Medical Nutrition Therapy for Diabetics

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Contents

- Magnitude and consequences of the problem
- General goals of treatment
- Collaborative management
- Nutritional therapy

Magnitude & Consequences

Types of DM

- Type 1(5-10%)
- Type 2 (90-95%)
- Gestational
- “Other Specific Types” from
  - specific genetic syndromes
  - surgery
  - drugs
  - Malnutrition (old term)
  - infections
  - other illnesses
- Impaired glucose tolerance (pre-diabetes)

Diabetes: A Worldwide Epidemic

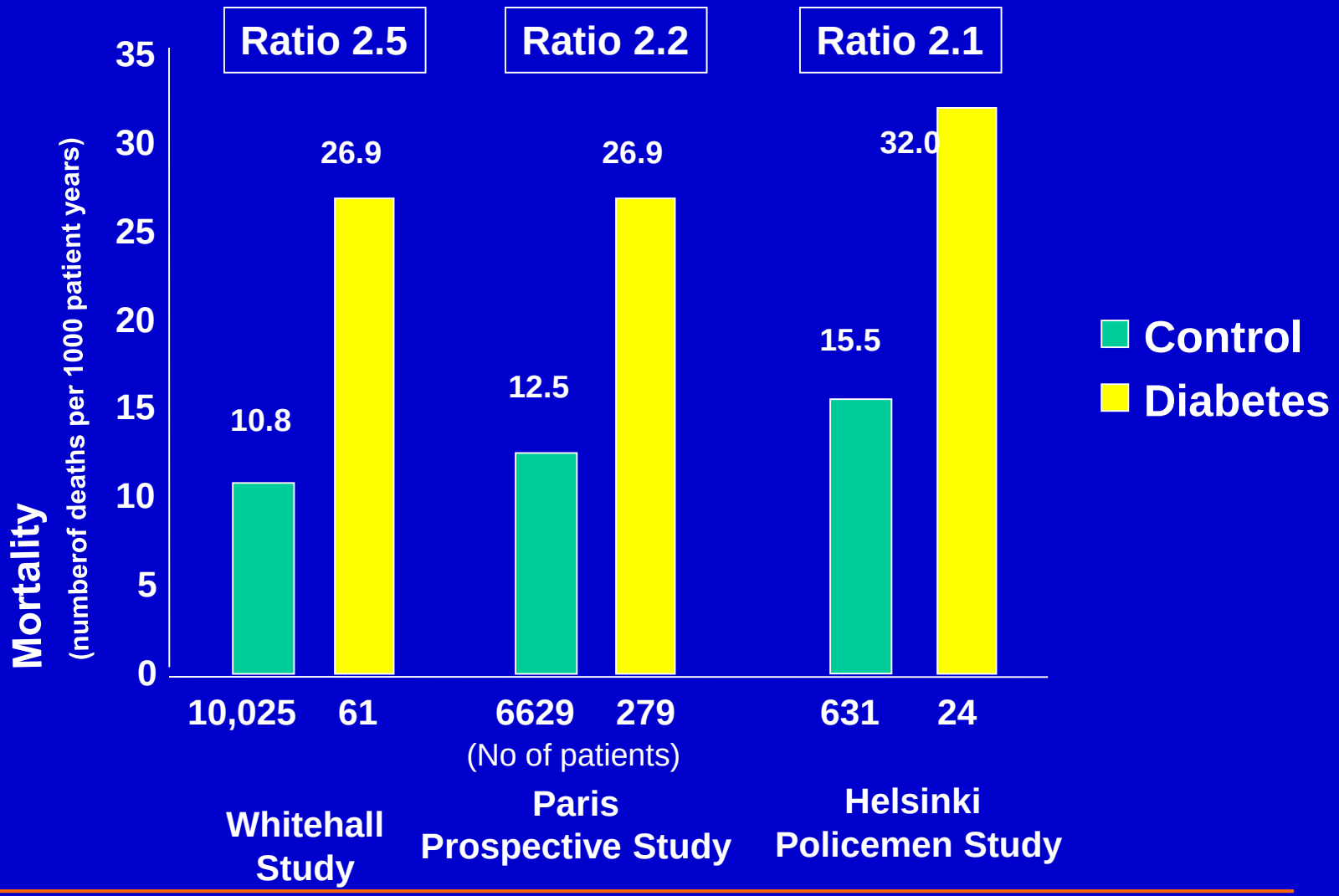
The Rise in Diabetes: Why?

- Increasing longevity.
- Change in demographics and genetic predispositions: the greatest growth of patients will be in Asia
- Rising urbanization and change in lifestyle.
- Increase in obesity

Diabetes, Obesity & Adolescence

- **In developing nations, more than 70% of the childhood population presenting with diabetes suffers from type 2 disease.**

Mortality in diabetes patients double that compared to non-diabetics



Balkau Lancet 1997; 350:1680

Causes of Death Among People With Diabetes

Cause	% of Deaths
Ischemic heart disease	40
Other heart disease	15
Diabetes (acute complications)	13
Cancer	13
Cerebrovascular disease	10
Pneumonia/influenza	4
All other causes	5

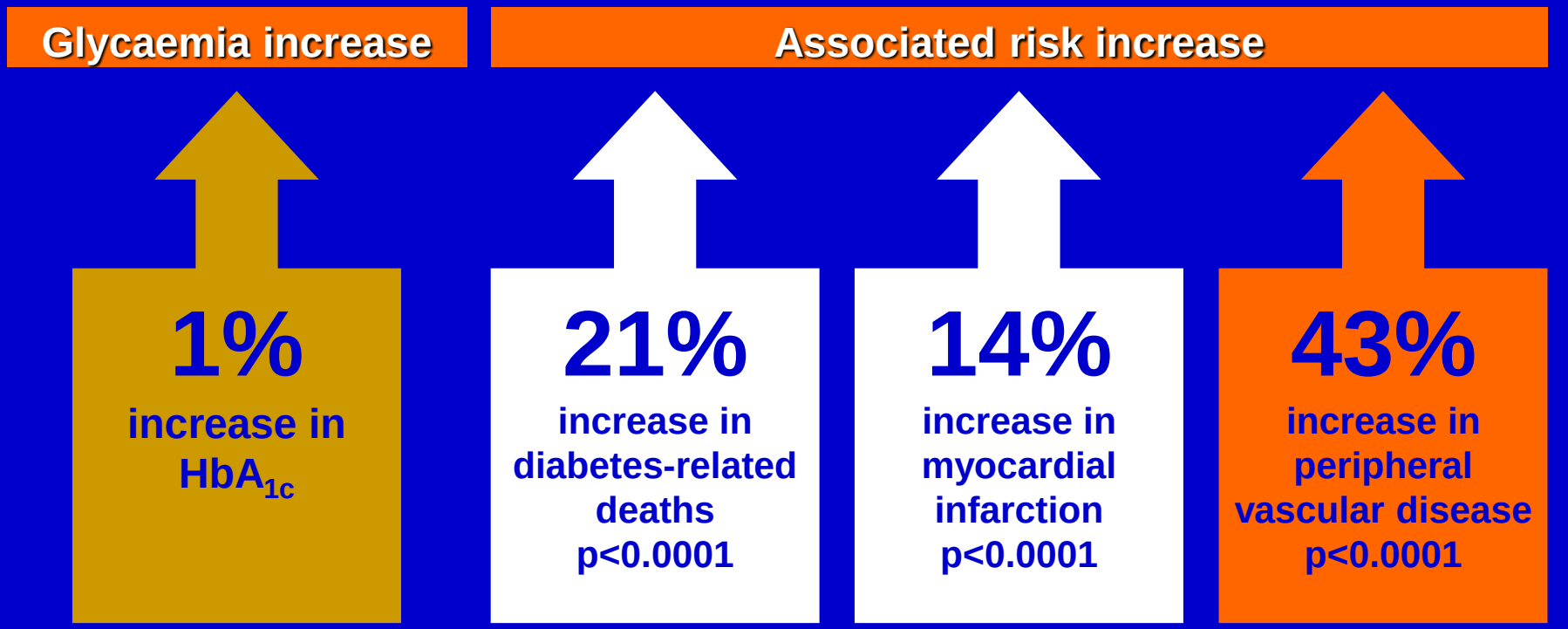
Complications of Diabetes

- Macrovascular
  - coronary artery disease (MI)
  - cerebrovascular disease (Stroke)
  - peripheral vascular disease
- Microvascular
  - retinopathy
  - nephropathy
  - neuropathy

Diabetes complications

- Retinopathy (blindness?)
- Nephropathy (kidney problems)
- Feet ulceration and/or amputations
- Hypertension
- Hyperlipidemia (cholesterol?)
- Gestational diabetes (during pregnancy)
- Erectile Dysfunction

HbA_{1c} – relationship with CV risk



Stratton IM *et al*. BMJ 2000; 321: 405–12.

Why Treat Diabetes?

- DCCT
  - Diabetes Control and Complications Trial
  - 10-year study in 1441 patients with Type 1 DM
- Kumamoto Study
  - 6-year study in 110 Japanese patients with Type 2 DM
- UKPDS
  - United Kingdom Prospective Diabetes Study
  - 20-year study of 5102 newly diagnosed Type 2 DM

The burden of type 2 diabetes can be reduced

The UKPDS showed that, when glucose levels are above normal, any reduction in HbA_{1c} is beneficial

0.9%
reduction in HbA_{1c}

=

25%
reduction microvascular complications

UKPDS 33. Lancet 1998;352:837–853.

Preventative Measures
DCCT

- Intensive control of blood glucose reduced risk of diabetic complications
  - 76% reduction retinopathy onset
  - 54% reduction retinopathy progression
  - 54% reduction nephropathy
  - 60% reduction neuropathy
- 2-3x greater incidence of severe hypoglycemia

DCCT Research Group *N Engl J Med.* 1993;329: 977-986.

UKPDS Key Messages

- To reduce the complications of diabetes, it is necessary to control:
  - blood glucose and HbA_{1c} levels
  - blood pressure
- Epidemiologic analyses showed that for every percentage point reduction in HbA_{1c}, there was a
  - 35% reduction in microvascular complications
  - 25% reduction in diabetes-related deaths
  - 18% reduction in MI

American Diabetes Association. *Diabetes Care*. 1999;22(suppl 1):S27-S31.
UKPDS Group. *Lancet*. 1998;352:854-865.
UKPDS Group. *BMJ*. 1998;317:703-713.
Nathan D. *Lancet*. 1998;352:832-833.

It Works……at least for some things

	DCCT[1](1993)	Kumamoto[2](1995)	UKPDS[3]1998)
Retinopathy	Up to 76% less	69% less	21% decrease
Nephropathy	Up to 56% less	70% less	33% decrease
Neuropathy	Up to 60% less		
Atherosclerotic Events	41% fewer	50% fewer	ND
Overall Microvascular Complications	Data not Available	Data not Available	25% decrease

[1] The DCCT Group. *N Engl. J Med* 1993.

[2] Ohkubo Y, etl. al. *Diab Res Clin Pract* 1995.

[3] UKPDS Group. *Diabetes Care* 1998.

General Goals of treatment

Goals of Treatment

- Alleviate symptoms
- Prevent complications
- Prevent progression of current complications
- Improve quality of life

Goals of treatment

Guidelines for Glycemic, BP, & Lipid Control

	American Diabetes Assoc. Goals
HbA1C	**< 7.0%** *(individualization)*
Preprandial glucose	**70-130** mg/dL (3.9-7.2 mmol/l)
Postprandial glucose	**< 180** mg/dL
Blood pressure	**< 130/80** mmHg
Lipids	**LDL:** **< 100** mg/dL (2.59 mmol/l) **< 70** mg/dL (1.81 mmol/l) (with overt CVD) **HDL:** **> 40** mg/dL (1.04 mmol/l) ♂ **> 50** mg/dL (1.30 mmol/l) ♀ **TG:** **< 150** mg/dL (1.69 mmol/l)

HDL = high-density lipoprotein; LDL = low-density lipoprotein; PG = plasma glucose; TG = triglycerides.

ADA. *Diabetes Care.* 2012;35:S11-63

Diabetic control

- Normal HBA_{1C} 3.5 – 6.5%
- Targets

	HBA1c	Fasting plasma glucose
Low risk	≤6.5	≤100
Macrovascular risk	>6.5	>100
Microvascular risk	>7.5	>110

Collaborative Management

Collaborative Management

- Nutritional Therapy
- Activity
- Monitoring of Blood Glucose
- Medication - Insulin or Oral Agents
- Education

Nutritional therapy

Nutritional Therapy

- Cornerstone of care for Diabetic
- No one “diabetic” or “ADA” diet
- Use individualized approach
- Consider financial status and cultural and ethnic influences
- Priority placed on amount of CHO, not source of the CHO

Goals of Nutritional Therapy

- Goals:
  - Near Normal Glucose Levels
  - Normal Blood Pressure
  - Normal Serum Lipid Levels
  - Reasonable Body Weight
  - Promotion of Overall Health

Nutrition Goals for

Type 1 ***

- Increase in energy intake possible
- Diet and Insulin nec. to control BS
- Equal distribution of CHO through meals for insulin activity
- Consistency in daily intake - control BS

*** Type 2

- Reduction of energy intake for obese
- Diet alone may control blood glucose
- Equal distribution of CHO desirable, not essential;low fat desirable
- Consistency in daily intake - control wt.

Nutritional Goals (con't)

Type 1 **

- Timing of meals - crucial
- Snacks - frequently necessary
- Additional food for exercise - CHO 20 g/h for moderate physical activity

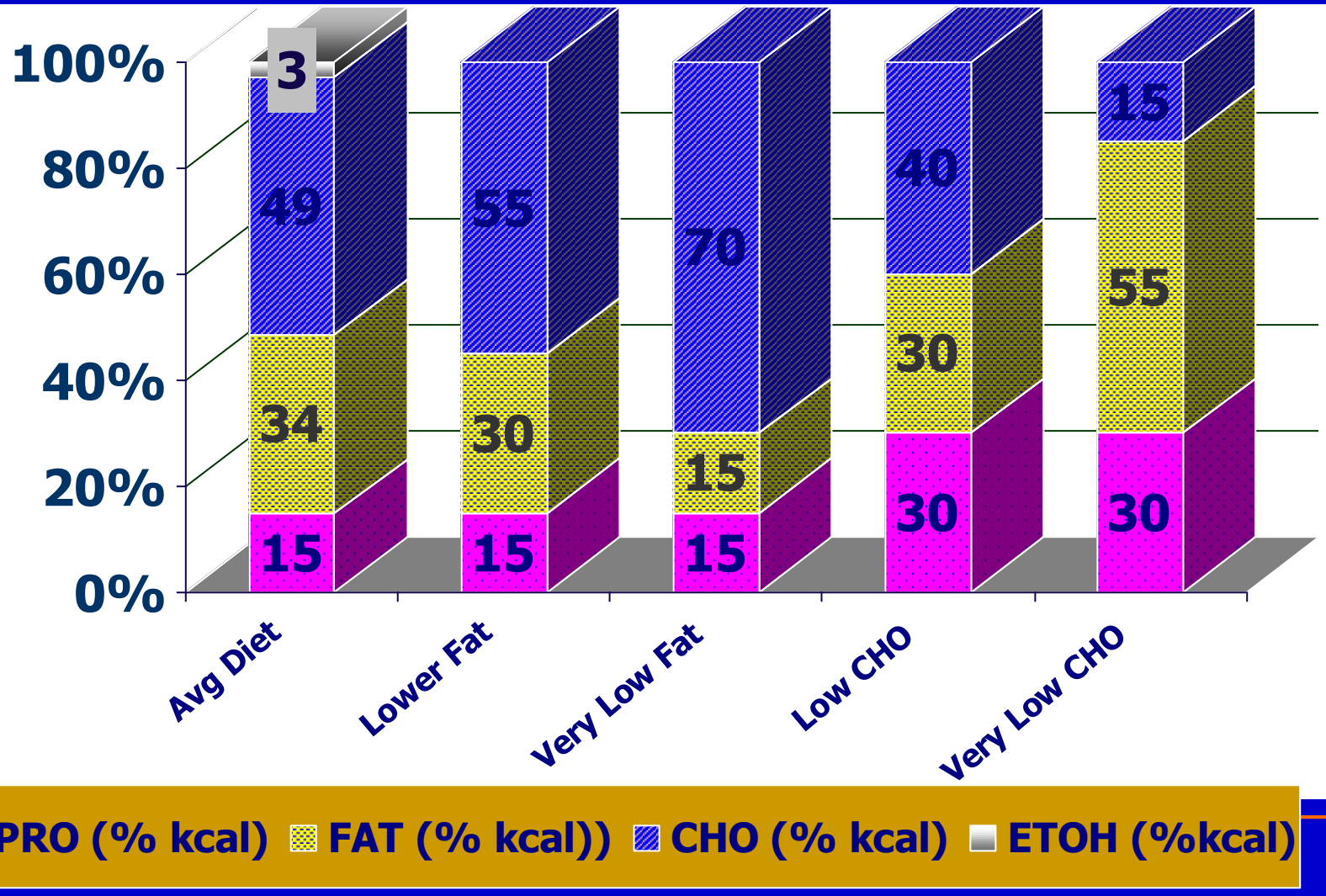
**Type 2

- Timing of meals not essential
- Snacks - not recommended
- Additional food for exercise if on sulfonylurea or insulin

Dietary Intake in Myanmar

- Mean daily intake?
  - 1500-2000 Total kcal
    - ? 35% Fat
    - ? 15% Protein
    - ? 50% CHO

Macronutrient Composition of Various Diets



Type 2 Diabetes Mellitus

Nutrition Goals for Type 2

- Weight loss of approximately 10-20 lb (4.5-9.0 kg)
- Space meals throughout day
- Avoid excessive CHO intake at one meal
- May need consistent mealtime depending on insulin use or insulin secretagogues
- Exercise

Diabetes Prevention Program Research Group

- 3234 adults with impaired glucose tolerance
- Randomized (3 years)
  - standard lifestyle plus Metformin
  - standard lifestyle plus placebo
  - intensive lifestyle modification

Lifestyle Modification

- Weight loss (decrease weight by 7 %)
  - individualized counseling
  - healthy, low calorie, low-fat diet
  - A 16 lesson curriculum on diet, exercise, behavior modification
- Exercise 150 minutes per week

Results

- Intensive lifestyle modification group
  - reduced incidence of diabetes by 58 %
- Metformin
  - reduced incidence of diabetes by 31 %

Exercise

- Potential Benefits
  - Improved Glucose tolerance
  - Weight loss or maintenance or desirable weight
  - Improved cardiovascular risk factors
  - Improved response to pharmacologic therapy
  - Improved energy level, muscular strength, flexibility, quality of life, and sense of well being

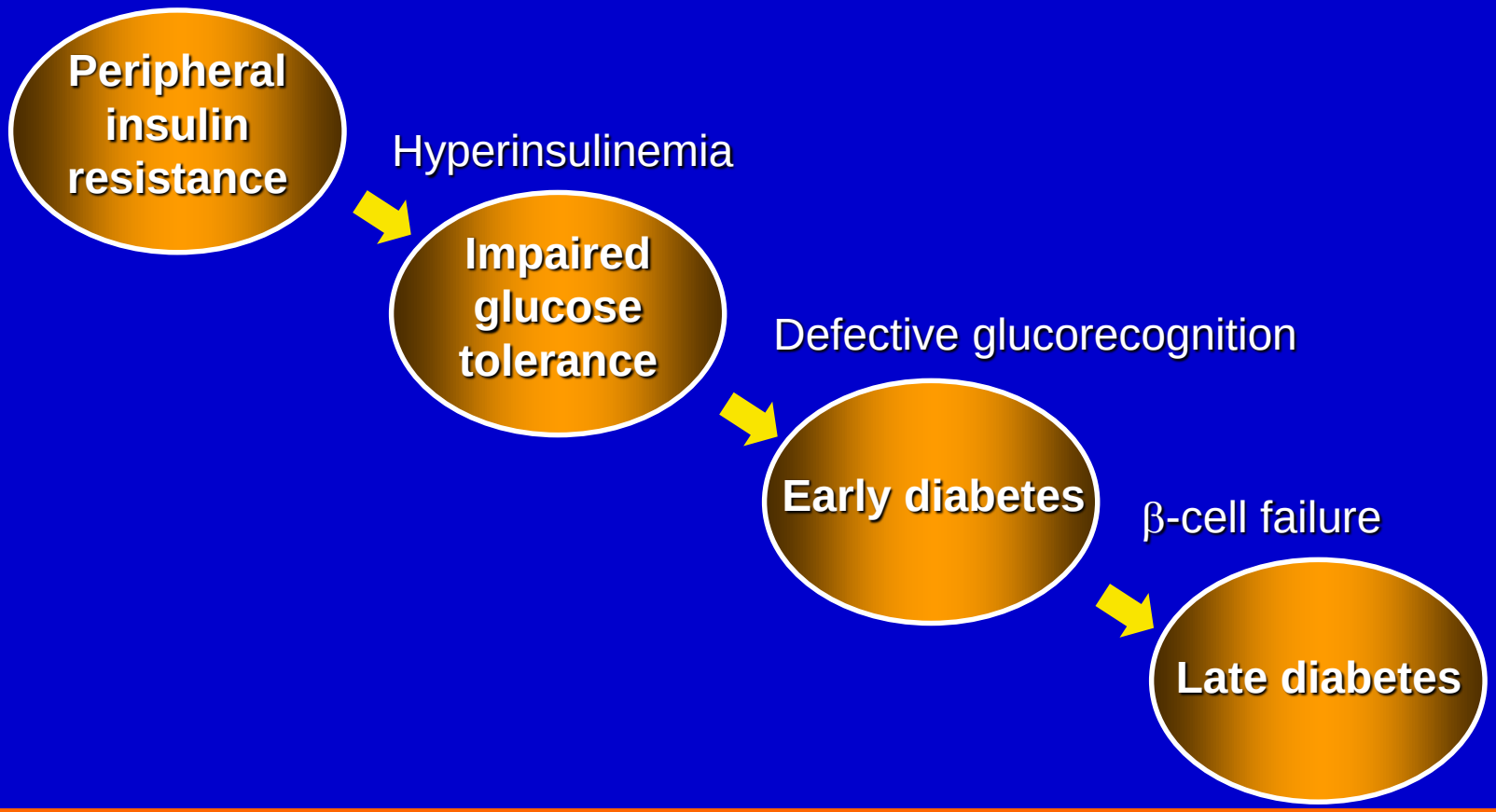
Exercise Prescription

- Interest
- Capacity
- Motivation
- Physical status
- Individualized approach

Types of exercise

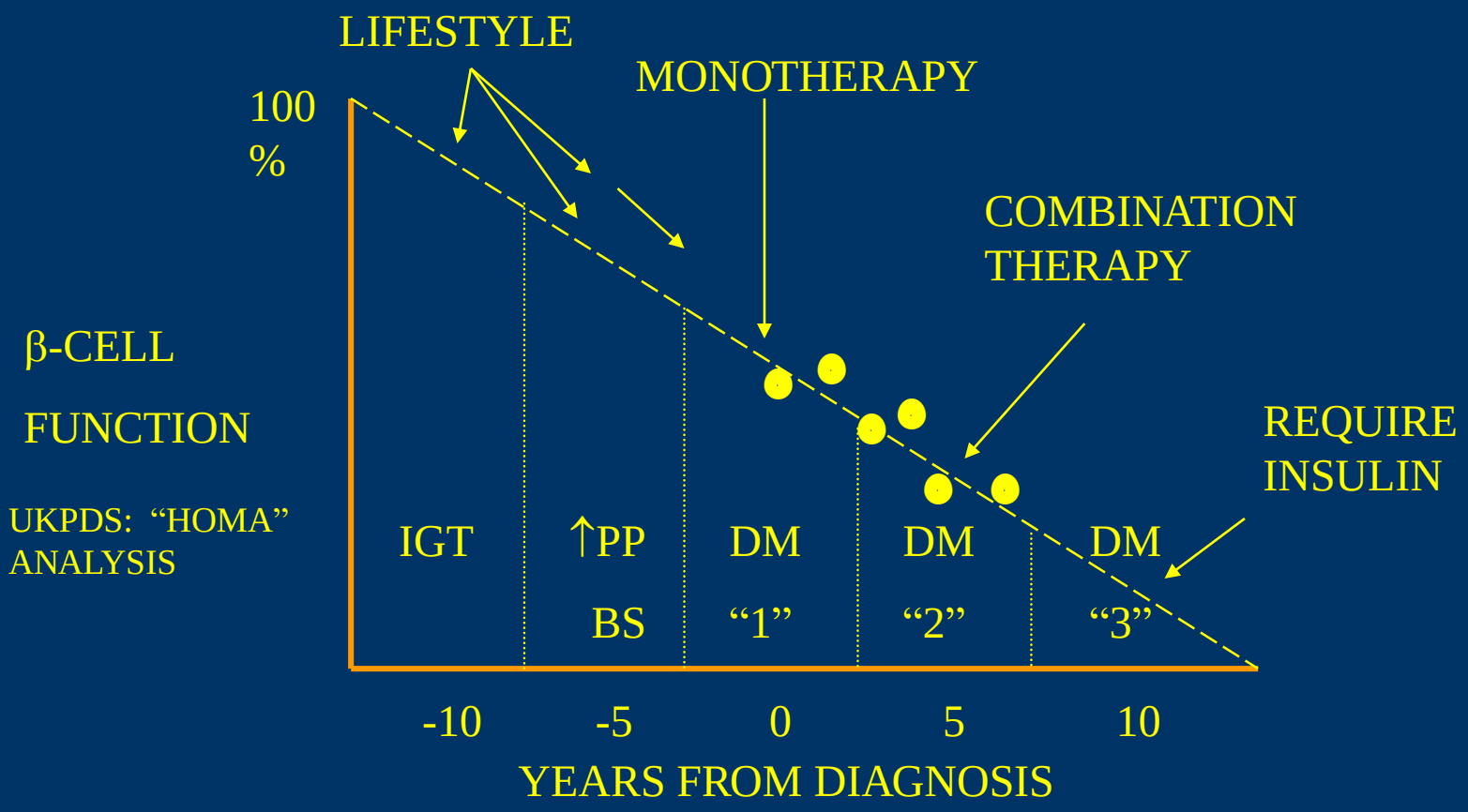
- Walking
- Biking and stationary cycling
- Lap swimming and water aerobics
- Weight lifting
- At least 3-4 times a week, 30-40 minutes per session
- Wt. loss is enhanced if exercise is increased to 5-6 times per week

Metabolic Staging of Type 2 Diabetes



Saltiel AR, Olefsky JM. *Diabetes.* 1996;45:1661-1669.

"STAGES" OF TYPE 2 DIABETES



"Pre-diabetes"

- new term to describe IFG (impaired fasting glucose) and IGT (impaired glucose tolerance).
  - 16 million people have pre-diabetes.
  - Most will develop diabetes within 10 years.
- Prevention strategies
  - screen at risk populations (> 45 yrs, obese)
  - lose 5-10% of weight
  - modest exercise 30 min/day

Weight Control

Energy In	=	Energy Out
CHO: 4 kcals/g		Metabolism
Protein: 4 kcals/g		Daily Activities
Fat: 9 kcals/g		Exercise
EtOH: 7 kcals/g		

Weight Loss

- Improves Glucose Control
- Increases Sensitivity to insulin
- Lower lipid levels and blood pressure
- Corresponding lowering of the dosage of pharmacologic agents

For a Successful Outcome

- Modest Energy Restrictions
- Spreading energy intake throughout the day
- Increased Physical Activity
- Behavior Modification
- Psychosocial Support

Estimating Energy Needs

- Harris-Benedict Equation (BEE)
  - Variables:
    - Sex
    - Weight (kg)
    - Height (cm)
    - Age (years)
  - Men: 66.47 + (13.75 x weight) + (5 x height) – (6.76 x age)
  - Women: 655.1 + (9.56 x weight) + (1.85 x height) – (4.67 x age)

Total energy needs = BEE x activity factor x stress factor

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Estimating Energy Needs

Simplistic Formula

Calorie requirement = 25 to 30 kcal/kg/day

Weight Loss

1 pound body fat = 3500 kcals stored energy

- Energy deficit of 500 kcals/day to lose 1 lb/wk
- Energy deficit of 250 kcals/day to lose 1/2 lb/wk

Create energy deficit by:

- Eating less calories
- Exercise more

Guidelines for Weight Loss

- Limit eating for emotional or situational reasons.
- Limit non-nutritious energy sources.
- Limit added fats.
- Use lean meats.
- Use lowfat dairy products.
- Use lowfat cooking methods.
- Choose low calorie beverages.
- Eat a balanced diet and don’t skip meals.
- Exercise regularly.

Getting to the Heart of the Matter

- The number 1 cause of death for people with diabetes is heart disease.
- Minimize risk factors:

  * control BG
  * don't smoke
  * control BP
  * control lipids
  * control weight
  * exercise regularly

Treatment Goals

- Blood Pressure ≤ 130/80

- Total Chol < 200 mg/dl
- LDL Chol < 100 mg/dl
- HDL Chol > 40 mg/dl
- Triglycerides < 150 mg/dl

Heart Healthy Diet

- Decrease saturated, hydrogenated, and trans-fatty acids. (< 7% kcals)
- Limit dietary cholesterol. (<200 mg/d)
- Increase intake of omega-3 fatty acids.
- Increase intake of soluble fiber. (10-25 g/d)
- Include plant stanols/sterols. (2 g/d)

Dietary Fats Defined

- Saturated Fats
  - solid at room temperature
  - animal fats
- Hydrogenated Fats
  - vegetable oils in origin, modified to solidify
- Trans Fatty Acids
  - occur mostly in hydrogenated fats

All of the above fats can raise LDL cholesterol.

Dietary Fats Defined

- Polyunsaturated Fats
  - safflower, corn, sunflower, sesame, cottonseed
- Monounsaturated Fats
  - olive, canola, peanut, avocados
- Omega-3 Fatty Acids
  - fish: salmon, tuna, mackerel, herring, sardines
  - vegetarian sources: flaxseed, walnut, soybean, canola, evening primrose.

Dietary Cholesterol

- Only found in animal products.
- Most concentrated sources:
  - eggs (212 mg/yolk)
  - shrimp (194 mg/3.5 oz, 100g)
  - squid (231 mg/3.5 oz, 100g)
  - liver (389 mg beef, 631 mg chicken, 3.5 oz, 100g)
  - meat (75-95 mg/3.5 oz, 100g beef, chicken, pork)

Soluble Fiber

- Binds bile acids in the intestine, so that the bile acids are not absorbed in the terminal ileum.
- New bile acids are made from circulating cholesterol, thus lowering serum chol.
- Best Sources:
  - oats, beans/legumes, rice bran, barley
  - carrots, broccoli, sweet potatoes,
  - citrus, papaya, apples, strawberries

Homocysteine Alert

- Elevated homocysteine levels may increase the risk of heart disease.
- Adequate intake of these vitamins can lower homocysteine levels:
  - Folate: fruits, vegetables, legumes, avocado, yeast, wheat germ, fortified cereals and grains.
  - Vit B6: whole grains, legumes, fish, chicken...
  - Vit B12: milk, cheese, meat, fish, chicken, eggs

Blood Pressure Control

- Lifestyle Modifications
  - control weight
  - exercise regularly
  - limit sodium
  - limit alcohol
  - eat diet rich in potassium
  - eat adequate amounts of calcium (?)

Reduce Sodium Intake

- Limit to 2,400 mg/d
- Low Sodium Strategies:
  - avoid the salt shaker
  - limit use of processed foods
  - limit fast food restaurant meals
  - season with herbs, spices, garlic, ginger, lemon, onions, flavored vinegar

Potassium

- Unless patient is limiting potassium for renal disease, or hyperkalemia, encourage a diet rich in potassium. Sources include:
  - apricots, avocados, bananas, cantaloupe, kiwi, mangos, oranges, strawberries
  - artichokes, tomatoes, potatoes, yams, legumes, parsnips, winter squash
  - milk, yogurt
  - lean meat, fish, skinless poultry

Complications = Restricted Diets

- Nephropathy
  - protein restriction 0.8 g/kg/day
  - potassium, phosphorus, sodium, fluid restrictions.
- Gastroparesis
  - small frequent meals
  - lowfat, low fiber, puree/liquid consistency
  - difficulty matching insulin kinetics and digestion timing.

Dietary Management of Diabetes: Guidelines

Same as for the general population

Total fat: 30% or less of total energy

- (20% or less in obese)
- If elevated triglycerides, reduce CHO and increase fat to 35-40% of energy
- Saturated fat -- 10% of total energy

Protein: 10 - 20% of total energy intake

CHO: 55% of total energy intake

Dietary Management of Diabetes: Guidelines

Carbohydrates and Sweeteners

- Emphasis on total CHO rather than simple or complex
- Can have sucrose as part of CHO allotment up to a maximum of 10% of calories
- Different foods have different effects on blood sugar level -- glycemic index

Nutrition Consult – Individualized Meal Planning

- Conduct Initial Assessment of Nutritional Status
- Diet History, Lifestyle, Eating Habit
- Provide Patient Education Regarding
  - Basic principles of diet therapy
  - Meal planning
  - Problem solving
  - Developing individualized meal plan
  - Emphasize one or two priorities
  - Minimize changes from the patient's usual diet

Priorities for Meal Planning

If require insulin (two injections of mixed short and intermediate acting insulin):

- Timing of meals and snacks important
- Quantity and quality of food important
- Watch CHO content
- Snacks at time of peak insulin action

With more intensive use of insulin (including regular insulin before meals)

- Have more flexibility in food and timing

Priorities for Meal Planning

Type 2 diabetes with no insulin:

- Gradually reduce total and saturated fat
- Spread calories throughout the day
- Avoid large amount of food at one time
- Space meals at least 4-5 hours apart
- Aim for healthy body weight
- Promote appropriate exercise

Diabetic Exchange System

- Are tools for enabling food choices based on categories of foods and serving sizes
- Patients need to be fairly literate
- Canadian and American and European systems differ

Glycemic Index (GI)

- An indicator of the impact of foods on the response of blood glucose
- Foods with a low GI are digested and absorbed more slowly than foods with a high GI
- Low GI foods increase amount of CHO entering colon and increase fermentation
- Used for making food choices by diabetics and people with impaired glucose tolerance

Glycemic Index Value: Examples

Food	Glycemic Index
bread	100
cereal	72
milk	39
sucrose	87
orange juice	74

Artificial Sweeteners

- Sugar alcohols (sorbitol, mannitol, xylitol cause less rise in blood glucose

Non-nutritive Sweeteners

- Aspartame (Equal, Nutrasweet, candarel)
- Saccharin (Sweet’n Low, Sugar Twin)

Alcohol Inake

Alcohol

- Moderate amounts can be consumed when diabetes is well controlled
- No more than two drinks per day
- Should always take alcohol with food

Some Special Situations

Delayed meals

- Eat a snack if expect meal will be delayed
- Carry available source of CHO i.e. Glucose tablets or hard candy to avoid hypoglycemic reaction

Some Special Situations

Strenuous exercise

- Eat extra food before activity and take 15-30 grams of CHO for every 30 min of strenuous activity (15 g CHO for each hour of less strenuous exercise)
- Eat hearty snack after activity
- If activity is pre-planned may reduce insulin dosage prior to activity

Some Special Situations

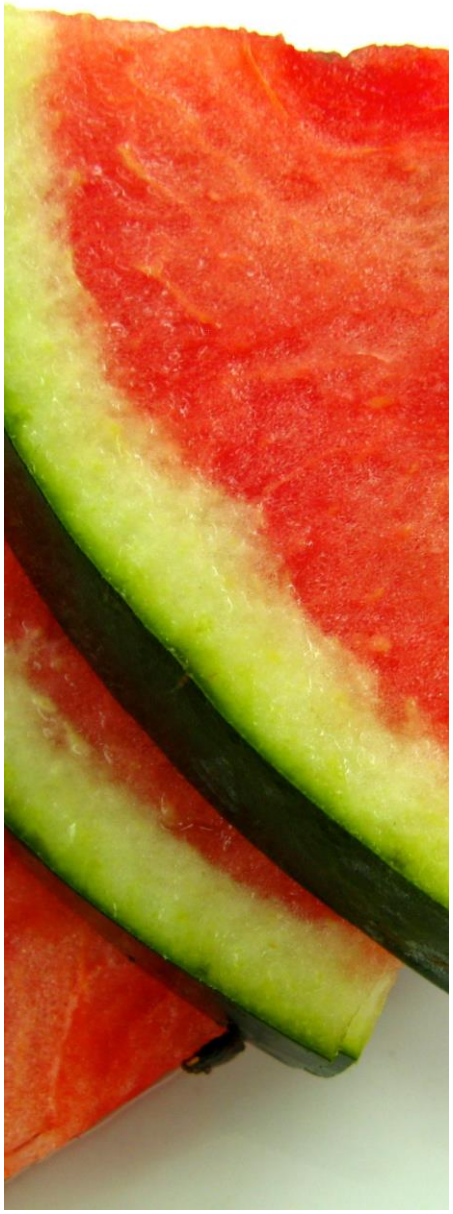
Illness

- Lack of appetite often with illness
- Substitute foods that are well tolerated
- Drink sugar containing liquids
- For each missed meal give 50 g CHO in small frequent feedings over 3-4 hours
- Type I should not miss insulin as illness often causes rise in blood glucose

Hypoglycemia: Treatment

- Give quickly absorbed CHO immediately (1/3 can coke, 2 sugar cubes, 15 g glucose tablets)
- Repeat treatment every 15-20 minutes if symptoms continue
- If unconscious give intravenous glucose or glucagon injection

- So MNT in diabetics is ?



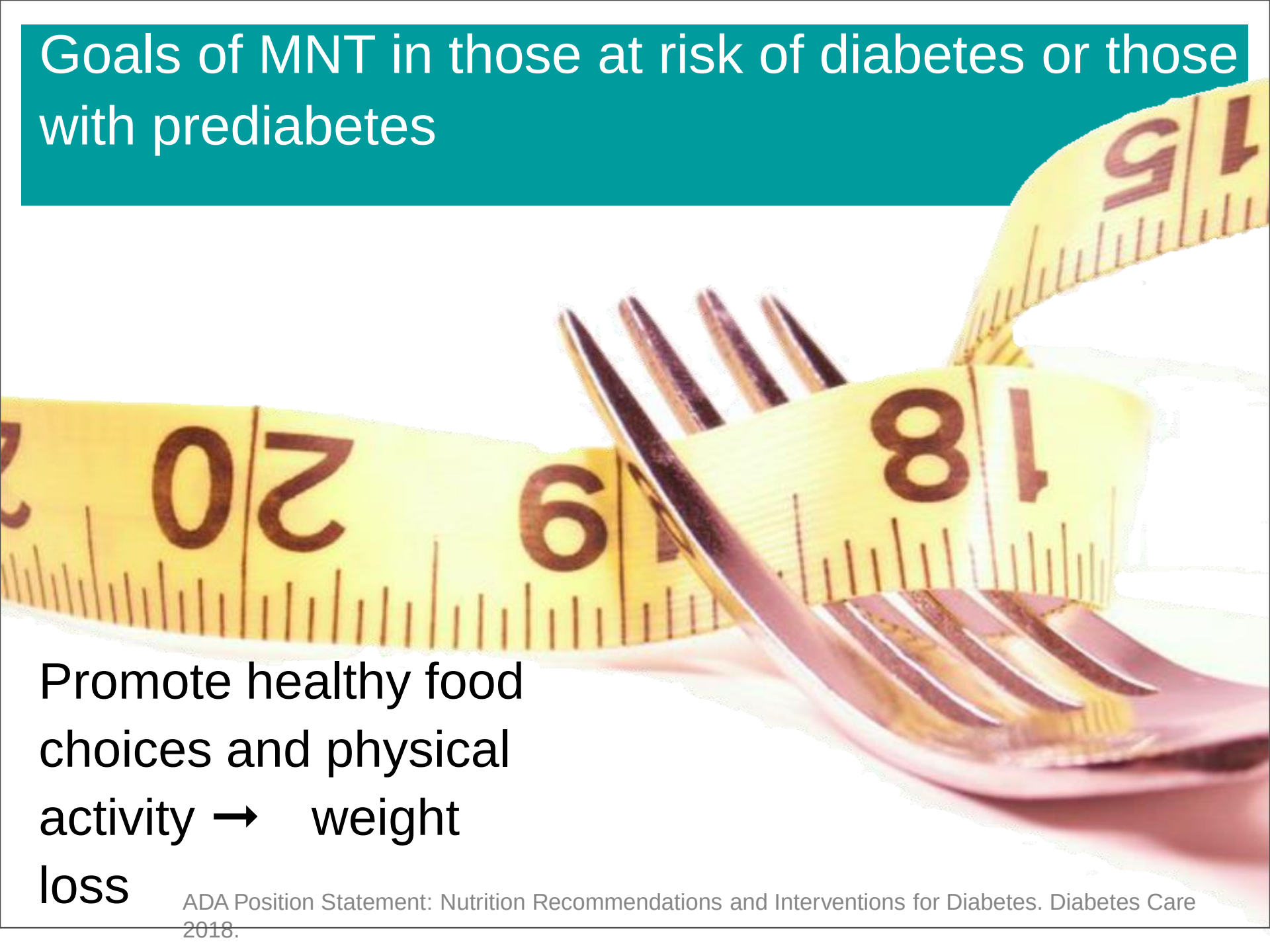
Plate, Pyramid or Perseverance ?

Who should receive MNT?

All individuals **at risk for diabetes**, those with **prediabetes** or **diabetes** and **overweight** individuals with **metabolic syndrome** should be advised

Morbidly obese belly by FBellon
https://flic.kr/p/iczMwD

Goals of MNT in those at risk of diabetes or those with prediabetes



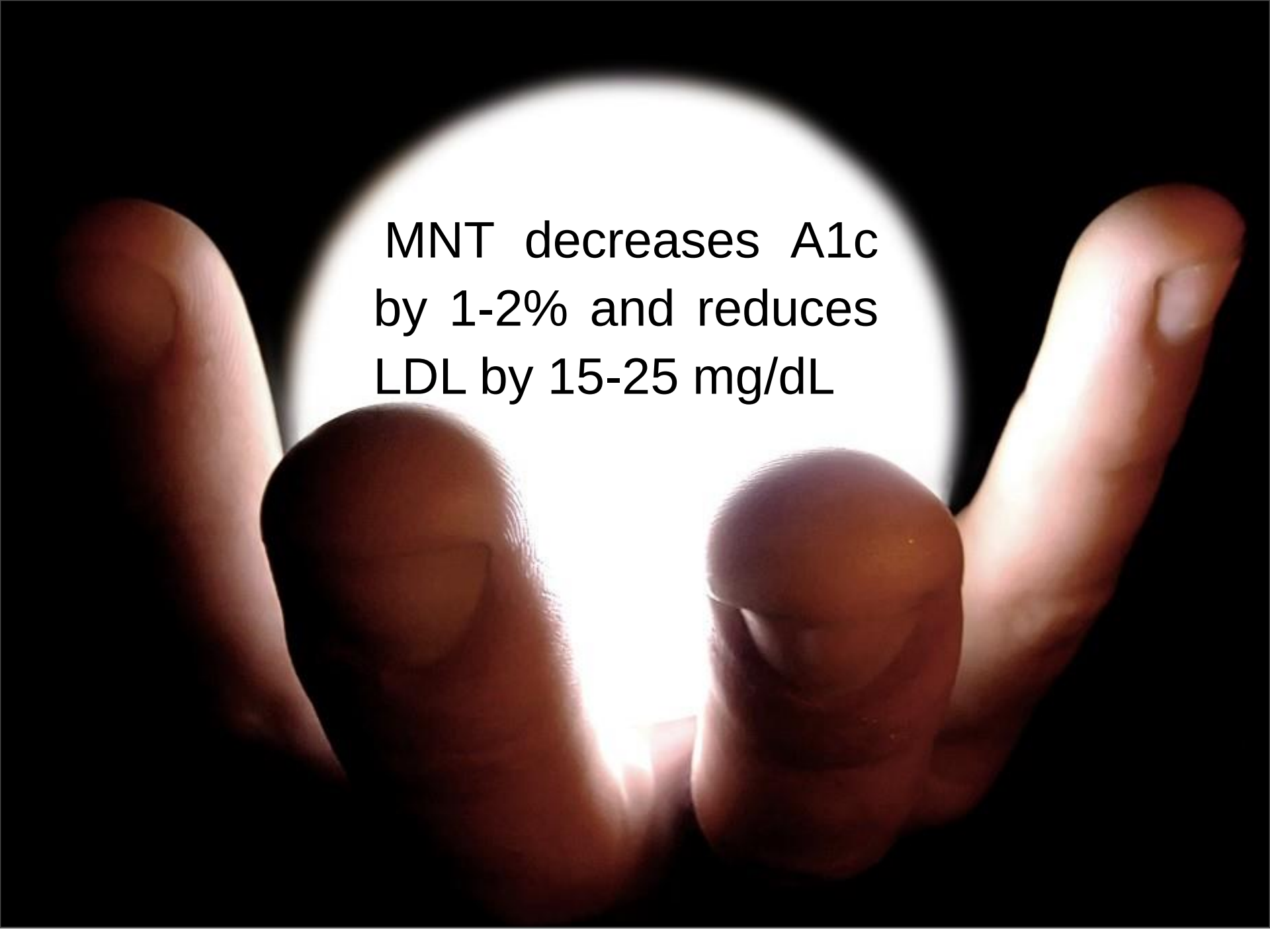
Promote healthy food choices and physical activity → weight loss

ADA Position Statement: Nutrition Recommendations and Interventions for Diabetes. Diabetes Care 2018.

Goals of MNT in those with diabetes

- Normal or as near normal as possible glucose, lipids and blood pressure
- Prevent or slow down the rate of development of chronic complications
- Address individual nutrition needs (personal/cultural preferences and willingness to change)
- Maintain pleasure of eating by only limiting food choices when indicated by scientific evidence

ADA Position Statement: Nutrition Recommendations and Interventions for Diabetes. Diabetes Care 2018.


MNT decreases A1c by 1-2% and reduces LDL by 15-25 mg/dL

EAT MOST

Use one or more of these foods as the basis of every meal

Vegetables, legumes, lentils, grains, barley, wholegrain cereals, fresh fruit (non- sweet)

EAT MODERATELY

Have small servings of protein-rich foods

fish, seafood, eggs, lean meat, skinless chicken, low-fat cheese, low-fat yoghurt, low-fat milk, nuts

EAT LEAST

Minimise fats, sugars, salt and alcohol

butter, oil, ghee, cream, coconut milk and cream, processed meat, fried foods, preserved or processed foods, pastries, sweets, biscuits, soft drink

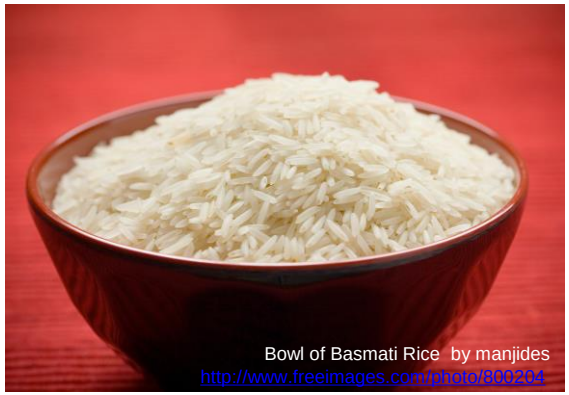
Asia Pacific Type 2 Diabetes Policy

Fresh vegetables 6 by MeiTeng
http://www.freeimages.com/photo/1441972

Japanese sushi by chokingxi
http://www.freeimages.com/photo/1443887

Bits-n-bites Truffle by Subhadipin
http://www.freeimages.com/photo/1437365

Olive oil by TanjaS
http://www.freeimages.com/photo/259035


Bowl of Basmati Rice by manjides
http://www.freeimages.com/photo/800204


Pink salmon by lockstockb
http://www.freeimages.com/photo/977608

Fat

Not >30%

Saturated fat <10%

Carbohydrate

50-55%

Sucrose <10%

Protein

15-20%

Asia Pacific Type 2 Diabetes Policy Group

Reduce salt intake to <6 g/day for those with hypertension

Asia Pacific Type 2 Diabetes Policy Group

Higher dietary fiber intake (25-50 g/day) for persons with diabetes

Diabetic Exchanges

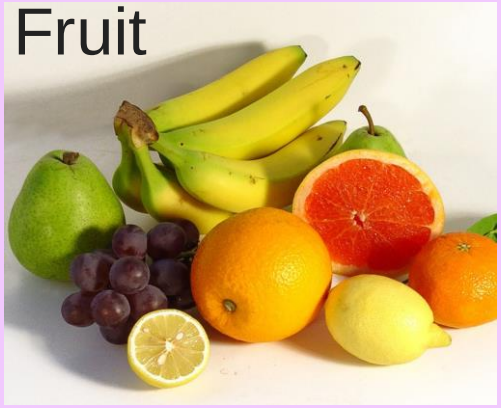
Daily meal plan based on a set amount of servings from each category

Starch

Meat/meat substitutes

Non-starchy vegetables

Fruit



Milk

Fats

Diabetic Exchanges

Starch

Meat/meat substitutes

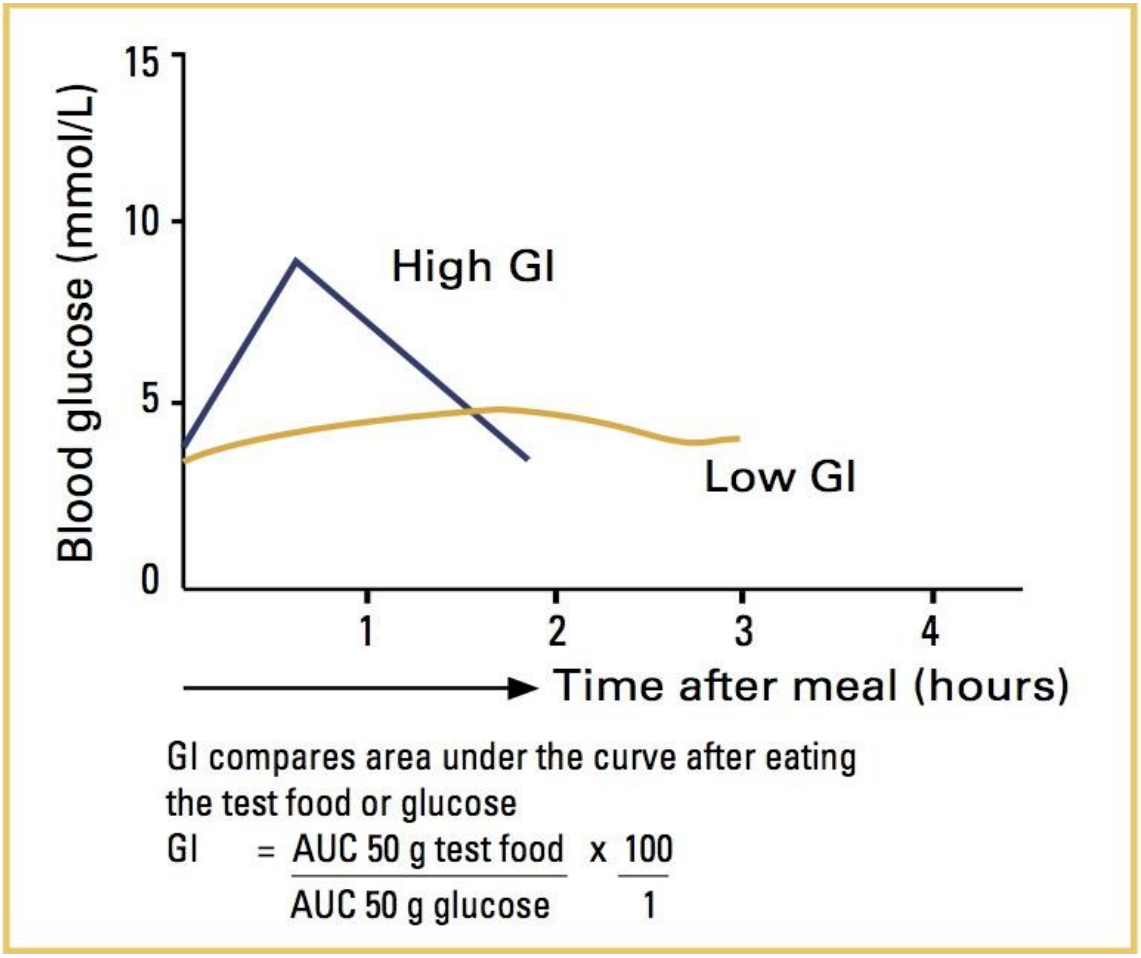
Non-starchy vegetables

Fruit

Milk

Fats

- Allows a person to measure rather than weigh food
- Any food may be substituted for another within the same food category
- Free food contains <20 cal (can be eaten in any amount spread throughout the day) i.e. catsup, soy sauce, spices



Low GI
0-55

Intermediate
56-69

High GI
≥70

GLYCEMIC INDEX (GI)

Increase in blood glucose (over fasting level) in 2 h following ingestion of 50 g CHO

Llona A. Nutr Hosp 2006;21:53-59

Issues with GI

- Only accounts for CHO type (not total amount)
- Measures response to individual food consumed in isolation
- GI for any particular food item highly variable
- Inaccurate predictor of postprandial response in diabetes

Dietary CHO (Amount & Type) in the Prevention & Management of Diabetes: American Diabetes Association Position Statement (2004)

Major Goals for Diabetes Management

Goal	Benefit
Glycemic control	Prevent/limit microvascular complications
Controlled lipid metabolism and blood pressure	Prevent/limit macrovascular complications
Balanced food intake and energy output	Control weight Improve overall health

TNT 3.0 AN INTEGRATED APPROACH TO PATIENT CARE
TOTAL NUTRITION THERAPY™

Goals of Medical Nutrition Therapy

Achieve and maintain optimal glycemia and lipid levels

- Moderate postprandial blood glucose response
- Achieve and maintain healthy weight
- Address individual nutrition needs

American Diabetes Association. *Diabetes Care* 2006;29:S4-S42.

TNT 3.0 AN INTEGRATED APPROACH TO PATIENT CARE
TOTAL NUTRITION THERAPY™

MNT for Diabetics

- Calorie requirements
  - 25-30 kcal/kg/day
- Carbohydrates
  - Amount
  - Timing
  - Source
- Fat
- Protein

Dietary Recommendations

Macronutrient Distribution

Nutrient	EASD (% Energy)	ADA (% Energy)
Protein	10-20	15-20
Fat	35	-
SFA	SFA + trans fats < 10, individually tailor MUFA	<7, limit trans fats Cholesterol < 200 mg/ day, individually tailor MUFA
Carbohydrate	45-60	At least 130 g/day

TNT 3.0 AN INTEGRATED APPROACH TO PATIENT CARE
TOTAL NUTRITION THERAPY™

Mann JI, et al. *Nutr Metab Cardiovasc Dis* 2004;14:373-394.
American Diabetes Association. *Diabetes Care* 2007;30(suppl 1):S48-S65.

- So finally

  “ You are what you eat”

  “They are what they eat”

One, Two … Count your food
Three, Four ...Exercise more
Five, Six ... Small meals fix
Seven, Eight ... Now how’s your weight
Nine, Ten ... Start again

Thank you