DIABETES TYPE 1: CLINICAL MANAGEMENT (3) –MNT

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DMI – MEDICAL NUTRITION THERAPY (MNT)

CHO, CHO counting, physical activity

Why MNT in DM I ?

- RDTs of MNT demonstrated decreases in A1C of around 1% in DMI patients.

- Diabetes Control and Complications Trial (DCCT)→ specific diet behaviors were associated with achieving up to a **1 point lower mean A1C (8 versus 7 %) in the intensive treatment group.**

- Reduced incidence of hypoglycemia, weight gain and complications.

Components of MNT

- Consistency in day-to-day carbohydrate intake at meals and snacks

- Adjusting insulin for variations in blood glucose, food, or activity

- Weight management.

- Nutritional content (balance of selected protein, CHO, and fats)

- Meal-insulin timing

CHO consistency

- Variations in food intake, particularly CHO intake, can result in irregular blood sugars and hypoglycemia in patients with DM I.

- **Intensive insulin regimens**, which combine a basal insulin with short-acting premeal insulins, allow some flexibility in the CHO content of meals.

- **However, patients receiving fixed doses of short- and intermediate-acting insulin,**

  → **day-to-day consistency in CHO amount and source at meals and snacks is more important.**

Meal Planning approaches

- **Basic and advanced carbohydrate counting,**

- **The exchange system.**

- **Sample menus.**

**The best approach for individual patients is determined by an assessment of their lifestyle and learning capabilities.

Carbohydrate counting

■ **Basic CHO counting :**

- The simplest form.

- Goal → to promote glycemic control by implementing a **consistent pattern of carbohydrate consumption with meals and snacks day-to-day.**

- Patients consume a **predetermined** total amount of CHO at meals and snacks each day, calculated in grams of CHO per food portion.

- The calculated CHO intake is derived from the percentage of CHO of total calories.

▪ **Advanced CHO counting – will be discussed later.**

Exchange system

- Developed in 1950 by the American Dietetic Association, the American Diabetes Association, and the US Public Health Service

→ An educational tool **to allow a wider variety of food choices for DM Pts**

- Originally, foods categorized into 6 groups: starch, meat and meat substitutes, vegetables, fruit, milk, and fat.

→ Each portion within a group was **"exchangeable"** as it contained the same nutritional value in terms of calories, carbohydrate, protein, and fat.

- Recently categorized into 3 groups for easier CHO education.

→ **These three groups are : carbohydrate, meat and meat substitutes, and fat**

Reminder : Exchange system

Group	Carbohydrate, grams	Protein, grams	Fat, grams	Calories, grams
Carbohydrate group				
Starch	15	3	0 to 1	80
Fruit	15	0	0	60
Milk	12	8	varies	90 to 150
Other carbohydrates	15	varies	varies	varies
Non-starchy vegetables	5	2	0	25

Sample menus

- Defined meal menus that specify the time and amounts of food to be eaten at each meal and snack.

- Created after review of a person's typical food intake; they are best suited for patients who have fairly routine eating habits and who do not eat a wide variety of foods.

- They are alos appropriate for patients who need structured guidance on what to eat.

Insulin treatment and CHO- Insulin adjustments/advanced CHO counting

Advanced CHO counting :

■ Adjustment of food, insulin, and activity based on patterns from detailed logs.

■ Patient needs to record time of meals and snacks, the amount and type of food eaten, amount of CHO consumed, insulin dose, physical activity, and blood glucose results.

■ Patients first practice eating **consistent CHO** at meals and snacks so that baseline insulin requirements can be matched to usual CHO intake using pre- and postprandial blood glucose testing.

Insulin treatment and CHO- Insulin adjustments/ advanced CHO counting

■ When blood glucose levels are in target range, the insulin-to-CHO ratios is determined as follows:

1. Divide the number of grams of CHO at meals by the number of units of pre-meal insulin (eg, 45 g carbohydrate divided by 3 units of insulin is a **1 to 15 ratio**).

2. 450 to 500 rule — Calculate the insulin-to-CHO ratio as follows:

   Regular insulin -to-carbohydrate ratio = 450 divided by total daily dose (TDD) of insulin.

   Rapid acting insulin-to-carbohydrate ratio = 500 divided by TDD of insulin.

Insulin treatment and CHO- Insulin adjustments/ advanced CHO counting/ 3.Weight method

Weight, lbs	Ratio
120 to 129	1:15
130 to 139	1:14
140 to 149	1:13
150 to 169	1:12
170 to 179	1:11
180 to 189	1:10
190 to 199	1:9
>200	1:8

Insulin treatment and CHO- Insulin adjustments/ blood glucose levels

■ **Elevated blood glucose levels** — **An insulin correction factor** can be used to adjust insulin dose for hyperglycemia before meals or between meals. To calculate the insulin correction factor:

■ For <u>regular insulin</u> , divide 1500 by TDD

■ For rapid-acting insulin, divide 1800 by TDD

Insulin treatment and CHO- Insulin adjustments/ blood glucose levels

- ■ As an example:

- ■ if a patient using rapid-acting insulin has a TDD of 45 units:

- → The insulin correction factor = 1 unit for every 40 mg/dL reduction in blood sugar (1800 divided by 45).

- → If the patient had a premeal blood sugar of 180 mg/dL and wanted to **correct to a premeal blood glucose of 100 mg/dL (target)**, then the patient would take an extra 2 units of rapid-acting insulin to correct to the target of 100 mg/dL **and**

- → Add the number of units needed to cover the CHO consumed.

Carbohydrate counting - examples

■ Calculate the number of CHO choices in these meals:

- Turkey and Cheese toast (2 slices bread, 1 slice of cheese and turkey) =
- **2 choices (30 g)**

- Falafel beget (3 falafel + 3 tbsp Hummus+2tsp Tahnini) =
- **4 choices (60 g)**

- Green beans meal (2 cups beans+ 1 cup rice + 4 oz meat)=
- **4 choices (60 g)**

Reminder - Carbohydrates types

- Simple CHO

- Complex CHO

- Dietary Fiber: all plant polysaccharides that are resistant to

  hydrolysis by the digestive enzymes of man.

Glycemic Index (GI) and Glycemic Load (GL)

GI –

- "The ranking of foods based on their immediate effect on blood sugar levels" (The Glucose Revolution – Hodder & Stoughton ISBN 034077021X)

- They are ranked according to **high, intermediate and low GI.**

GL-

- Introduced by researchers at Harvard University to **quantify the glycemic impact of a portion of food** (Consider the GI and the amount of CHO in the portion of food eaten).

- –More practical in assessing the impact of CHO on glycemia
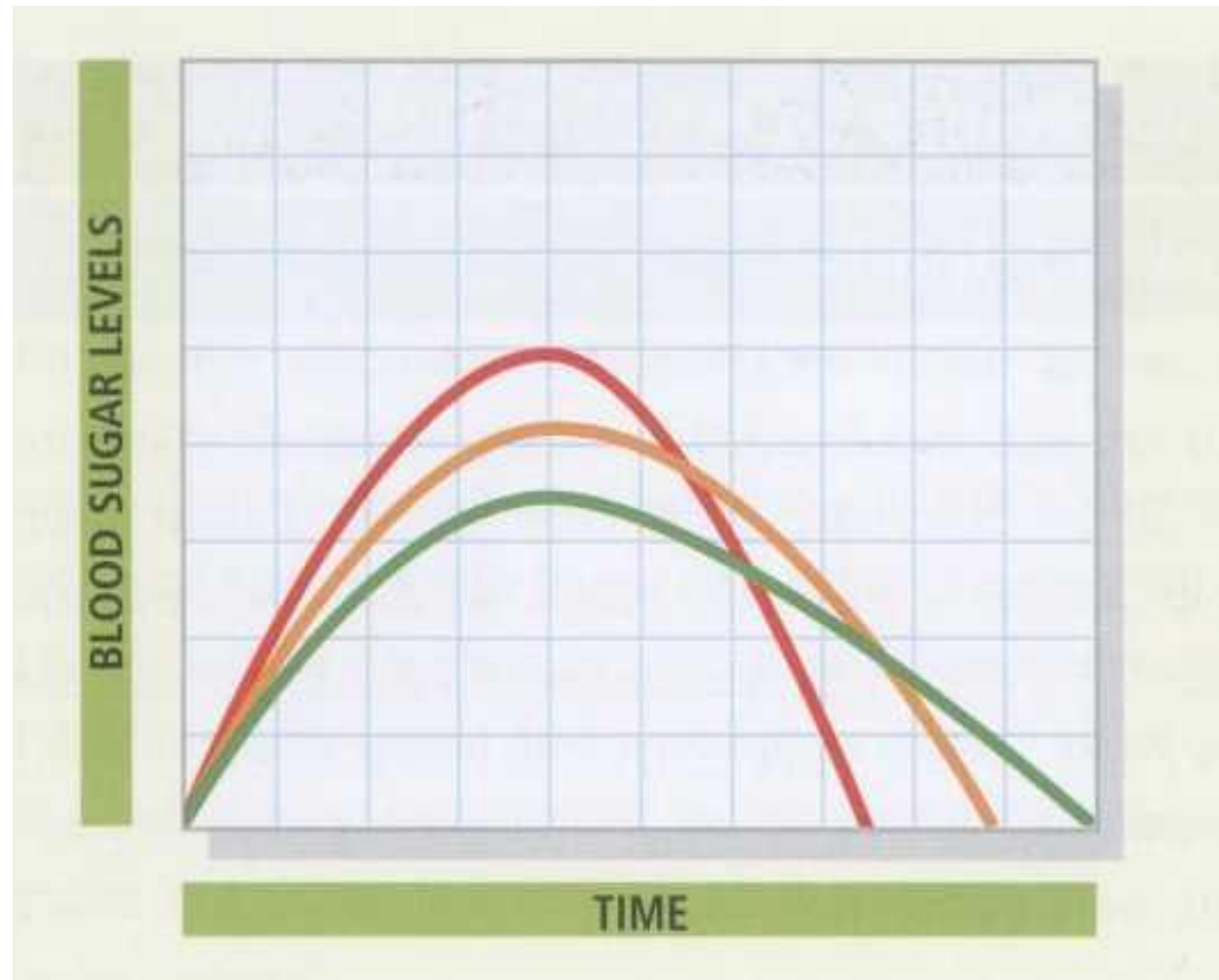
Measurements of GI and GL

GI:

- Low < 55

- Medium 55-70

- High >70

■ GL:

Quantity of food consumed* amount of CHO in the food/100

- Low < or = 10

- Medium 11-19

- High > or = 20

Glycemic Index (GI) according to different foods.

Green-complex CHO (low GI)

Orange-Starchy CHO (Intermediate GI)

Red-refined CHO (High GI)

Food Values: Glycemic Index/Glycemic Load

	Low GI	Med GI	High GI
Low GL	All-bran cereal (8,42) Apples (6,38) Carrots (3,47) Peanuts (1,14) Strawberries (1,40) Sweet Corn (9,54)	Beets (5,64) Cantaloupe (4,65) Pineapple (7,59) Sucrose, i.e. table sugar (7,68)	Popcorn (8,72) Watermelon (4,72) Whole wheat flour bread (9,71)
Med GL	Apple juice (11,40) Bananas (12,52) Fettucine (18,40) Orange juice (12,50) Sourdough wheat bread (15,54)	Life Cereal (16,66) New potatoes (12,57) Wild rice (18,57)	Cheerios (15,74) Shredded wheat (15,75)
High GL	Linguine (23,52) Macaroni (23,47) Spaghetti (20,42)	Couscous (23,65) White rice (23,64)	Baked Russet potatoes (26,85) Cornflakes (21,81)

Source: Revised International Table of Glycemic Index (GI) and Glycemic Load (GL), the American Journal of Clinical Nutrition, July 2002

Factors affecting GI and GL

• Food processing methods and high Temperatures.

– High temperature more gelatinization.

– Amylose have lower GI (used in manufacturing).

• Fat content of foods- slow gastric emptying/secretion of gut hormone that clear glucose from blood

• Protein content of food

• Soluble fiber

• polyphenols

DMI OTHER CONSIDERATIONS

Physical activity and weight management

Physical activity/Exercise

■ Benefits of exercise include :

- Improved glycemic control.

- Weight control

- Reduction in co-morbidities (hypertension, dyslipidemia, and cardiovascular disease).

- Improved mood, and quality of life.

Physical activity/Exercise

- Although exercise has not been consistently shown to improve glycemic control in DM I,

→ **patients who learn to self-adjust their diet or insulin to accommodate exercise can achieve near-normal A1C levels without hypoglycemia.**

Physical activity/Exercise

- For patients trying to lose weight → adjust insulin doses rather than increase food intake to compensate for exercise.

- **Timing of exercise in relation to insulin dose, type, mode of delivery, and time of injection should be considered.**

- Patients should check blood sugar before and after exercise, especially in the beginning of an exercise program, to evaluate glycemic response to exercise and adjust insulin regimen.

- Patients should have a snack handy, in case of low blood sugar.

Weight management in DMI

- The risk of comorbidities associated with excess adipose tissue increases with high BMI.

- Lowering caloric intake and inducing weight loss are of major importance for overweight and obese patients, such like DM II.

- **Weight gain with intensive therapy** — occurs when insulin dosing matches nutritional intake and glycosuria is eliminated.

Weight management in DMI

- DCCT study → The mean increase in weight in patients was 5.1 kg in the intensive therapy group and 2.4 kg in the conventional therapy group.

- At study end, 33% of the intensive therapy group was overweight compared with 19% of the conventional treatment group.

Weight management in DMI

- If A1C is high enough to promote glycosuria, then lowering calorie intake by an additional 250 to 300 calories per day is necessary to prevent weight gain in intensive therapy.

- Other strategies are:

→ **Reduce insulin doses** preferentially for patterns of hypoglycemia rather than increasing meal size or adding an undesired snack.

→ **Reduce calories further**, it is helpful to reduce fat intake and try to keep CHO intake consistent to minimize risk of hypoglycemia.

You can watch these videos

- https://www.youtube.com/watch?v=lGIXS-NTBoY

- https://www.youtube.com/watch?v=P8SfArvam3w