELIAL DYSFUNCTION
Foam Cells
Fatty Streak
Intermediate Lesion
Atheroma
Fibrous Plaque
Complicated Lesion/Rupture
From first decade
From third decade
From fourth decade
Growth mainly by lipid accumulation
Smooth muscle and collagen
Thrombosis, hematoma
Atherosclerosis is occurred as the age progresses
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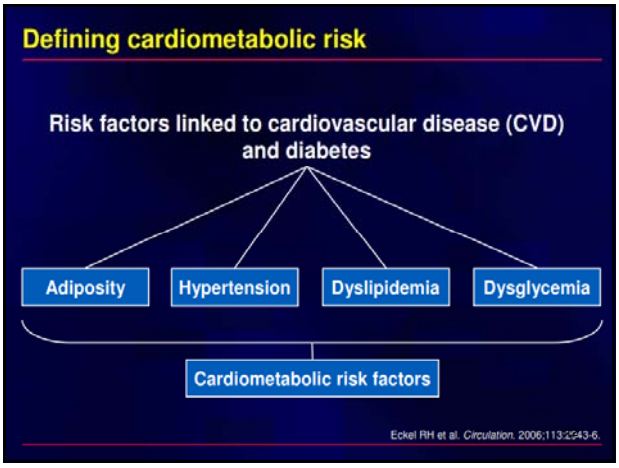
Defining cardiometabolic risk
Risk factors linked to cardiovascular disease (CVD) and diabetes
Adiposity
Hypertension
Dyslipidemia
Dysglycemia
Cardiometabolic risk factors
Eckel RH et al. Circulation. 2006;113:2643-6.

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What is cardio-metabolic risk?

Cardiometabolic risk is based on the concept of risk continuum

- **Cardiometabolic risk** represents the overall risk of developing type 2 diabetes or cardiovascular disease, which is due to a cluster of modifiable risk markers
- **Classical risk factors** such as smoking, high LDL, hypertension, elevated blood glucose
- **Emerging risk factors** closely related to abdominal obesity (especially intra-abdominal adiposity), such as insulin resistance, low HDL, high triglycerides and inflammatory markers

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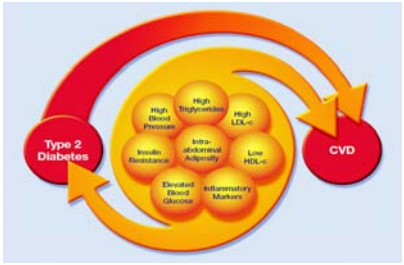
Global cardio-metabolic risk



Abdominal obesity is associated with multiple cardiometabolic risk factors which are major indicators of cardiovascular disease and type 2 diabetes

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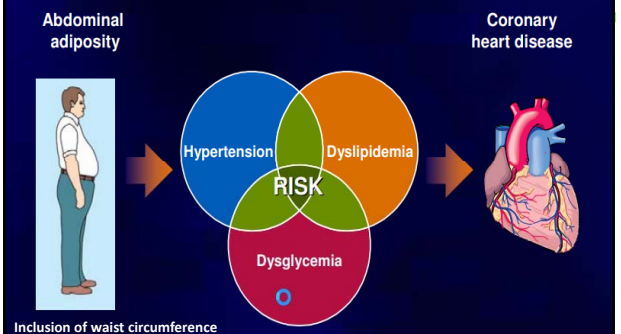
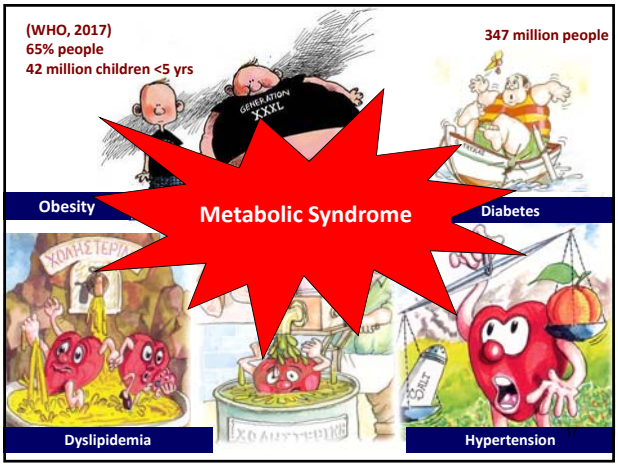
Gelfand EV *et al*, 2006; Vasudevan AR *et al*, 2005

A new vital sign: Waist circumference



Inclusion of waist circumference measurement in the standard physical examination

Adapted from Després J-P et al. *BMJ*. 2001;322:716-20.



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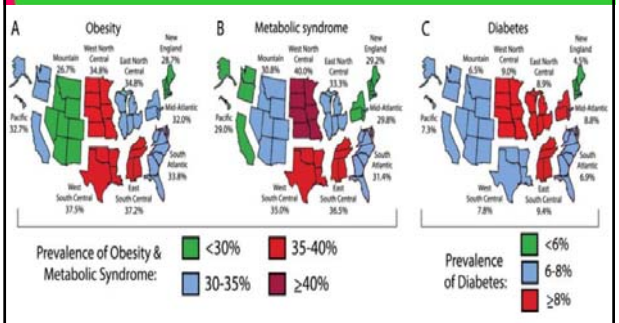

Data shown for prevalence of **a** obesity, **b** metabolic syndrome, and **c** diabetes are among US adults aged 20–65 years, from the National Health and Nutrition Examination Survey, 1999–2014

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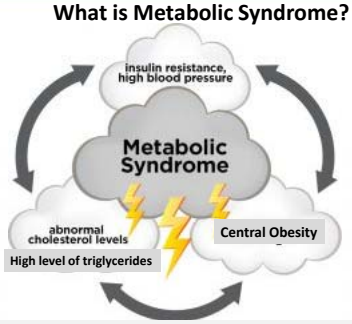
What is Metabolic Syndrome?



Mets is diagnosed when any three of the five risk factors are present.

MetS is a cluster of metabolic risk factors

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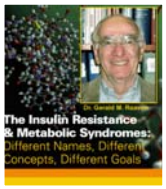
Other Names Used

- Syndrome X
- Cardiometabolic Syndrome
- Cardiovascular Dysmetabolic Syndrome
- Insulin-Resistance Syndrome
- Reaven's Syndrome
- etc



Dr. Reaven coined the term Syndrome X and brought into focus the clustering of features of MetS

[Reaven GM. Banting lecture (1988). Role of insulin resistance in human disease. Diabetes 1988;37:1595-607.
Reaven GM. (2005). The metabolic syndrome: requiescat in pace. Clin Chem, 51:931-8]

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Clustering Components of MetS (WHO)

- ✓ Glucose Tolerance (IGT) OR
- ✓ Type 2 diabetes mellitus OR
- ✓ Insulin resistance OR

The criteria to identify MetS are by the presence of one of three risk factors

and three or more of these risk factors:

- Hypertension: BP ≥140/90 mmHg
- Dyslipidemia: TG > 150 mg / dL (1.7 mmol/L)
  HDL- C < 35 mg / dL males
  HDL- C < 39mg /dL females
- Obesity (central): BMI ≥ 30 kg/m²
  Waist/Hip ratio > 0.9 males > 0.85 females
- Fasting Glucose:
  FG ≥ 110 mg/dL (6.1mmol/L)

Takamiya et al. (2004). Diabetes Care, 27(12): 2977-79.

WHO. Definition, Diagnosis and Classification of Diabetes Mellitus and Its Complications: Report of a WHO Consultation. Geneva: WHO, 1999.

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International Diabetes Federation (IDF, 2006)

Central Obesity is defined with ethnicity specific values (Europe: waist circumference ≥ 94 cm males and ≥ 80 cm females)

AND

Two or more of the following measurements:

- Triglycerides ≥150 mg/dL or medical treatment)
- Reduced HDL-cholesterol (males <40 mg/dL, females <50 mg/dL or medical treatment)
- Increased Blood Arterial Pressure (Systolic ≥130 mmHg, Diastolic ≥85 mmHg or taking antihypertensive treatment)
- Elevated fasting glucose (≥ 100 mg/dL or 5.6 mmol/l) or prior diagnosis of type 2 diabetes

The IDF Consensus (2006) http://idf.org/webdata/docs/IDF_Metasyndrome_definition.pdf

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JOINT SCIENTIFIC STATEMENT

Harmonizing the Metabolic Syndrome

A Joint Interim Statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity

K.G.M.M. Alberti, Robert H. Eckel, Scott M. Grundy, Paul Z. Zimmet, James I. Cleeman, Karen A. Donato, Jean-Charles Fruchart, W. Philip T. James, Catherine M. Loria and Sidney C. Smith

Download PDF http://dx.doi.org/10.1161/CIRCULATIONAHA.109.192644 Circulation. 2009;120:1640-1645 Originally published October 19, 2009

Circulation

Table 2. Current Recommended Waist Circumference Thresholds for Abdominal Obesity by Organization

Population	Organization (Reference)	Recommended Waist Circumference Threshold for Abdominal Obesity: Men	Women
Europid	IDF (4)	≥94 cm	≥80 cm
Caucasian	WHO (7)	≥94 cm (increased risk) ≥102 cm (still higher risk)	≥80 cm (increased risk) ≥88 cm (still higher risk)
United States	AHA/NHLBI (ATP III)* (5)	≥102 cm	≥88 cm
Canada	Health Canada (8,9)	≥102 cm	≥88 cm
European	European Cardiovascular Societies (10)	≥102 cm	≥88 cm
Asian (including Japanese)	IDF (4)	≥90 cm	≥80 cm
Asian	WHO (11)	≥90 cm	≥80 cm
Japanese	Japanese Obesity Society (12)	≥85 cm	≥90 cm
China	Cooperative Task Force (13)	≥85 cm	≥80 cm
Middle East, Mediterranean	IDF (4)	≥94 cm	≥80 cm
Sub-Saharan African	IDF (4)	≥94 cm	≥80 cm
Ethnic Central and South American	IDF (4)	≥90 cm	≥80 cm

*Recent AHA/NHLBI guidelines for metabolic syndrome recognize an increased risk for CVD and diabetes at waist-circumference thresholds of ≥94 cm in men and ≥80 cm in women and identify these as optional cut points for individuals or populations with increased insulin resistance.

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Table 2: The IDF consensus definition of metabolic syndrome in children and adolescents

Age group (years)	Obesity* (WC)	Triglycerides	HDL-C	Blood pressure	Glucose (mmol/L) or known T2DM
6–<10	≥90th percentile	Metabolic syndrome cannot be diagnosed, but further measurements should be made if there is a family history of metabolic syndrome, T2DM, dyslipidemia, cardiovascular disease, hypertension and/or obesity.			
10–<16 Metabolic syndrome	≥90th percentile or adult cut-off if lower	≥1.7 mmol/L (≥150 mg/dL)	<1.03 mmol/L (<40 mg/dL)	Systolic ≥130/ diastolic ≥85 mm Hg	≥5.6 mmol/L (100 mg/dL) (If ≥5.6 mmol/L [or known T2DM] recommend an OGTT)
16+ Metabolic syndrome	Use existing IDF criteria for adults, ie: Central obesity (defined as waist circumference ≥ 94cm for Europid men and ≥ 80cm for Europid women, with ethnicity specific values for other groups*) plus any two of the following four factors: • raised triglycerides: ≥ 1.7mmol/L • reduced HDL-cholesterol: <1.03mmol/L (<40 mg/dL) in males and <1.29mmol/L (<50 mg/dL) in females, or specific treatment for these lipid abnormalities • raised blood pressure: systolic BP ≥130 or diastolic BP ≥85mm Hg, or treatment of previously diagnosed hypertension • impaired fasting glycemia (IFG): fasting plasma glucose (FPG) ≥5.6 mmol/L (≥100 mg/dL), or previously diagnosed type 2 diabetes				

WC: waist circumference; HDL-C: high-density lipoprotein cholesterol; T2DM: type 2 diabetes mellitus; OGTT: oral glucose tolerance test.
*The IDF Consensus group recognises that there are ethnic, gender and age differences but research is still needed on outcomes to establish risk.

International Diabetes Federation (2007)

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Signs of Metabolic Syndrome

Excessive visceral fat deposition

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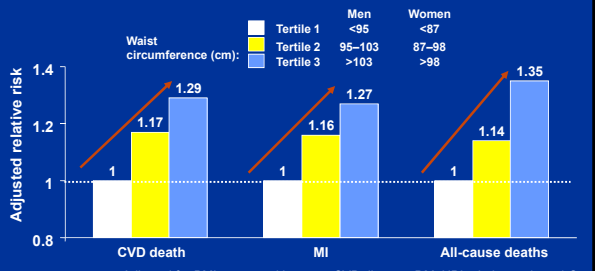
Abdominal obesity and increased risk of cardiovascular events
Heart Outcomes Protection Evaluation (HOPE) study



Adjusted for BMI, age, smoking, sex, CVD disease, DM, HDL-cholesterol, total-C; CVD: cardiovascular disease; MI: myocardial infarction; BMI: body mass index; DM: diabetes mellitus; HDL: high-density lipoprotein cholesterol

Dagenais GR *et al*, 2005

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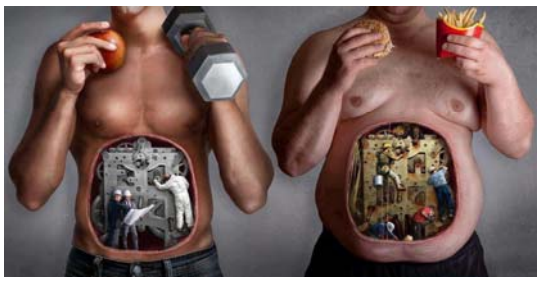
Management of MetS



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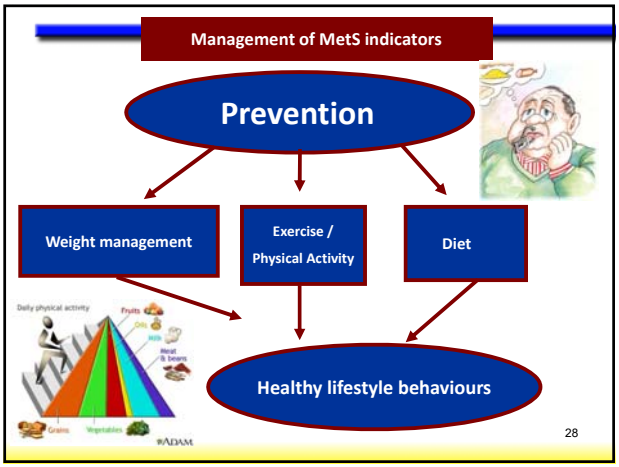
Management of MetS indicators



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CE 2 HOURS Continuing Education

ORIGINAL RESEARCH

By Shu-Hung Chang, PhD, MSN, Miao-Chuan Chen, MSN, Nai-Hui Chien, MSN, and Li-Yu Wu, MSN

Examining the Links Between Lifestyle Factors and Metabolic Syndrome

Why do some overweight and obese people remain metabolically healthy?

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ABSTRACT

Background: As it is in many other developed countries, obesity is a growing health concern in Taiwan, affecting nearly 20% of the adult population. Obesity can increase the risk of developing metabolic syndrome, diabetes, and cardiovascular disease. Recent data indicate that the prevalence of metabolic syndrome in Taiwan is 25.5%. Yet some overweight and obese individuals have normal metabolic profiles. It's not clear why some overweight or obese people remain metabolically healthy while others do.

Purpose: The purpose of this study was to examine lifestyle factors associated with metabolic syndrome in people who are overweight or obese. We were

Conclusions: Lifestyle factors may significantly affect the development of metabolic syndrome in people who are overweight or obese. Our findings indicate that practicing healthy lifestyle behaviors may be the best way to prevent metabolic syndrome. Public health interventions promoting smoking cessation, regular exercise, and good dietary habits can be created and conducted at relatively low cost. At the community level, all nurses can prioritize such interventions for their overweight and obese patients.

...metabolic syndrome among all 734 participants was 36.4%. For the normal, overweight, and obese groups, the prevalence of metabolic syndrome was 12.4%, 36.4%, and 51.8%, respectively. The results of logistic regression showed, however, that obese individuals who exercised regularly and ate sufficient amounts of fruit were less likely to have metabolic syndrome, and that overweight individuals who were nonsmokers and ate sufficient amounts of vegetables were also less likely to have metabolic syndrome.

Conclusions: Lifestyle factors may significantly affect the development of metabolic syndrome in people who are overweight or obese. Our findings indicate that practicing healthy lifestyle behaviors may be the best way to prevent metabolic syndrome. Public health interventions promoting smoking cessation, regular exercise, and good dietary habits can be created and conducted at relatively low cost. At the community level, all nurses can prioritize such interventions for their overweight and obese patients.

Keywords: community health, lifestyle factors, metabolic syndrome, obesity, overweight, public health, risk reduction

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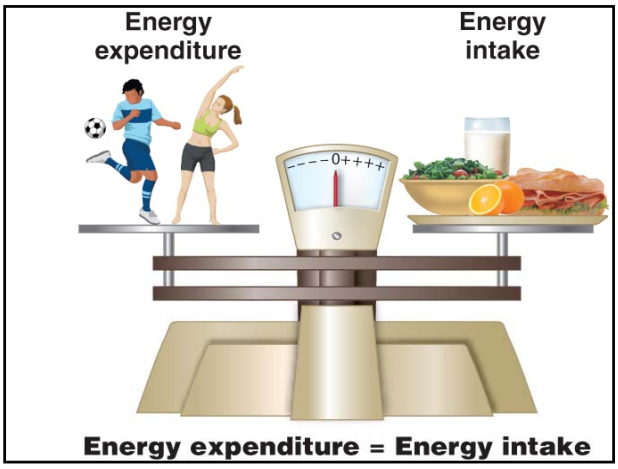
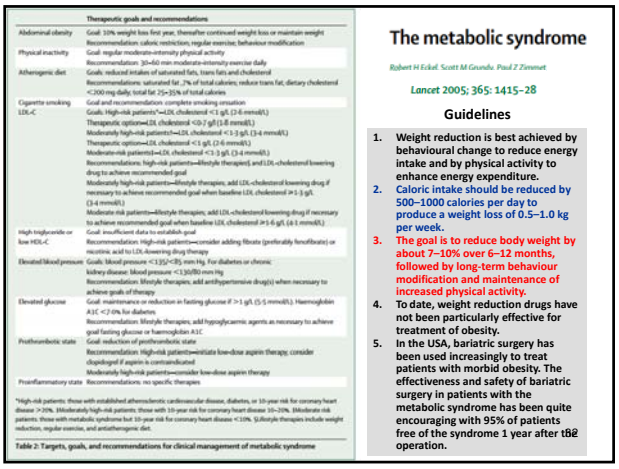
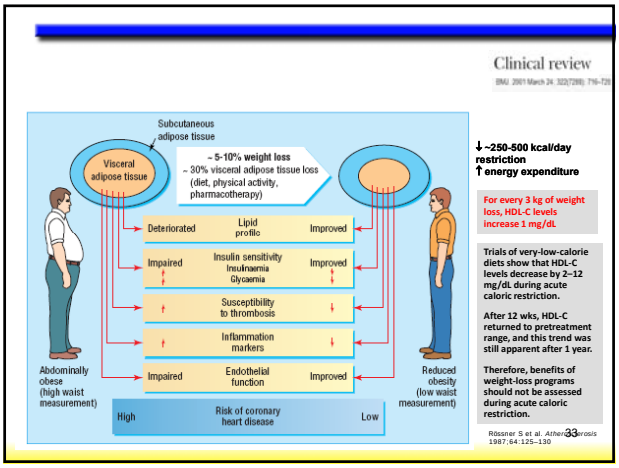

Energy expenditure
Energy intake
Energy expenditure = Energy intake


Therapeutic goals and recommendations
The metabolic syndrome
Robert H Eckel, Scott M Grundy, Paul Z Zimmet
Lancet 2005; 365: 1415–28
Guidelines
1. Weight reduction is best achieved by behavioural change to reduce energy intake and by physical activity to enhance energy expenditure.
2. Caloric intake should be reduced by 500–1000 calories per day to produce a weight loss of 0.5–1.0 kg per week.
3. The goal is to reduce body weight by about 7–10% over 6–12 months, followed by long-term behaviour modification and maintenance of increased physical activity.
4. To date, weight reduction drugs have not been particularly effective for treatment of obesity.
5. In the USA, bariatric surgery has been used increasingly to treat patients with morbid obesity. The effectiveness and safety of bariatric surgery in patients with the metabolic syndrome has been quite encouraging with 95% of patients free of the syndrome 1 year after the operation.


Clinical review
Subcutaneous adipose tissue
Visceral adipose tissue
~ 5-10% weight loss
~ 30% visceral adipose tissue loss
(diet, physical activity, pharmacotherapy)
Deteriorated
Lipid profile
Improved
Impaired
Insulin sensitivity
Insulinaemia
Glycaemia
Improved
Susceptibility to thrombosis
Inflammation markers
Impaired
Endothelial function
Improved
Abdominally obese (high waist measurement)
Reduced obesity (low waist measurement)
High
Risk of coronary heart disease
Low
↓ ~250-500 kcal/day restriction
↑ energy expenditure
For every 3 kg of weight loss, HDL-C levels increase 1 mg/dL
Trials of very-low-calorie diets show that HDL-C levels decrease by 2–12 mg/dL during acute caloric restriction.
After 12 wks, HDL-C returned to pretreatment range, and this trend was still apparent after 1 year.
Therefore, benefits of weight-loss programs should not be assessed during acute caloric restriction.
Rössner S et al. Atherosclerosis 1987;64:125–130
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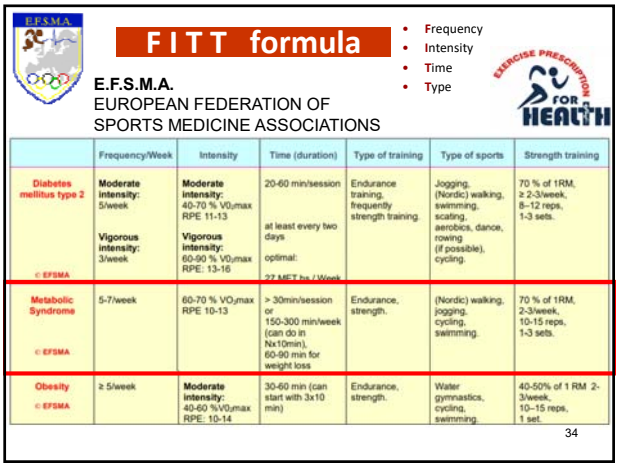
E.F.S.M.A.
F I T T formula
Frequency
Intensity
Time
Type
E.F.S.M.A.
EUROPEAN FEDERATION OF SPORTS MEDICINE ASSOCIATIONS
EXERCISE PRESCRIPTION FOR HEALTH
Frequency/Week
Intensity
Time (duration)
Type of training
Type of sports
Strength training
Diabetes mellitus type 2
Moderate intensity: 5/week
Vigorous intensity: 3/week
Moderate intensity: 40-70 % VO2max RPE 11-13
Vigorous intensity: 60-90 % VO2max RPE: 13-16
20-60 min/session
at least every two days
optimal:
Endurance training, frequently strength training.
Jogging, (Nordic) walking, swimming, scating, aerobics, dance, rowing (if possible), cycling.
70 % of 1RM, ≥ 2-3/week, 8–12 reps, 1-3 sets.
© EFSMA
Metabolic Syndrome
5-7/week
60-70 % VO2max RPE 10-13
> 30min/session or 150-300 min/week (can do in Nx10min), 60-90 min for weight loss
Endurance, strength.
(Nordic) walking, jogging, cycling, swimming.
70 % of 1RM, 2-3/week, 10-15 reps, 1-3 sets.
© EFSMA
Obesity
≥ 5/week
Moderate intensity: 40-60 %VO2max RPE: 10-14
30-60 min (can start with 3x10 min)
Endurance, strength.
Water gymnastics, cycling, swimming.
40-50% of 1 RM 2-3/week, 10–15 reps, 1 set.
© EFSMA
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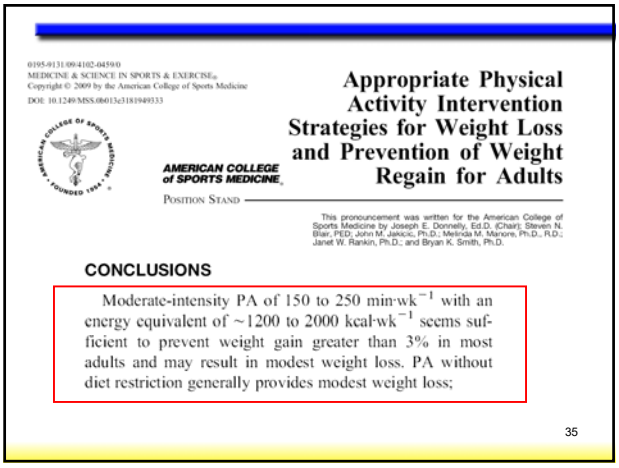
0195-9131/09/4102-0459/0
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DOI: 10.1249/MSS.0b013e3181949333
AMERICAN COLLEGE of SPORTS MEDICINE
POSITION STAND
Appropriate Physical Activity Intervention Strategies for Weight Loss and Prevention of Weight Regain for Adults
This pronouncement was written for the American College of Sports Medicine by Joseph E. Donnelly, Ed.D. (Chair); Steven N. Blair, PED; John M. Jakicic, Ph.D.; Melinda M. Manore, Ph.D., R.D.; Janet W. Rankin, Ph.D.; and Bryan K. Smith, Ph.D.
CONCLUSIONS
Moderate-intensity PA of 150 to 250 min·wk^{-1} with an energy equivalent of ~1200 to 2000 kcal·wk^{-1} seems sufficient to prevent weight gain greater than 3% in most adults and may result in modest weight loss. PA without diet restriction generally provides modest weight loss;
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Physical Activity/Exercise and Diabetes: A Position Statement of the American Diabetes Association
Diabetes Care 2016;39:2065–2079 | DOI: 10.2337/dc16-1728
BENEFITS OF AND RECOMMENDATIONS FOR REDUCED SEDENTARY TIME
Recommendations
• All adults, and particularly those with type 2 diabetes, should decrease the amount of time spent in daily sedentary behavior. B
• Prolonged sitting should be interrupted with bouts of light activity every 30 min for blood glucose benefits, at least in adults with type 2 diabetes. C
• The above two recommendations are additional to, and not a replacement for, increased structured exercise and incidental movement. C
Benefits Of Exercise For Diabetics
PHYSICAL ACTIVITY AND TYPE 2 DIABETES
Recommendations
• Daily exercise, or at least not allowing more than 2 days to elapse between exercise sessions, is recommended to enhance insulin action. B
• Adults with type 2 diabetes should ideally perform both aerobic and resistance exercise training for optimal glycemic and health outcomes. C
• Children and adolescents with type 2 diabetes should be encouraged to meet the same physical activity goals set for youth in general. C
• Structured lifestyle interventions that include at least 150 min/week of physical activity and dietary changes resulting in weight loss of 5%–7% are recommended to prevent or delay the onset of type 2 diabetes in populations at high risk and with prediabetes. A
This position statement was reviewed and approved by the American Diabetes Association Professional Practice Committee in June 2016 and ratified by the American Diabetes Association Board of Directors in September 2016
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Lipids and Exercise

Duration of exercise effect on lipids

- Triglycerides increase delays for several hours after exercise and this effect can persist for 24-48 hours or several days when exercise is prolonged and intense
- Usually HDL begins to rise after >10 weeks of exercise
- Single exercise sessions reduce postprandial hyperlipidemia but have no other effect on lipids
- After exercise cessation lipids return on original values
- The longer the exercise program lasted the longer the favorable lipid profile remains after exercise cessation

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WARNING: In severe obesity the participant can start even with 5 minutes of walking and increase his exercise time by 1 min in each training session

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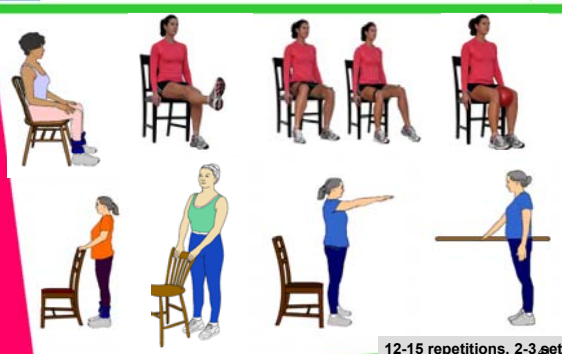

12-15 repetitions, 2-3 set

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12-15 repetitions, 2-3 sets

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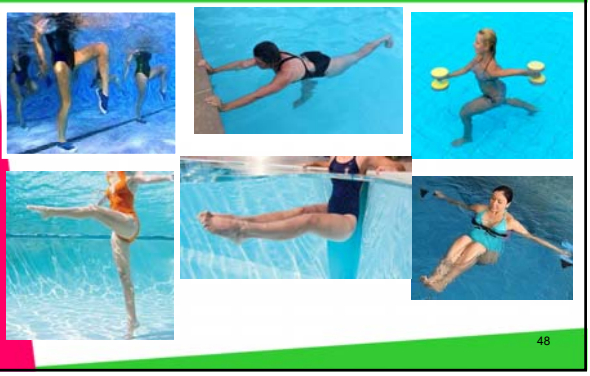

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Guidelines of Exercise Prescription

A stress test is required to participate in exercise programs

Main aim: Maximum total energy expenditure

Aerobic activities
- Large muscle groups (e.g. walking, cycling, swimming, water exercises, tennis)
- Long-term weight control (e.g. exercise duration 200-300 min / week and energy consumption > 2.000 kcal / week)
- Exercise intensity ranges from 40% to 70% of VO_{2max}
- The duration of the exercise is from 30 to 45 min (at least 150 minutes/week)
- The exercise frequency ranges from 3 to 5 times a week

Strength training exercises 40-60% of 1 RM
- 2-4 sets, 8-10 (up to 15) repetitions, 1-2 min breaks
- Activate main muscle groups
- The exercise frequency ranges from 2 to 3 times a week
- Progressive increase of load

Daily increase in physical activity
(e.g. housework, shopping, use of stairs, gardening, walking etc)

ACSM (2010). Med Sci Sports Exerc. 2010; 42(12): 2285-2303
ESSA (2012). Aust J Sci Med Sport, 15: 25-31

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«… If we personalize the appropriate exercise and the amount of nutrition, no less and no more, we will have found the safest way to health…»

Hippocrates (460-377 B.C.)

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