

**CASE STUDY #3 - NUT 116AL****Type I Diabetes Mellitus**

DUE Wednesday 12/9/15 by 4:00pm in Meyer 3135 (Nutrition Dept. office).

**Instructions:**

- Review the pt's medical record below. Answer each question and show your calculations (if necessary) for each. You may include your calculations in the answer box and, if needed, attach as a separate, hand-written sheet.
- Reference all calculation formulas with the text and page number from the Pocket Resource (i.e., PR p. \_\_\_\_). Only use the PR for all calculations. You may use lecture notes and the textbook for all other questions. After you have EXHAUSTED your search for answers to your CS questions and you are still unable to find the answer, you may use outside resources as long as they are credible resources. e.g.: Mayo Clinic, medline plus, research articles, etc., NOT wikipedia. Remember to conduct a thorough search of the resources available to you prior to using outside references to avoid losing points.
  - In your citation, please include the resource name (i.e.: Mayo Clinic), title of page/article, & exact URL link
- You must type your answers! If not, questions will not be graded and you will receive 0 points.
- To familiarize yourself with medical terminology, utilize an online dictionary such as: <http://www.medilexicon.com/medicaldictionary.php>
- CS #3 is worth 50 pts.

**Kxxxxx, Dxxxxx**

Male

22 yo

**Allergies:** NKA**Code:** FULL**Isolation:** NONE**Pt. Location:** RM 1202**Physician:** C. Johnston**Admit Date:** 12/02/15

**Pt Summary:** D.K. is a 22 yo male admitted through the ED who c/o excessive thirst and frequent urination of 2 wk duration, in addition to increased appetite and weight loss of 9 pounds in 3 weeks.

**PMH:** pt was product of normal pregnancy and delivery; had varicella at age 6, and an appendectomy at age 15. No Medications. NKA.

**FH:** Parents L&W. Maternal aunt has Type 1 DM; Paternal grandfather died of CVD 2° to Type 2 DM. Other grandparents L&W. Has 2 siblings, one older brother, one younger sister; both L&W.

**Social Hx:** 22 yo male, undergraduate student at UC Davis. Pt used to play ultimate frisbee three times a week, but says he now tires easily so he has not played in 2 weeks.

**ROS:**

GI:	No hx of N/V, or diarrhea
GU:	No hx of urgency, frequency, or burning urination except for present complaint of polyuria
CNS:	Alert and oriented, no hx of impaired LOC, convulsions, or difficulty walking

**PE:**

General:	Slightly underweight, tired appearing male; wt: 145# ht: 71"
Vitals:	T 98.2°F; P 120; R 27 with fruity odor; BP 110/70 mm Hg
Lungs:	Clear to percussion and auscultation
Heart:	Normal sinus rhythm, no murmurs
HEENT:	Non-contributory

Abdomen:	Flat, non-tender, no liver enlargement
Genitalia:	nl
Extremities:	Non-contributory
CNS:	Normal gait and deep tendon reflexes
Skin:	Smooth, warm, dry, no edema
Peripheral Vascular:	Pulse +4 bilaterally

#### Laboratory Results (non-fasting)

	Ref. Range	12/02/15 1950
<b>Chemistry</b>		
Sodium (mEq/L)	136-145	130 !↓
Potassium (mEq/L)	3.5-5.5	3.6
Chloride (mEq/L)	95/105	101
Carbon dioxide (CO <sub>2</sub> , mEq/L)	23-30	31 !↑
BUN (mg/dL)	8-18	18
Creatinine serum (mg/dL)	0.6-1.2	1.1
Glucose (mg/dL)	70-110	382 !↑
Phosphate, inorganic (mg/dL)	2.3-4.7	2.1 !↓
Magnesium (mg/dL)	1.8-3	1.9
Calcium (mg/dL)	9-11	10
Osmolality (mmol/kg/H <sub>2</sub> O)	285-295	306 !↑
Bilirubin total (mg/dL)	≤1.5	0.2
Bilirubin, direct (mg/dL)	<0.3	0.01
Protein, total (g/dL)	6-8	6.9
Albumin (g/dL)	3.5-5	3.2
Prealbumin (mg/dL)	16-35	15
Ammonia (NH <sub>3</sub> , umol/L)	9-33	9
Alkaline phosphatae (U/L)	30-120	110
ALT (U/L)	4-36	6.2
AST (U/L)	0-35	21
CPK (U/L)	30-135 F; 55-170 M	61
Lactate dehydrogenase (U/L)	208-378	229
Cholesterol (mg/dL)	120-199	180
Triglycerides (mg/dL)	35-135 F; 40-160 M	150
T <sub>4</sub> (ug/dL)	4-12	8
T <sub>3</sub> (ug/dL)	75-98	81
HbA <sub>1C</sub> (%)	3.9-5.2	8.12 !↑
C-peptide (ng/mL)	0.51-2.72	0.52
ICA	-	+ !↑
GADA	-	+ !↑
IA-2A	-	-
IAA	-	+ !↑
tTG	-	-
<b>Hematology</b>		
WBC (x 10 <sup>3</sup> /mm <sup>3</sup> )	4.8-11.8	10.6
RBC (x 10 <sup>6</sup> /mm <sup>3</sup> )	4.2-5.4 F; 4.5-6.2 M	5.8
<b>Urinalysis</b>		
Collection method	-	Clean catch
Color	-	Yellow
Appearance	-	clear
Specific Gravity	1.003-1.030	1.008
pH	5-7	4.9 !↓
Protein (mg/dL)	Neg	+1 !↑

Glucose (mg/dL)	Neg	+4 ! ↑
Ketones	Neg	+ 4 ! ↑
Blood	Neg	Neg
Bilirubin	Neg	Neg
Nitrites	Neg	Neg
Urobilinogen (EU/dL)	<1.1	Neg
Leukocyte esterase	Neg	Neg
Protein check	Neg	tr ! ↑
WBCs (/HPF)	0-5	0
RBCs (/HPF)	0-5	0
Bacteria	0	0
Mucus	0	0
Crys	0	0
Casts (/LPF)	0	0
Yeast	0	0

**Dx: New Onset Type 1 Diabetes Mellitus**

**MD's Plan:** Admit, achieve glycemic control with Regular Insulin then adjust to daily therapy with mixed insulin therapy; initiate diabetes SBGM training; nutrition consult for hospital and home diet planning and pt. education.

You are the in-patient RD.

1. What are three metabolic reasons for D.K.'s weight loss (number each for full credit). (3 points)

1. Insulin deficient individuals have limited or no glucose uptake by cells, resulting in a buildup of glucose in the blood, causing hyperglycemia. Hyperglycemia leads to glucosuria and eventually, polyuria, which causes fluid loss and dehydration.
2. In Type 1 DM, insulin deficiency results in a decreased uptake of amino acids in cells, which increases proteolysis due to counter regulatory hormones and results in lean body mass being broken down, contributing to weight loss.
3. When the body's cells do not receive the glucose it requires for energy, fat metabolism will increase as a result to counteract. This includes a decrease in triglyceride synthesis and an increase in lipolysis. When fat is used as a primary fuel source, electrolyte balance and osmotic diuresis can occur, causing dehydration.

Source(s): NUT116A Diabetes Lecture

2. Compare D.K.'s admission laboratory values with normal values. What does each value indicate, based on the hospital's lab value reference ranges above? (4 points)

Test	NI Values	D.K.'s Values	Comparison (+/-)	What do D.K.'s lab values suggest about his metabolic state?
BG	70-110 mg/dL	382 mg/dL	+	Hyperglycemia; Limited or lack of glucose cellular uptake
Urinary glucose	Neg.	+4	+	Glucosuria; Renal threshold for glucose has exceeded
Urinary ketones	Neg.	+4	+	Diabetic ketoacidosis; Increased lipolysis and use of fats as energy sources resulting in production of ketones
Alb	3.5-5 g/dL	3.2 g/dL	-	Nephropathy; Protein malnutrition
PreAlb	16-35 mg/dL	15 mg/dL	-	Protein depletion
HbA <sub>1c</sub>	3.9-5.2 (%)	8.12%	+	Hyperglycemia; elevated blood glucose levels for at least 3 months

\* Source: NUT116A CVD Lecture; NUT116A Diabetes Lecture  
WebMD – Diabetes Health Center  
<http://www.webmd.com/diabetes/microalbumin-urine-test>

3. List the following HbA<sub>1c</sub> ranges. (2 points)

Normal non-diabetic:	4-6%
Pt w/ controlled diabetes:	<7%
Pt w/ fair to poorly controlled diabetes:	≥7%

\*Source: NUT116AL Diabetes lecture

4. What is HbA<sub>1c</sub> and what does HbA<sub>1c</sub> measure? (1 point)

HbA<sub>1c</sub> refers to a glycosylated hemoglobin, which is a hemoglobin (a protein in RBC's) that has glucose attached to it. Glucose attaches itself to hemoglobin as the body processes it, and is proportional to the amount of sugar in your body at the time.

Since the turnover rate of HbA<sub>1c</sub> molecules in the body is roughly 3 months, the HbA<sub>1c</sub> test measures

the average blood glucose levels in an individual during that time frame.

\*Source: NUT116A Diabetes Lecture

5. Explain the role/relationship of HbA<sub>1c</sub> in the development of micro- and macro-vascular complications of diabetes. (3 points)

Hyperglycemia in diabetic individuals will result in the glycosylation of hemoglobin in the body, which increases HbA<sub>1c</sub> levels. Elevated HbA<sub>1c</sub> levels due to hyperglycemia and insulin deficiency left uncontrolled for extended periods of time can result in long-term consequences in the form of macro and microvascular complications.

Since elevated HbA<sub>1c</sub> and hyperglycemia have a positive correlation with one another, long-term elevated hyperglycemia can result in damage to microvascular structures such as the eyes (retinopathy), kidneys (nephropathy), and nerves (neuropathy). On a macrovascular level, hyperglycemia for extended periods of time can result in cardiovascular diseases, heart disease or attacks, and stroke

Source: NUT116A CVD and Diabetes Lectures

You meet with D.K. to do a nutrition assessment and begin a general introduction to dietary management of diabetes. You take a diet history (listed below) as part of your assessment. D.K. states that these are the types of foods that he usually eats, but the quantity is much greater than usual because he has felt so hungry lately.

**Breakfast (eaten at home):**

1 c. oatmeal with brown sugar and ½ cup of 2% milk  
1 c. juice (orange, apple, or cranberry)  
Toast (2 slices or English muffin) w/ butter & jelly  
Coffee with sugar and 2% milk  
(occasionally 2 scrambled eggs and 2 strips of bacon instead of the cereal)

**Lunch (eaten at the CoHo on weekdays):**

2 slices of pepperoni pizza with a small salad *or*  
Cheeseburger and French fries *or*  
Spinach Crepe  
16 oz of sweetened iced tea  
dessert such a cookies or a brownie  
(sometimes 8 oz of 2% milk instead of the iced tea)

**Mid afternoon:**

medium mocha or latte,  
A cookie or a piece of fruit

**Dinner:**

Spaghetti w/ meat sauce (about 2 c. cooked noodles)  
2 pieces of garlic bread  
Salad w/ fat free dressing  
12 ounces of 2% milk  
*or*  
~6 oz. meat (chicken or beef, only occasionally fish)  
1 cup of rice or large baked potato w/ butter  
Vegetables in season (will eat w/ salt & butter but prefers cheese or bechamel sauce)

12 ounces of 2% milk

**or**

A deli sandwich and chips and soda if he does not have time to cook

**HS:**

D.K. eats one of the following:

Bag of microwave popcorn w/ 1-12 oz can of regular soda

2 scoops of ice cream

1 c 2% milk and 4-5 cookies

2 oz. cheese and 12 "Wheat Thin" crackers

6. Based on the diet history information above and what you know about MNT management of Type 1 Diabetes Mellitus, name 3 nutrition-related topics that are important to discuss in educating D.K. as he prepares to head home from the hospital. (3 points)

1. Meal planning using exchanges
2. Both basic & advanced carbohydrate counting; being able to identify which foods contain carbohydrates and how much they contain
3. Insulin: Carbohydrate ratios and how to cover meals with insulin

Source: NUT116a "The Art and Science of Diabetes" Guest Lecture

7. You determine that D.K. needs 2510-2920 kcals/day based on your calculations and the fact that D.K. needs to gain weight to achieve his normal weight. You want to follow his normal eating pattern as much as possible while still meeting his protein requirements and keeping the kcal from fat at 30-40% of total kcals. Using the Exchange Lists, develop a "pattern" for D.K.'s diet. (15 points)

Food group	Number of Exchanges	CHO grams	Protein grams	Fat grams
<b>Breakfast</b>				
Starch	1	15	3	1
Fruit	1.5	22.5	0	0
Milk & Subs (2%)	0.5	6	4	2.5
Protein (high-fat)	1.5	0	10.5	12
Fats	0	0	0	0
<b>Morning Snack</b> (write in Food Group below)				
Fruit	1.5	22.5	0	0
<b>Lunch</b>				
Starch	3.5	52.5	10.5	3.5
Fruit	2	30	0	0
Milk & Subs (2%)	1	12	8	5
Non-starchy vegetables	1.5	7.5	3	0
Protein (med-fat)	3	0	21	15
Fats	3.5	0	0	17.5
<b>Afternoon Snack</b> (write in Food Group below)				

Fruit	1	15	0	0
Protein (lean)	1.5	0	10.5	3
<b>Dinner</b>				
Starch	4	60	12	4
Fruit	1.5	22.5	0	0
Milk & Subs (2%)	1.5	18	12	7.5
Non-starchy vegetables	1.5	7.5	3	0
Protein (lean)	4	0	28	8
Fats	0	0	0	0
<b>HS Snack</b> (write in Food Group below)				
Milk/subs (2%)	1	12	8	5
Starch	1	15	3	1
Fats	4	0	0	20
Total grams		<b>318</b>	<b>136.5</b>	<b>105</b>
		X4	X4	X9
kcal from each macronutrient		<b>1270</b>	<b>545</b>	<b>945</b>
<b>TOTAL KCAL</b>	<b>2760</b>	<b>46%</b>	<b>20%</b>	<b>34%</b>

\*Source: Choose Your Foods (pg. 8-56)

8. D.K. is taught about his diet, insulin injections, SBGM, and other self-care issues prior to discharge. He will be discharged on a basal injection of Lantus, with bolus injections of Humalog insulin at mealtimes. Provide the information below. Also note any dietary recommendations, contraindications/precautions, and interactions. What effect will these medications have on his nutritional care? Refer to the medication information in the Food-Medication Interactions text. (3 points)

**Lantus®**

Generic name:	<b>Insulin Glargine</b>
Classification:	<b>Long acting basal insulin</b>
Onset of Action:	<b>1-2hr</b>
Peak:	<b>6h</b>
Duration:	<b>18-26h</b>

**Humalog®**

Generic name:	<b>Insulin Lispro</b>
Classification:	<b>Rapid acting bolus insulin</b>
Onset of Action:	<b>10-20min</b>
Peak:	<b>1.5-2.5h</b>
Duration:	<b>4.5-6h</b>

**Lantus® & Humalog®**

Indication:	<b>Antidiabetic, hypoglycemia</b>
Diet:	<b>Diabetic meal planning with appropriate carbohydrate to insulin balance</b>
Possible Food-Medication Interactions:	<ul style="list-style-type: none"> <li>• Alcohol (may affect blood glucose levels)</li> <li>• Do not use insulin with Gatifloxacin (may cause hypoglycemia)</li> </ul>
Potential	<b>May cause weight-gain</b>

9. Write an ADIME note for D.K., using the information that you have obtained up until this point. Base your note on the pertinent information given in the presentation data, diet history, and questions above. Write the ADIME note below and attach a separate sheet with all calculations. Include two PES statements. (8 points)

**A:**

22 yo male admitted into the ED for excessive thirst and urination over the past 2 weeks. Pt. reports weight loss of 9# in the last 3 weeks despite increased appetite and eating higher quantities of food than usual intake. Pt. usually plays Ultimate Frisbee 3x/wk. but has been feeling too tired to do so last 2 weeks. MD has given him a diagnosis of new onset Type 1 Diabetes Mellitus. Family hx. indicates that paternal grandfather has Type 2DM, and maternal aunt has Type 1DM.

**Anthropometrics:**

Age: 22

Gender: M

Ht: 5'11"/180.3cm (**calculation**)

Wt: 145#/65.9kg; underweight(**calculation**)

BMI: 20.3 (**normal**) (**calculation; kg/m<sup>2</sup>**)

IBW: 172#/78.2kg (**calculation**)

% IBW: 84.3% (**calculation**)

UBW: 154#/70kg (**calculation**)

% Wt. Change: 5.84% (**calculation**)

Interpretation: >5% weight loss in <1 month, classified as severe weight loss

Nutrition focused physical finding:

Overall Appearance: Slightly underwt.

**MD Orders:**

Glycemic control with regular insulin treatment then switch to daily therapy with mixed insulin therapy; begin SBGM training; nutrition consultation with hospital for assistance with diet planning at home and pt. education. Diet: CHO-controlled.

**Labs (Chemistry):**

- Glucose (mg/dL): 382 (Ref Range: 70-110) **High**
- Osmolality (mmol/kg/H<sub>2</sub>O): 306 (Ref Range: 285-295) **High**
- HbA<sub>1c</sub> (%): 8.12 (Ref Range: 3.9-5.2) **High**
- pH: 4.9 (Ref Range: 5-7) **Low**

**Labs (Urinalysis):**

- pH: 4.9 (Ref Range: 5-7) **Low**
- Glucose (mg/dL): +4 (Ref Range: Neg.) **High**
- Ketones: +4 (Ref Range: Neg.) **High**

**Medications:**

- Lantus – long acting basal insulin
- Humalog – rapid acting bolus insulin

**Estimated Nutrient Needs:**

EER (MSJ): 2510-2920 kcal/day (AF: Average Activity)  
EPR: 53g protein/day (Non-Stressed/Well-Nourished)  
Fluid: 1mL/kcal = 2510-2920mL/day

**Diet History**

**Breakfast (eaten at home):**



1 c. oatmeal with brown sugar and ½ cup of 2% milk  
1 c. juice (orange, apple, or cranberry)  
Toast (2 slices or English muffin) w/ butter & jelly  
Coffee with sugar and 2% milk  
(occasionally 2 scrambled eggs and 2 strips of bacon instead of the cereal)

**Lunch (eaten at the CoHo on weekdays):**

2 slices of pepperoni pizza with a small salad *or*  
Cheeseburger and French fries *or*  
Spinach Crepe  
16 oz of sweetened iced tea  
dessert such a cookies or a brownie  
(sometimes 8 oz of 2% milk instead of the iced tea)

**Mid afternoon:**

medium mocha or latte,  
A cookie or a piece of fruit

**Dinner:**

Spaghetti w/ meat sauce (about 2 c. cooked noodles)  
2 pieces of garlic bread  
Salad w/ fat free dressing  
12 ounces of 2% milk  
*or*  
~6 oz. meat (chicken or beef, only occasionally fish)  
1 cup of rice or large baked potato w/ butter  
Vegetables in season (will eat w/ salt & butter but prefers cheese or bechamel sauce)  
12 ounces of 2% milk  
*or*  
A deli sandwich and chips and soda if he does not have time to cook

**HS:**

D.K. eats one of the following:  
Bag of microwave popcorn w/ 1-12 oz can of regular soda  
2 scoops of ice cream  
1 c 2% milk and 4-5 cookies  
2 oz. cheese and 12 "Wheat Thin" crackers

**Assessment of Current Diet:**

Pt's current diet does not meet his recommended caloric intake of 2500-2700 kcal/d. This may be a contributor to his recent weight loss. Additionally, his current diet does not meet the dietary recommendations of a diet that contains 40-50% kcal from carbohydrates, 20% protein, and 30-40% fat.

**Concerns with Labs/Meds**

Blood glucose and HbA<sub>1c</sub> levels are elevated and should be reduced to within reference range values as soon as possible. Must be cautious with alcohol intake and Gatifloxacin; both may cause hypoglycemia when used in conjunction with insulin.

**Food & Nutrition History**

This is the 1<sup>st</sup> time pt. has seen an RD

**IBW: 1<sup>st</sup> 5ft. = 106lbs + 6lbs. each addtl. Inch >5ft.**

$$106 + 6\# (11\text{in.}) = 106 + 66 = 172\#$$

$$\% \text{ Wt. Change} = 100 - \% \text{ UBW} = 100 - 145/154 = 100 - 94.16 = 5.84\%$$

Source: PR pg. 2

**D:**

**PES #1:**

Impaired nutrient utilization (NC-2.1) r/t untreated Type 1 Diabetes AEB altered nutrition-related laboratory values (NC-2.2) which includes high blood and urinary glucose, high ketone levels, high HbA<sub>1c</sub>, low albumin, and pre-albumin levels indicated by blood and urine labs.

**PES #2:**

Unintended weight loss (NC-3.2) r/t inadequate energy intake (NI-1.2) AEB diet history showing insufficient energy intake and weight loss of 9 pounds over course of 3 weeks.

**I:**

**MNT Goal:**

Follow a CHO controlled diet through education and choosing healthier food choices.

**Recommendations:**

**Diet:**

1. Meet EER of 2500-2700 kcal/day
2. Follow kcal distribution guidelines:
  - 40-50% carbohydrate
  - 20% protein
  - 30-40% fat
- d. No more than 30-45g of carbohydrates at breakfast
3. Limit intake of simple sugars to <10% of kcals

**Behavioral Goals:**

1. Learn to count carbohydrates and how to perform exchanges
2. Monitor and keep track of blood sugar levels; SBGM
3. Learn how to calculate insulin to carbohydrate ratio and how to cover meals with insulin if needed

**M/E:**

1. Closely monitor glucose levels (urine & blood), HbA<sub>1c</sub>, ketones, albumin, and pre-albumin levels
2. Monitor food recalls to ensure pt is following a CHO controlled diet
3. In-person follow up monthly for the first 12 months; annual visits thereafter

10. D.K. does well over the next few months in learning to manage his diabetes. However, he is finding it difficult to keep his activity and intake constant due to the fact that his schedule is variable and he wants to resume playing ultimate frisbee. He and the health care team agree to use an insulin pump with intensive therapy in order to make his self-care more flexible and achieve tighter glucose control. You begin teaching D.K. about carbohydrate counting.

- a. Assume that his kcal needs have remained the same. How many CHO “points” or servings are in his daily diet from question 7? (1 point)

- b. Describe briefly how this will differ from his exchange-based diet plan that he was using. (1 point)

The exchange-based diet plan revolves around selecting foods that have been placed into food categories (i.e. starches, fruits, milk & substitutes, proteins, fats). Each category has a fixed calorie and kcal breakdown associated with it (i.e. Starch: 15g carbohydrate, 3g protein, 1g fat).

In the exchange-based system, a health-care professional will develop a meal plan that distributes exchanges from each of the aforementioned food categories into the various meals of the day and references a food list, such as *Choose Your Foods*, in order to track caloric, carbohydrate, fat, and protein intake.

This differs from the carbohydrate counting system, where the pt. determines the amount of carbohydrates they expect to eat in a meal, and calculates the amount of insulin they will need to account for that to keep their blood glucose levels stable.

\*Source: Joslin Diabetes Center: Should I count Calories or Use Exchanges for My Meal Planning Approach?

[http://www.joslin.org/info/should\\_i\\_count\\_calories\\_or\\_use\\_exchanges\\_for\\_my\\_meal\\_planning\\_approach.html](http://www.joslin.org/info/should_i_count_calories_or_use_exchanges_for_my_meal_planning_approach.html)

11. D.K. brings his SBGM record in for review when he comes for nutrition counseling. The pre-prandial BG goal is 80-120 mg/dl. Several pre-meal entries are listed below.

BG mg/dl				
Day	Breakfast	Lunch	Dinner	HS Snack
1	94	145	110	100
2	90	106	97	72
3	158	108	95	102

- a. Circle the values that are outside the desirable range. (1 point)  
b. What adjustment(s) should D.K. make if the values are above the desirable range? (1 point)

- c. What adjustment(s) should D.K. make if the values are below the desirable range? (1 point)

12. What adjustments should D.K. make on the days when he plays ultimate frisbee? (1 point)

13. D.K. has caught a cold and has a fever of 101° F. He feels miserable and is not eating much. He calls you to ask if he should reduce his insulin dose since his diet is just a few foods (chicken noodle soup and low kcal Jello and diet 7-up). What advice would you give him and why? (2 points)

--