Lifestyle changes in Diabetes

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Lifestyle management

- lifestyle—healthy and appropriate food choices and physical activity—play an important role in both prevention and treatment in diabetes

- lifestyle strategies in individuals at risk for diabetes (prediabetes) can effectively prevent or delay type 2 diabetes

- Type 2 diabetes is known to be a progressive disease, lifestyle interventions are effective at any time in the disease process, they have their greatest impact earlier in the course of the disease

- Preventing obesity and increasing physical activity is a high priority for the prevention of diabetes and other chronic diseases

- Identifying individuals with prediabetes and implementing prevention interventions is essential
- as the disease progresses the goal of nutrition therapy is to prevent and manage the long-term complications of diabetes

- First-line therapy for disease reduction for diabetes and CVD: stopping cigarette smoking, reducing glucose, LDL cholesterol, and blood pressure
- Nutrition therapy: a reduction of body weight by 5%–10% in overweight and obese individuals, an increase in physical activity to 30–60 min/day of moderate-intensity activity, implementation of a cardioprotective diet (an increase in whole grains and fiber and a decrease in saturated and *trans*-fatty acids and dietary cholesterol)

OVERWEIGHT AND OBESITY

- strongly associated with insulin resistance, slowing the rising prevalence of obesity will have a positive impact on slowing the epidemic of diabetes and other chronic diseases

- Body mass index (BMI = kg/m2) and waist circumference (WC)

- the physical activity goal: increase the number of steps an individual takes throughout the day by about 2000 steps above baseline

- the decreased energy intake goal: eat 100 fewer calories per day

PREDIABETES: PREVENTING DIABETES

- Prediabetes is defined as hyperglycemia not sufficient to meet the diagnostic criteria for diabetes
- Impaired fasting glucose (IFG), impaired glucose tolerance (IGT), and hemoglobin A1c (A1C) values in the 5.7%–6.4% identify persons at increased risk for diabetes as well as CVD
- As A1C rises, the risk of diabetes rises disproportionately. Individuals with A1Cs between 6.0% and 6.49% are considered to be at very high risk for diabetes

Criteria for the Diagnosis of Diabetes

- A1C ≥6.5%
- or
- Fasting plasma glucose (FPG) ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h
- or
- 2 h plasma glucose (PG) ≥200 mg/dL (11.1 mmol/L) during an oral glucose tolerance test (OGTT). This test uses the equivalent of 75 g anhydrous glucose dissolved in water
- or
- Classic symptoms of diabetes and casual PG ≥200 mg/dL (11.1 mmol/L)

Categories of Increased Risk for Diabetes (Prediabetes)

- A1C 5.7%–6.4%
- Or
-
- FPG 100–125 mg/dL (5.6–6.9 mmol/L): IFG
- or
- 2 h PG in the 75 g OGTT 140–199 mg/dL (7.8–11.0 mmol/L): IGT

Diabetes Prevention Trials

- Intensive lifestyle interventions: the safest, most efficacious, and usually the least expensive way to prevent diabetes
- medications (i.e., metformin, acarbose, orlistat, rosiglitazone, voglibose, pioglitazone) can also prevent or delay progression from prediabetes to diabetes
- The American Diabetes Association: only metformin as drug therapy for individuals with prediabetes

- Metformin is most effective in individuals with a BMI of at least 35 kg/m2 and who are under the age of 60 years

- Cost, side effects, weight gain, and lack of persistence of effect in some studies are concerns with other medications

A sustained reduction in the rate of conversion to type 2 diabetes was reported:

- at 20 years in the Da Qing study:43%
- at 7 years in the Finnish DPS: 43%
- at 10 years in the DPP: 34%
- Lifestyle intervention resulted in sustained lifestyle changes and a reduction in diabetes incidence, which remained after the individual lifestyle counseling was stopped

Nutrition Therapy for Prediabetes

- The goal of nutrition therapy for prediabetes: prevent or delay the progression to type 2 diabetes
- Interventions proven to be effective: a reduced energy intake leading to moderate weight loss and increased physical activity
- Weight loss (5%–10% of body weight) and regular physical activity (30 min daily)

Weight Loss Interventions

- 8 different interventions: diet alone, diet and exercise, exercise alone, meal replacements, very low-calorie diets, orlistat, sibutramine, and advice alone
- A mean weight loss of 5–8.5 kg (5%–9% of baseline weight) was observed in the first 6 months from interventions involving a reduced energy diet and/or weight loss medications

- A plateau in weight loss was observed between ~6 and 12 months
- in studies extending to 48 months, a mean 3–6 kg (3%–6%) of weight loss was maintained with none of the groups experiencing weight regain to baseline
- In contrast, advice-only and exercise-alone groups experienced minimal weight loss at any time point

Carbohydrates and Insulin Resistance

- It is often assumed that a high carbohydrate intake contributes to insulin resistance and to increases in triglyceride concentrations
- Observational and intervention studies provide support for the concept that high-carbohydrate diets, at the very least, do not adversely affect insulin sensitivity and may be beneficial for insulin sensitivity
- carbohydrate appears to only increase triglyceride levels when energy intake and weight are constant and carbohydrate intake is ~55% of total energy intake

- high intakes of dietary fats, especially SFA and *trans*-fatty acids: a decline in insulin sensitivity

- Excess energy intake, regardless of the energy source, and positive energy balance (production of obesity): insulin resistance

- increased consumption of sugar-sweetened beverages (SSB): soft drinks, fruit drinks, iced teas, and energy and vitamin-water drinks
- the highest quartile of SSB (most often one to two servings per day): a 26% greater risk of developing type 2 diabetes than those in the lowest quartile (none or less than one serving per month) and a greater risk for metabolic syndrome
- SSBs: weight gain and obesity

traditional Mediterranean Diet (MedDiet):

- high consumption of vegetables, legumes, grains, fruits, nuts, and olive oil
- moderate consumption of fish and alcohol
- low consumption of red and processed meat and whole fat dairy products
- a protective effect against diabetes
- changing foods eaten can substantially reduce diabetes risk without weight loss

- **Prediabetes and metabolic syndrome:** enlarged WC, lipid abnormalities, hypertension, insulin resistance, elevation in fasting glucose levels

- **adherence to the MedDiet:** decreased risk of metabolic syndrome, improvements in WC, lipids, blood pressure, and glucose, effectively prevent both the metabolic syndrome and diabetes

Whole Grains and Dietary Fiber

- inversely associated with insulin resistance and risk of type 2 diabetes
- lower fasting glucose and insulin concentrations independent of demographics, other dietary and lifestyle factors, and BMI
- improved insulin sensitivity, independent of body weight

Persons at risk for diabetes:

- consume at least half of all grains as whole grains
- limit the consumption of foods that contain refined grains, especially grain foods that contain solid fats, added sugars, and sodium

Dietary Fats

- Prevention studies have focused on reduced dietary fat as a key component of the intervention
- the type of fats consumed is of importance as well as their contributions to total energy intake
- intake of SFA is positively associated with (1) increased serum total and LDL cholesterol and increased risk of CVD and (2) increased markers of insulin resistance.

- decreased SFA intake: improves measures of both CVD and type 2 diabetes risk
- A 5% energy decrease in SFA, replaced by (MUFA) or (PUFA): decreases risk of CVD and type 2 diabetes in healthy adults and improves insulin responsiveness in insulin-resistant and type 2 diabetes individuals

- consumption of dietary cholesterol in the amount of one egg per day is not harmful and is not associated with risk of CVD or stroke in healthy adults, although consumption of more than seven eggs per week is associated with increased risk
- in individuals with type 2 diabetes increased dietary cholesterol is associated with CVD risk. Therefore, the recommendation is to limit dietary cholesterol to less than 200 mg/day for persons with or at high risk for CVD and type 2 diabetes

Glycemic Index/Glycemic Load

- The role of the glycemic index (GI) and glycemic load (GL) and risk of diabetes has been controversial
- there is not sufficient, consistent evidence to conclude that low GI/GL diets reduce the risk of diabetes
- Conclusion: when selecting carbohydrate foods, there is no need for concern with their GI or GL. What is important to heed is their calories, caloric density, and fiber content

Alcohol

- Observational studies suggest a U- or J-shaped association between moderate consumption of alcohol and increased risk of diabetes
- A meta-analysis based on 32 studies found that compared to no alcohol use, moderate consumption (one to three drinks per day [15–45 g alcohol]) was associated with a 33%–56% lower incidence of type 2 diabetes and a 34%–55% lower incidence of diabetes-related coronary heart disease

- compared with moderate consumption, heavy consumption (more than three drinks per day [45 g alcohol]) was associated with up to a 43% increased incidence of type 2 diabetes
- Another meta-analysis of 15 studies reported that compared to lifestyle abstainers, the risk for type 2 diabetes among men was most protective when consuming 22 g/day alcohol and became deleterious at just over 60 g/day alcohol
- Among women, consumption of 24 g/day alcohol was most protective and became deleterious at 50 g/day alcohol

- Despite the benefit of alcohol when consumed in moderation, when consumed in excess, alcohol can cause serious health problems and increased diabetes risk

- Therefore, if alcohol is consumed, it should be consumed in moderation —up to one drink per day for women and two drinks per day for men— and only by adults of legal drinking age

Physical Activity

- Increases in physical activity significantly reduce the risk of type 2 diabetes and, independent of weight loss, improve insulin sensitivity

- individuals who regularly engaged in physical activity of moderate intensity had an ~30% lower risk of type 2 diabetes as compared with sedentary individuals even in those who did not lose weight

- at least 2.5 h/week of walking is associated with a 63% lower risk of type 2 diabetes as compared with <1 h/week
- Protection from diabetes occurs from moderate-intensity activities, such as brisk walking, as well as from vigorous physical activity
- Benefits of exercise are particularly apparent in overweight individuals and in those at greatest risk for diabetes

Physical activity recommendations for cardiovascular fitness and reduced risk of chronic health problems including type 2 diabetes:

- **Moderate-intensity** aerobic physical activity a minimum of 30 min 5 days/week (150 min/week) (i.e., walking 3–4 miles/h) above usual activity

- **Vigorous-intensity** aerobic physical activity a minimum of 30 min 3 days/week (90 min/week)

- The physical activity should be distributed over at least 3 days/week, with no more than 2 days without activity

- Muscle-strengthening activities involving all major muscle groups >=2 days/week are also recommended

- To prevent weight gain, 60 min of moderate- to vigorous-intensity activity most days of the week (increase energy expenditure by ~150–200 kcal) is recommended

DIABETES: IMPROVING METABOLIC OUTCOMES

- There are important nutrition therapy intervention differences between preventing and treating diabetes

- For example, although weight loss is an important strategy for prevention, nutrition therapy for diabetes focuses on interventions shown to improve and maintain metabolic outcomes related to glucose, lipids, and blood pressure

- As the disease progresses, weight loss may or may not be of benefit for achieving glycemic goals

- there are other nutrition therapies, independent of weight loss, that contribute to improved metabolic control

- Improving health through food choices and physical activity is the basis for nutrition recommendations for diabetes

- Nutrition therapy is reported to lower LDL cholesterol by 15–25 mg/dL, or by 9%–12%, compared to baseline values or to a Western diet

- Nutrition therapy for hypertension is reported to decrease both systolic and diastolic blood pressure ~5 mm Hg

- Outcomes of nutrition therapy interventions are evident by 6 weeks to 3 months
- Central to these interventions are multiple encounters to provide education and counseling on a continued basis
- Just as there is no one medication or insulin regimen that is effective for all individuals with diabetes, there is not one type of effective nutrition intervention

- **effective interventions:** reduced energy/fat intake, carbohydrate counting, simplified meal plans, guidelines for healthy food choices, individualized meal planning strategies, exchange lists, insulin-to-carbohydrate ratios, physical activity, and behavioral strategies
- Choosing nutrition interventions that individuals with diabetes **can implement** is essential

Nutrition Interventions for Type 2 Diabetes

- As individuals move from prediabetes and being insulin resistant to type 2 diabetes and insulin deficiency, one of the goals of therapy is to achieve near-euglycemia in hope of slowing β-cell exhaustion
- Moderate weight loss may be beneficial for some individuals, primarily those who are still primarily insulin resistant, but for many it is too late for weight loss to improve hyperglycemia

- At later stages of the disease when medications—including insulin—need to be combined with nutrition therapy, weight gain often occurs and preventing this becomes important
- Persons receiving either nutrition therapy alone, glucose-lowering medications, or fixed insulin doses generally do better if carbohydrate intake is consistently distributed throughout the day on a day-to-day basis

- Diets too low in carbohydrate may eliminate too many foods that are important sources of vitamins, minerals, fiber, and energy

- Teaching individuals how to make appropriate food choices (often by means of carbohydrate counting) and using data from blood glucose monitoring to evaluate outcomes are interventions that can be implemented for successful nutrition therapy

- Regular physical activity is encouraged, primarily from the benefits associated with enhanced cardiorespiratory fitness that are independent of weight, but exercise must be undertaken regularly to have continued benefits

- It is important to monitor metabolic outcomes to determine if medications need to be added (or adjusted)

- Many individuals with type 2 diabetes also have dyslipidemia and hypertension, so decreasing intakes of saturated and *trans*-fats, cholesterol, and sodium should also be a priority

SUMMARY

- nutrition therapy involves a common process:
- (1) assessment (evaluation at follow-up visits)—what lifestyle changes is the individual willing and able to make
- (2) diagnosis of nutrition-related problems—used to develop nutrition interventions
- (3) nutrition interventions—implemented using self-management education and counseling
- (4) monitoring and evaluation of nutrition-related outcomes

Glycemic Index (GI) and Diabetes

- measures how a carbohydrate-containing food raises blood glucose
- A food with a high GI raises blood glucose more than a food with a medium or low GI
- Meal planning with the GI involves choosing foods that have a low or medium GI. If eating a food with a high GI, you can combine it with low GI foods to help balance the meal

Examples of carbohydrate-containing foods with a low GI

- dried beans and legumes (like kidney beans and lentils)
- all non-starchy vegetables, some starchy vegetables like sweet potatoes
- most fruit
- many whole grain breads and cereals (like barley, whole wheat bread, rye bread, and all-bran cereal)
- Meats and fats don't have a GI because they do not contain carbohydrate

Low GI Foods (55 or less)

- 100% stone-ground whole wheat or pumpernickel bread
- Oatmeal (rolled or steel-cut), oat bran, muesli
- Pasta, converted rice, barley, bulgar
- Sweet potato, corn, yam, lima/butter beans, peas, legumes and lentils
- Most fruits, non-starchy vegetables and carrots

Medium GI (56–69)

- Whole wheat, rye and pita bread
- Quick oats
- Brown, wild or basmati rice, couscous

High GI (70 or more)

- White bread or bagel
- Corn flakes, puffed rice, bran flakes, instant oatmeal
- Shortgrain white rice, rice pasta, macaroni and cheese from mix
- Russet potato, pumpkin
- Pretzels, rice cakes, popcorn, saltine crackers
- melons and dates

Low GI	
Cherries	22
Plums	24
Grapefruit	25
Peaches	28
Peach, canned in natural juice	30
Apples	34
Pears	41
Dried Apricots	32
Grapes	43
Coconut	45
Coconut Milk	41
Kiwi Fruit	47
Oranges	40
Strawberries	40

Medium GI
Mango
Sultanas
Bananas
Raisins
Papaya
Figs
Pineapple

High GI
Watermelon
Dates

What Affects the GI of a Food?

- Fat and fiber tend to lower the GI of a food. As a general rule, the more cooked or processed a food, the higher the GI; however, this is not always true.

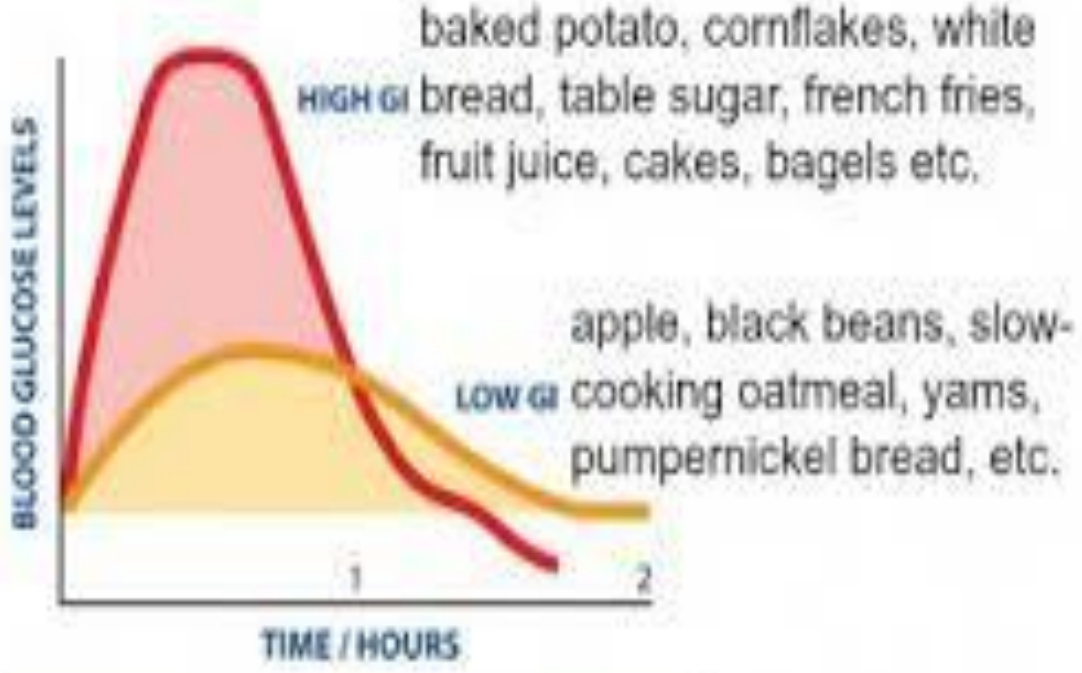
a few specific examples of other factors that can affect the GI of a food:

- **Ripeness and storage time** — the more ripe a fruit or vegetable is, the higher the GI
- **Processing** — juice has a higher GI than whole fruit; mashed potato has a higher GI than a whole baked potato, stone ground whole wheat bread has a lower GI than whole wheat bread.
- **Cooking method** — how long a food is cooked (al dente pasta has a lower GI than soft-cooked pasta)
- **Variety** — converted long-grain white rice has a lower GI than brown rice but short-grain white rice has a higher GI than brown rice

Other Considerations

- The GI value represents the type of carbohydrate in a food but says nothing about the amount of carbohydrate typically eaten. Portion sizes are still relevant for managing blood glucose and for losing or maintaining weight
- The GI of a food is different when eaten alone than it is when combined with other foods. When eating a high GI food, you can combine it with other low GI foods to balance out the effect on blood glucose levels

- Many nutritious foods have a higher GI than foods with little nutritional value. For example, oatmeal has a higher GI than chocolate. Use of the GI needs to be balanced with basic nutrition principles of variety for healthful foods and moderation of foods with few nutrients
- Glycemic index and glycemic load offer information about how foods affect blood sugar and insulin. The lower a food's glycemic index or glycemic load, the less it affects blood sugar and insulin levels



The amount of carbohydrate in the reference and test food must be the same.

GI or Carbohydrate Counting (glycemic load) ?

- There is no one diet or meal plan that works for everyone with diabetes. The important thing is to follow a meal plan that is tailored to personal preferences and lifestyle and helps achieve goals for blood glucose, cholesterol and triglycerides levels, blood pressure, and weight management
- both the amount and the type of carbohydrate in food affect blood glucose levels
- the total amount of carbohydrate in food, in general, is a stronger predictor of blood glucose response than the GI

FOOD	Glycemic index (glucose = 100)	Serving size (grams)	Glycemic load per serving
Ice cream, regular	57	50	6
Ice cream, premium	38	50	3
Milk, full fat	41	250mL	5
Milk, skim	32	250 mL	4
Reduced-fat yogurt with fruit, average	33	200	11
Apple, average	39	120	6
Banana, ripe	62	120	16

FOOD	Glycemic index (glucose = 100)	Serving size (grams)	Glycemic load per serving
Dates, dried	42	60	18
Grapefruit	25	120	3
Grapes, average	59	120	11
Orange, average	40	120	4
Peach, average	42	120	5
Pear, average	38	120	4
Raisins	64	60	28
Watermelon	72	120	4
Baked beans, average	40	150	6
Blackeye peas, average	33	150	10
Black beans	30	150	7

FOOD	Glycemic index (glucose = 100)	Serving size (grams)	Glycemic load per serving
Fettucini, average	32	180	15
Macaroni, average	47	180	23
Macaroni and Cheese (Kraft)	64	180	32
Spaghetti, white, boiled, average	46	180	22
Spaghetti, white, boiled 20 min, average	58	180	26
Spaghetti, wholemeal, boiled, average	42	180	17

FOOD	Glycemic index (glucose = 100)	Serving size (grams)	Glycemic load per serving
Green peas, average	51	80	4
Carrots, average	35	80	2
Baked russet potato, average	111	150	33
Boiled white potato, average	82	150	21
Instant mashed potato, average	87	150	17
Sweet potato, average	70	150	22
Honey, average	61	25	12

Food	GI Value
Cherries	22
Grapefruit	25
Prunes	29
Apricots, dried	30
Apple	38
Peach, canned in juice	38
Pear, fresh	38
Plum	39
Strawberries	40
Orange, Navel	42
Peach, fresh	42
Pear, canned	43
Grapes	46
Mango	51
Banana	52
Fruit Cocktail	55
Papaya	56
Raisins	56
Apricots, fresh	57
Kiwi	58
Figs, dried	61
Apricots, canned	64
Cantaloupe	65
Pineapple, fresh	66
Watermelon	72
Dates	103

Fruit	Glycemic Load	Serving Size (grams)
Apple	6	120g
Apricot	3	120g
Banana	11	120g
Blueberries	5	120g
Canteloupe	4	120g
Cherries	9	120g
Dates	18	60g
Figs	16	60g
Grapefruit	3	120g
Grapes	11	120g
Guava	4	120g
Strawberry	1	120g

Fruit	Glycemic Load	Serving Size (grams)
Kiwi	7	120g
Lemon	3	120g
Lime	1	120g
Mango	8	120g
Oranges	4	120g
Peach	5	120g
Pear	4	120g
Pineapple	6	120g
Plum	5	120g
Prunes	10	60g
Raisins	28	60g
Watermelon	4	120g