**Module 3 Questions: Diabetes**

I. **Abbreviations/Definitions**

**Ketone Bodies** - Ketone bodies are three water-soluble molecules (acetoacetate, beta-hydroxybutyrate, and their spontaneous breakdown product, acetone) that are produced by the liver from fatty acids during periods of low food intake (fasting), carbohydrate restrictive diets, starvation, prolonged intense exercise, or in untreated (or inadequately treated) type 1 diabetes mellitus.

**DKA**- An emergency condition in which extremely [high blood glucose](https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0024701) levels, along with a severe lack of [insulin](https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0024496), result in the breakdown of [body fat](https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0018959) for energy and an accumulation of ketones in the blood and [urine](https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0022162). Signs of DKA are [nausea](https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0024775) and [vomiting](https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0024776), [stomach](https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0018966) pain, fruity [breath odor](https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0025397), and rapid breathing. Untreated DKA can lead to coma and death.

**Prediabetes** - Prediabetes is a serious health condition where blood sugar levels are higher than normal, but not high enough yet to be diagnosed as type 2 diabetes. Approximately 84 million American adults more than 1 out of 3 have prediabetes. Of those with prediabetes, 90% don’t know they have it. Prediabetes puts you at increased risk of developing [type 2 diabetes(https://www.cdc.gov/diabetes/basics/type2.html)](https://www.cdc.gov/diabetes/basics/type2.html), [heart disease](https://www.cdc.gov/heartdisease/index.htm), and [stroke](https://www.cdc.gov/stroke/index.htm).

**Incretin**- Incretins are a group of metabolic hormones that stimulate a decrease in blood glucose levels. Incretins do so by causing an increase in the amount of insulin released from pancreatic beta cells of the islets of Langerhans after eating, before blood glucose levels become elevated.

II. **Anatomy/Physiology**

Describe the primary endocrine and exocrine functions of the pancreas. The pancreas has two main functions: an exocrine function that helps in digestion and an endocrine function that regulates blood sugar.

**Describe the effects of glucagon, epinephrine, growth hormone, corticosteroids and somatostatin on blood glucose levels**.

Glucagon is released overnight and between meals and is important in maintaining the body’s sugar and fuel balance. It signals the liver to break down its starch or glycogen stores and helps to form new glucose units and ketone units from other substances. It also promotes the breakdown of fat in fat cells. Epinephrine and growth hormone help maintain blood sugar levels. They, along with **glucagon** are called “stress” they make the blood sugar rise. Effects of oral corticosteroids is that they can increase blood glucose levels and [increase insulin resistance](https://www.diabetes.co.uk/insulin-resistance.html), which can lead to type 2 diabetes. Ssomatostatin lowers blood glucose concentrations as a secondary effect of inhibition of glucagon secretion.

III. **Pathophysiology**

**Discuss the etiology and clinical symptoms of diabetes.**

Type 1 diabetes is caused by genes and environmental factors, such as viruses, that might trigger the disease. Type 2 diabetes—the most common form of diabetes—is caused by several factors, including lifestyle factors and genes.

**Clinical symptoms**- increased thirst and urination, increased hunger, fatigue, blurred vision, numbness or tingling in the feet or hands, sores that do not heal, unexplained weight loss

**Differentiate between Type 1, Type 2 and gestational diabetes.** Type 1 diabetes, an autoimmune disease where the pancreas produces very little insulin or no insulin at all. People who get Type 1 diabetes are usually under the age of 20, usually presenting itself when the person is a child or young adult. Type 2 diabetes is normally found in people who are overweight as they get older. Although it is sometimes called adult onset diabetes, in some country, such as the United States, more children and young adults are being diagnosed with Type 2 diabetes because they are not getting enough activity. Gestational diabetes, is a condition that women can get when they are in the second trimester of pregnancy. About 4 percent of all pregnant women will develop gestational diabetes. Unlike Type 1 and Type 2 diabetes, gestational diabetes will disappear after the baby is born.

B. **For each of the following laboratory tests, identify normal values for healthy individuals and the significance of abnormal values in individuals with diabetes.**

1. Fasting blood glucose - The normal range for blood glucose is 70 to 100 mg/dl / in individuals with diabetes abnormal values indicate uncontrolled DM, insulin resistance or non-compliance.

**2. Two hour post prandial blood glucose** - Normally, before age 50, blood sugar levels should rise no higher than 140 milligrams per deciliter (mg/dL) 2 hours after eating a meal. In individuals with diabetes, higher value indicates insulin resistance.

**3. Serum triglycerides - Normal**: Less than 150 mg/dL, Borderline: 150 to 199 mg/dL

High: 200 to 499 mg/dL, Very High: 500 mg/dL or above. In individuals with diabetes High value excessive carbohydrate intake and high risk of metabolic syndrome.

**4. Urinary glucose** - The normal amount of glucose in urine is 0 to 0.8 mmol/L (millimoles per liter). A higher measurement could be a sign of a health problem. Diabetes is the most common cause of elevated glucose levels. In individuals with diabetes ketoacidosis acidosis secondary to uncontrolled diabetes.

**5. Urinary ketone bodies** - Although ketones are omnipresent in the blood (< 1 mg/dL), levels increase during periods of fasting and prolonged exercise. In individuals with diabetes High value indicates uncontrolled diabetes.

**6. Hemoglobin A1C** - in people without diabetes is about 4% to 5.9%. HgbA1c is the average serum glucose level over a 3-month period. Diabetes > 6.5% Prediabetes 5.7-6.4%

**C. Discuss the etiology, symptoms and treatment of hypoglycemia**.

Hypoglycemia is a condition caused by a very low level of blood sugar (glucose), the body's main energy source.Hypoglycemia is often related to the treatment of diabetes. However, a variety of conditions many rare can cause low blood sugar in people without diabetes. Like fever, hypoglycemia isn't a disease itself it's an indicator of a health problem.

**Symptoms hypoglycemia**: irregular heart rhythm, fatigue, pale skin, shakiness, anxiety, sweating, hunger, irritability and tingling sensation around the mouth.

**Treatment of hypoglycemia**

Early symptoms can usually be treated by consuming 15 to 20 grams of a fast-acting carbohydrate. Fast-acting carbohydrates are foods that are easily converted to sugar in the body, such as glucose tablets or gel, fruit juice, regular not diet soft drinks, and sugary candy such as licorice. Foods containing fat or protein aren't good treatments for hypoglycemia, because they affect the body's absorption of sugar.

**D. Discuss the relationship of diabetes to each of the following disorders:**

1. Atherosclerosis – individuals with diabetes have increase risks for lipid abnormalities. Individuals with T2DM often have high triglyceride, low HDL cholesterol levels. Excess glucose in the blood attaches to protein, thickening of the blood vessels causes’ plaque buildup in the walls of the artery.

**Nephropathy**- diabetic neuropathy has been the most common single cause of End stage renal disease ESRD. The early evidence is the abnormal urine albumin levels, to slow the progression glucose and blood pressure must be control.

**Neuropathy**- high levels of blood glucose leads to nerve damage, decrease in sensation in the feet and hands. This is caused by damaged blood vessels can lead to diabetic foot.

**Retinopathy**- damage of blood vessels around the retina caused by uncontrolled diabetes.

Cystic Fibrosis- is a complication of diabetes. Cystic fibrosis can cause scarring of the pancreas which can affect the organs ability to produce insulin. Insulin resistance can be increased as a result of taking corticosteroids to treat the symptoms of cystic

**IV. Management**

**A. Describe “pattern management” in diabetes care.** Pattern management is the systematic process of keeping blood glucose (BG) levels at individualized targets by identifying the relationship between BG values and patient behaviors and acting on this knowledge to improve glycemic control.

**B. List and discuss factors which affect insulin requirements**. Eating patterns, activity, Age, weight

**Exercise** - can make individual more sensitive to insulin, and may need less of the drug. However, sometimes intense exercise will cause blood sugar to go up, meaning you may need more insulin.

**Fats and Carbohydrates** - Fatty foods are absorbed slowly, and insulin may start to wear off before the food is absorbed. Carbohydrate-rich foods like white rice or white bread that have a higher glycemic index are absorbed faster and may affect blood sugar more quickly.

**Meal pattern**-Insulin to carbohydrate ratio can be established to decide the amount of insulin to inject. The type DM, timing of insulin should be individualized based on eating, exercise and blood glucose concentration.

**C. When is the use of oral hypoglycemic agents indicated?** Oral hypoglycemic agents are used in the treatment of Type 2 DM when glycemic control cannot be achieved with therapeutic lifestyle changes.

**What adverse side effects are associated with their use?**

**Biguanides- (Metformin)-**suppress hepatic glucose production and increase insulin uptake in muscle. May cause weight loss when therapy begins, may cause transient diarrhea, nausea and bloating.

**Sulfonylureas**- promote insulin secretion by the beta cells of the pancreas. May cause hypoglycemia (more with glyburide) contraindicated in individuals with renal insufficiency, weight gain.

**GLP-1 Antagonist**-Mimics glucose dependent insulin secretion, suppressed elevated glucagon secretion, delays gastric emptying. May cause hypoglycemia when used with sulfonylureas.

**Alpha Glucosidase inhibitors**-delays intestinal absorption of glucose. May cause flatulence, diarrhea, less efficacy frequent dosing. Contraindicated in individuals with intestinal disease must take with meals 3 times daily.

**D. What special considerations must be given to children with diabetes?** Integrate insulin regimen into usual eating habits and physical activity schedule. Attain and maintain optimal metabolic outcome including glucose levels in normal range or close to normal as possible to prevent or reduce risk of complication. Maintain Lipid or lipoprotein profile that reduce risk for macrovascular disease. Blood pressure that reduce risk for vascular disease.

Therapeutic life style changes for the treatment and prevention of obesity, dyslipidemia, CVD, HTN and nephropathy. Total energy and carbohydrate intake to avoid weight gain. Food choices will be consistent with the individual way of life and activity pattern. Nutritional needs individualized with regards to personal and cultural preferences while respecting the individual wishes and willingness to change. **Goals for Type 1 in Youth-** Maintain normal growth and development. Nutrition prescription based on nutrition assessment, Reduce risk of cardiovascular disease. Meal planning approaches including carbohydrate counting, Teaching-carbohydrate sources, serving sizes, limiting fats Improve food choices, increase physical activity to promote weight loss if overweight or obese.

**E. What effect does dietary fiber have on blood glucose levels?** Fiber is found in whole grains, fruits, vegetables and nuts. Fiber provides a feeling of fullness. Soluble fiber (found in oats, barley, apples, citrus and strawberries) lowers cholesterol. Insoluble fiber (found in wheat, vegetables and many fruits) can delay emptying of the stomach and decrease the amount of carbohydrate absorbed by the body, resulting in a lower or more gradual rise in blood glucose.

**F. Discuss the use of sugar substitutes in the diabetic diet. Include in your discussion, safety levels as established by the FDA.** People with type 2 diabetes may choose to consume foods and beverages containing nonnutritive sweeteners vs. those with added sugars as these sweeteners will affect blood sugars to a much smaller extent. All nonnutritive sweeteners approved for use in the United States are determined to be safe. The FDA has set an acceptable daily intake (ADI) level for each non-nutritive sweetener approved for general use in the U.S. (including pregnant and lactating women). The ADI is the maximum amount of sweetener that can be consumed each day over a lifetime without causing health risks. It is virtually impossible for the average consumer to exceed the ADI based on normal consumption levels for low-calorie foods and beverages. There is an exception regarding the use of aspartame (NutraSweet). This is for people who have been diagnosed with phenylketonuria (PKU), a rare genetic disorder in which the body lacks the enzyme that breaks down an amino acid called phenylalanine.

**G. What is the general recommended distribution of macronutrients for patients on diabetic diets?** Evidence suggests that there is not an ideal percentage of calories from carbohydrate, protein, and fat for all people with diabetes therefore, macronutrient distribution should be based on individualized assessment of current eating patterns, preferences, and metabolic goals. However on average, it has been observed that people with diabetes eat about 45% of their calories from carbohydrate, ∼36–40% of calories from fat, and the remainder (∼16–18%) from protein.

**What is the recommended distribution of macronutrients for patients with gestational diabetes?** 55–65% carbohydrate, ≤30% fat, and 10–20% protein.

**H. Briefly describe the following programs which may be used in planning diabetic meal patterns:**

1**. Exchange list system**- the meal plan is a guide which shows the number of food choices to eat at each meal and snack using the diabetic exchange lists. The exchange lists group foods together because they are alike. Foods on each list have about the same amount of carbohydrate, protein, fat and calories.

**2. Glycemic Index/ Glycemic Load**- compares the physiologic effect of carbohydrate on glucose. It measures the peak glucose response for individual foods high or low glycemic index occurs at the same time. The GI index for glucose is 100, white bread 70.

 **3. Glycemic Load**: The estimated GI load of foods, meals and dietary pattern is calculated by multiplying the GI by the amount of carbohydrate in each food the totaling the values for all foods in a meal or dietary pattern

**4. Carbohydrate Counting**- Carbohydrate, or carb counting is a method of calculating grams of carbohydrate consumed at meals and snacks. Foods that contain carb have the greatest effect on blood glucose compared to foods that contain protein or fat.

**I. How might having an eating disorder impact a person with diabetes?**

Having diabetes means paying closer attention to food intake and activity level and, for many, reaching and staying at a healthful weight. It’s not uncommon for people with diabetes to develop the mentality that there are “good” and “bad” foods in terms of weight and blood glucose management; the same attitude can develop in people with an eating disorder. Also, control plays a central role in both diabetes and disordered eating. Along with the “good” and “bad” foods come feelings of guilt, failure, or anger when blood glucose levels are too high or too low or if a complication, such as diabetic eye disease, occurs. Focusing on eating and medication management are ways to help get and keep blood glucose levels in a safer range. People with anorexia or bulimia may also exert a level of control in their lives by manipulating food and/or exercise to avoid or limit fluctuations in their weight.

J. Jane is a 24-year-old college senior who was diagnosed as having Type 1

Diabetes at the age of 12. Jane is 5'5" tall and weighs 118 lbs. She takes an

Injection of 25 units Lantus each evening and 8 units Lispro with each meal.

Jane’s IBW 125 lbs. +/-10%, Weight within IBW range 118 lbs./2.2kg= 54 kg

27-33 kcal/kg BW=1458-1782kcal Chose 1800 calories

20% protein=360/4kcal/kg=90 g

 50% carbohydrate= 900kcal/4=225g

30% fat=540/9=60gm

**1. What would be the appropriate diet prescription for Jane**? 1800 calories, 90 g protein, 225gm carbohydrate 60gm protein 225 gm carbohydrate=15 carbohydrate exchange

**2. using the principles of CHO counting, translate this diet prescription into a meal pattern.**

**Meals**

CHO exchange

Breakfast

4

Morning snack

2

Lunch

4

Dinner

4

Evening

2

**3. Using the principles of CHO counting, plan a menu for one day for Jane.**

|  |  |
| --- | --- |
| 1800 Calories  | Carbohydrate Exchange |
| Breakfast – 1 slice whole wheat toast 1 medium ripe banana1 boiled egg½ cup orange juice  | 1201 |
| Morning snack- 1 medium bunCheese  | 20 |
| Lunch – 1 cup chicken soup | 1 |
| 1/3 cup rice | 1 |
| Grilled chicken 6oz  | 0 |
| ½ peas | 1 |
| 1 cup fresh fruit | 1 |
|  |  |
| Dinner – baked salmon 4 oz. | 0 |
| ½ boiled corn | 1 |
| 1cup steamed green bean | 2 |
| 1 cup apple juice | 1 |
|  |  |
| Evening snack- 4 gram cracker1 medium Apple | 11 |
|  |  |

K. Mr. Doe, age 39, is a bank executive who has just been diagnosed as having Type 2 Diabetes. Mr. Doe is 5'11" tall and weighs 205 lbs. His blood glucose level is 190 mg/dl. Neither insulin nor an oral hypoglycemic agent is ordered.

1. What would be the appropriate diet prescription for Mr. Doe?

IBW 172 lbs. =78 kg BMI 28.5

Current weight 205 lbs. =93 kg weight 119 % of IBW 78x26kcal/kg=2028Kcal/day2000 kcal/day

20 % protein= 300/4=100gm

45% carbohydrate=900/4= =225

35% fat 700/9=78

 Using the principles of CHO counting, translate this diet. Using the principles of CHO counting, translate this diet prescription into a meal pattern.

3. Using the principles of CHO counting, plan a menu for one day for Mr. Doe.

Meals

CHO exchange

Breakfast

4

Morning snack

2

Lunch

4

Dinner

4

Evening

2

3. Using the principles of CHO counting, plan a menu for one day for Mr. Doe.

|  |  |
| --- | --- |
| 2000 calories | Carbohydrate Exchange  |
| Breakfast  |  |
| 1 cheese omelet | 0 |
| 2 slices whole wheat toast | 2 |
| 1 apple | 1 |
| 1 cup orange juice | 1 |
|  |  |
| Mid- morning snack |  |
| 1 cup milk | 1 |
| 4 gram crackers | 1 |
|  |  |
| Lunch  |  |
| 3.oz sliced roast beef | 0 |
| 1 cup mashed potato | 2 |
| ½ cup corn | 1 |
| 1 cup fruit salad | 1 |
|  |  |
| Evening snack |  |
| 1 6oz yogurt | 1 |
| ½ cup peach packed in juice  | 1 |

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