Learning Objectives:
1. Define advanced glycation end products (AGEs).
2. Identify at least three ways to help patients with diabetes reduce their AGE intake.
3. Identify when snacks are appropriate and inappropriate for patients with diabetes.
4. Identify the benefits and limitations of weight loss among patients with diabetes.
5. Identify at least one advantage and one disadvantage of using the glycemic index among patients with diabetes.

Session Description
Although diabetes is common and widely reported on, the disease and strategies to control it are more complicated than many understand. RDs frequently have questions about current diabetes research and literature. For instance, can weight loss cure type 2 diabetes? What are advanced glycation end products, and how do they affect diabetes? Is blood glucose monitoring helpful for people who don’t use insulin? This session identifies several aspects of diabetes care that can be confusing for health professionals and/or patients, and reviews the science and practical applications surrounding these topics.
What are AGEs?

- Compounds made of sugars bound to proteins or fat.
- Common in the diet
  - Cooking and additives
- Form spontaneously in the body
  - Controlled by natural defenses
- Partly responsible for complications

Maillard Reaction

Oral AGEs

- Consumed: 15 AGE Eq (15,000,000 U CML/day)
- Absorbed: 10%
- Excreted/Urine: NL: 3% D-CKD: < 3%
- Stool: ~ 90%

Tissues:
- NL: 7% or 1 Eq
- D-CKD: 10% or 1.5 Eq U AGE/day

H.Vlassara: PNAS 1996
Compliments of Helen Vlassara
Effects of AGEs

- Promote oxidation and inflammation
- Lead to:
  - Insulin resistance
  - Type 2 diabetes
  - Heart disease
  - Complications of diabetes
  - Peripheral nerves of pwd

AGE-Rich Meal in type 1 and type 2
- Increased inflammatory markers
- Decreased endothelial function

AGE Restriction Improves Insulin Resistance

- 12 pwd, type 2
- 4 months on isocaloric AGE-restricted diet (< 10 AGE Eq/d)
- Lowered insulin levels, markers of insulin resistance, oxidative stress, and inflammation
- 26 pwd, type 2
  - ½ changed cooking techniques, 44% fewer AGES
  - Reduced inflammation & oxidative stress

Basic Principles to Reduce AGEs

1. Limit high-AGE foods
2. Choose cooking methods that limit AGE formation
3. Use ingredients to inhibit AGE formation
Reducing AGES

Increase
- Fish
- Legumes
- Low-fat milk products
- Vegetables
- Fruits
- Whole grains

Decrease
- Solid fats
- Fatty meats
- Full-fat dairy products
- Added sugars
- Processed foods

High-AGE Foods

<table>
<thead>
<tr>
<th>Meat</th>
<th>Beef &gt; poultry &gt; fish &gt; eggs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Roasted, grilled, broiled, fried &gt; poached, steamed, stewed, braised, etc.</td>
</tr>
<tr>
<td></td>
<td>High-fat &gt; lower-fat</td>
</tr>
<tr>
<td>Cheese</td>
<td>High-fat, aged, processed &gt; lower-fat</td>
</tr>
<tr>
<td>Fats, oils</td>
<td>Butter, cream cheese &gt; margarine, mayonnaise, oils, nuts</td>
</tr>
</tbody>
</table>

AGE Content of Foods

Dry vs. Moist Heat

Compliments of Sandra Woodruff, MS, RD, LD/N

JADA 2010;110:911-916
AGE Content of Foods
Animal vs. Vegetable Protein

- Beef
- Chicken
- Salmon
- Egg
- Beans
- Veggie Burger

AGEs (kU/90 g)

AGE Content of Selected Cheeses

<table>
<thead>
<tr>
<th>Cheese</th>
<th>AGE (kU/30 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parmesan</td>
<td>5070</td>
</tr>
<tr>
<td>American</td>
<td>2603</td>
</tr>
<tr>
<td>American, low-fat</td>
<td>1212</td>
</tr>
<tr>
<td>Cheddar</td>
<td>1657</td>
</tr>
<tr>
<td>Cheddar, 2%</td>
<td>737</td>
</tr>
<tr>
<td>Cottage, 1%</td>
<td>436</td>
</tr>
</tbody>
</table>

AGE Content of Selected Fats

<table>
<thead>
<tr>
<th>Fat</th>
<th>AGE (kU/15 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter</td>
<td>1890</td>
</tr>
<tr>
<td>Margarine</td>
<td>540</td>
</tr>
<tr>
<td>Olive oil</td>
<td>450</td>
</tr>
<tr>
<td>Avocado</td>
<td>235</td>
</tr>
</tbody>
</table>
Lower-AGE Foods

| Grains | Crackers, chips, cookies > breads, oatmeal, boiled/steamed grains |
| Fruits, Veggies | Roasted, grilled > fresh, steamed |
| Milk | Hot cocoa mix, evaporated milk > milk, yogurt, ice cream, pudding |

Choose Cooking Methods that Inhibit Formation of AGEs

<table>
<thead>
<tr>
<th>Chicken</th>
<th>AGEs (kJ per 90g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw</td>
<td>700</td>
</tr>
<tr>
<td>Poached/boiled/steamed</td>
<td>1,000</td>
</tr>
<tr>
<td>Roasted</td>
<td>4,850</td>
</tr>
<tr>
<td>Broiled/grilled</td>
<td>4,800</td>
</tr>
<tr>
<td>Chicken nuggets</td>
<td>7,760</td>
</tr>
</tbody>
</table>

Use Ingredients to Inhibit AGE Formation

- Water
- Moist heat
- Poach
- Stew
- Braise
- Acid
  - Lemon juice, vinegar, wine, tomato juice
  - Marinades
  - Cooking liquids

![Graph showing the reduction in AGEs with different cooking methods and ingredients.](JADA_2010;110:911-916)
Tips

• Cook low and slow
• Cook with moisture
• Cook with acids
• Grill breads, fruits, vegetables, not meats
• Shrink the meat
• Go Lean
• More fruits, veg, whole grains
• Prepare it yourself

Glycemic Index

• Relative area under glucose curve of 50g digestible carbohydrate compared to 50g of a standard food
  • Pure glucose = 100
• Theory:
  • Low GI foods are better
  • Low GI foods don’t cause BG to rise and fall greatly
  • Low GI foods are better for diabetes
Glycemic Index

![Glycemic Index Graph](https://example.com/glycemic-index-graph)

### Change in Blood Glucose

- **Glucose 50**
- **High GI**
- **Low GI**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Time (min)</th>
<th>High GI</th>
<th>Low GI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miller</td>
<td>15</td>
<td>97</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>105</td>
<td>95</td>
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</tr>
<tr>
<td></td>
<td>90</td>
<td>105</td>
<td>95</td>
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</tbody>
</table>

#### Food GI

<table>
<thead>
<tr>
<th>Food</th>
<th>GI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrots, raw, diced</td>
<td>35</td>
</tr>
<tr>
<td>Chickpeas, boiled</td>
<td>36</td>
</tr>
<tr>
<td>Apple, raw</td>
<td>40</td>
</tr>
<tr>
<td>Ice cream, low-fat, vanilla</td>
<td>46</td>
</tr>
<tr>
<td>Chocolate, plain</td>
<td>69</td>
</tr>
<tr>
<td>Brown rice, steamed</td>
<td>50</td>
</tr>
<tr>
<td>Sweet corn, boiled</td>
<td>60</td>
</tr>
<tr>
<td>Marshmallows</td>
<td>62</td>
</tr>
<tr>
<td>Milky Way bar</td>
<td>62</td>
</tr>
<tr>
<td>Cantaloupe, raw</td>
<td>65</td>
</tr>
<tr>
<td>Pineapple, raw</td>
<td>66</td>
</tr>
<tr>
<td>Watermelon, raw</td>
<td>72</td>
</tr>
<tr>
<td>Rice cake</td>
<td>82</td>
</tr>
<tr>
<td>Baguette, white, plain</td>
<td>95</td>
</tr>
<tr>
<td>Baked potato w/out skin</td>
<td>98</td>
</tr>
</tbody>
</table>

### Diabetes and Low-GI Diet

- **Meta-analysis**
  - 14 studies, 356 subjects with types 1 and 2 diabetes
  - 12 days – 12 months
  - GI = 83 and 65
  - Conclusion: Lower GI reduces A1C by 0.43% more than high-GI diet
  - Drug Comparison: 0.5% - 2.0%
- **2013 ADA Position Paper**
  - 0.2 – 0.5%
  - Substituting low-glycemic load foods for higher-glycemic load foods may modestly improve glycemic control.
Nutritional Trouble

• Give up nutrient-dense foods
• Choose ice cream (37) for dessert vs. grapes (59)
• Pile on low GI foods
• Limit food choices

Variability of GI Score

• Physical form of the food
  ▪ Mashed potato vs whole potato
• Variety
  ▪ Fettuccini vs. macaroni
  ▪ Basmati grain vs Jasmine grain rice
• Degree of cooking/processing
  ▪ Overcooking increases GI
  ▪ Vinegar slows stomach emptying
  ▪ Cooling starches increases resistant starch content
• Total meal or snack
• Ripeness of food
  ▪ Under-ripe bananas contains more resistant starch

ADA on Diet & Glycemic Control

“Based on the research, for most people with diabetes, the first tool for managing blood glucose is some type of carbohydrate counting.”
GI Variability

<table>
<thead>
<tr>
<th>Food Name</th>
<th>GI</th>
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<tbody>
<tr>
<td>White bread, wheat flour</td>
<td>69</td>
</tr>
<tr>
<td>White bread, wheat flour</td>
<td>75</td>
</tr>
<tr>
<td>White bread, wheat flour</td>
<td>87</td>
</tr>
<tr>
<td>White bread, wheat flour</td>
<td>88</td>
</tr>
<tr>
<td>White bread, wheat flour, homemade</td>
<td>89</td>
</tr>
<tr>
<td>White bread, wheat flour</td>
<td>89</td>
</tr>
<tr>
<td>White bread, wheat flour</td>
<td>70</td>
</tr>
</tbody>
</table>

Consider Portions

- **50 g ice cream**
  - 1+ cup

- **50 g carrots**
  - 1.5 pounds
Glycemic Load

(GI x grams of CHO)/100

- Low GL: ≤ 10
- High GL: ≥ 20

GI of watermelon = 72
GI of lima beans = 32

Glycemic Load

- Lima beans: 1-cup contains 35 g carbohydrate
  - GI = 32
  - GL = (32 x 35)/100 = 11.2

- Watermelon: 1-cup melon balls contains 12 g carbohydrate
  - GI = 72
  - GL = (72 x 12)/100 = 8.6

Mixed Meals

- Weighted contribution of carb-containing foods
  - Pan-fried chicken, sweet potatoes, peas, carrots, tomato sauce (25 g CHO)
    - + 25 g CHO potato, rice or spaghetti
  - Overestimate GI of meals by 22-50%
    - Potato meal: 63/33
    - Rice meal: 51/38
    - Spaghetti meal: 54/38

Individual Response

- Pre-meal
- 2 hour post-prandial
  - Difference – 40 - 50 mg/dl
  - Blood glucose before eating: 104 mg/dl
  - Blood glucose two hours after the first bite: 137 mg/dl
    + 33 mg/dl
  - ADA target: < 180 mg/dl (1 – 2 hours)

High GI Foods Did Not Increase Appetite

- Isoenergetic servings of 38 foods
- Satiety ranking every 15 minutes for 2 hours
- Protein, water & fiber correlated with satiety score
- Ad libitum consumption following the 2 hours test period was negatively correlated

<table>
<thead>
<tr>
<th>FOOD</th>
<th>SI SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potatoes</td>
<td>323</td>
</tr>
<tr>
<td>Orange</td>
<td>202</td>
</tr>
<tr>
<td>Popcorn</td>
<td>154</td>
</tr>
<tr>
<td>All Bran</td>
<td>151</td>
</tr>
<tr>
<td>Lentils</td>
<td>133</td>
</tr>
</tbody>
</table>

25 Studies Looking at GI & Weight Loss

- Ranged from 8 days to 18 months
  - 19 NS
  - 4 low GI performed better than high GI
  - 1 low GI performed better than low fat
  - 1 high GI performed better than low GI

From Katherine Beals, PhD, RD, FACSM, CSSD, WM
University of Utah
Symposium March 2014
Practice Pearls

- Master carb counting or other method first
  - Fine-tuning
- Avoid simple and complex carb terminology
- Focus on the greatest contributors
  - Breakfast cereals, breads, sweets
- Compare within the same food category
- Combine high and low GI foods
  - Don’t avoid nutritious foods!
- SMBG

Instead of this... | Eat this!
---|---
White bread | Sourdough or rye bread
Baked white potato without skin | Baked white potato with skin
White rice | Lentils
Soft Spaghetti | Al dente spaghetti
Corn chips | Nuts
Raisins | Grapes
Cornflakes | Rolled oats

SMBG in Non-insulin Treated Patients
Is SMBG Worth the Expense?

- $465 million
- Strips
- Lancing devices
- Lancets
- Meters
- Batteries
- Calibration solutions

Guide treatment decisions
Evaluate individual response to therapy
Detect/prevent hypoglycemia
Influence food choices
Identify patterns
Guide physical activity

Cefalu WT Diabetes Care 2013 36 ;1 176

Is SMBG Worth the Expense?

- Meta-analysis¹
  - 0.25% at 6 months
- Cochrane Review²
  - No effect by 12 months
  - More reported hypoglycemia
  - No QOL effects

"When prescribed as part of a broader educational context, SMBG results may be helpful to guide treatment decisions &/or patient self-management for patients using less frequent insulin injections or noninsulin therapies."

ADA Clinical Practice Guidelines 2014

In Practice

Martha
- 64 y o f, type 2 x 1 year
- Metformin
- A1C 6.9%
- Fearful

Jean
- 59 y o f, type 2 x 8 years
- Glyburide
- A1C 8.6%
- Fearful
Lisa’s Surprise

A1C goal: < 7% (eAG = 154 mg/dl)
Actual A1C: 8.5% (eAG = 197 mg/dl)

<table>
<thead>
<tr>
<th></th>
<th>SUN</th>
<th>MON</th>
<th>TUES</th>
<th>WED</th>
<th>THURS</th>
<th>FRI</th>
<th>SAT</th>
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<td>FBG</td>
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<td>99</td>
<td>128</td>
<td>103</td>
<td>98</td>
<td>105</td>
<td>119</td>
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<tr>
<td>HS</td>
<td>110</td>
<td>129</td>
<td>119</td>
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</table>

Pattern Management

<table>
<thead>
<tr>
<th>Day</th>
<th>FBG</th>
<th>After Breakfast</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUN</td>
<td>116</td>
<td>150</td>
</tr>
<tr>
<td>MON</td>
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<td>188</td>
</tr>
<tr>
<td>TUES</td>
<td>117</td>
<td>181</td>
</tr>
<tr>
<td>WED</td>
<td>128</td>
<td>198</td>
</tr>
<tr>
<td>THURS</td>
<td>98</td>
<td>144</td>
</tr>
<tr>
<td>FRI</td>
<td>129</td>
<td>201</td>
</tr>
<tr>
<td>SAT</td>
<td>99</td>
<td>188</td>
</tr>
</tbody>
</table>

What the Patient Must Know

- Pathophysiology of diabetes
- Mechanisms of action of medications
- Target BG levels
- Schedule for SMBG
- Foods most likely to affect BG
- Role of exercise
<table>
<thead>
<tr>
<th>Day</th>
<th>Fasting</th>
<th>2 Hrs After B</th>
<th>Before Lunch</th>
<th>2 Hrs After L</th>
<th>Before Dinner</th>
<th>2 Hrs After D</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>√</td>
<td>√</td>
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</tbody>
</table>

Are Snacks Required?

America Snacks

**Adults (1997-2006)**
- 200 to 475 calories from snacks
- 1765 to 2164 calories daily
- Approximately 400 additional calories daily
- Every 3 hours

**Children (1997-2006)**
- 250 to 500 calories from snacks
- 1850 to 2100 calories daily
- Approximately 200 additional calories daily
- Every 3.5 hours
Why Snack?

- **Healthy:**
  - Satisfies hunger (esp. important for children)
  - Meets nutritional needs (esp. important for children)
  - Controls appetite later
- **Less healthy:**
  - See others eating
  - Participating in social events
  - It’s a habit
  - Erases boredom or anxiety
  - Keep kids busy
  - Sleep? Hormones?
    - 221 extra snack calories


Out with Old Dogma About Snacking and Diabetes

- Do people with diabetes have to snack to manage diabetes?
- Is snacking necessary to prevent hypoglycemia?
- Does one set of guidelines fit everyone?
  - HS
  - Assess medication schedules
    - Proper dose, proper timing
    - Other medications

Meet Rose

- 48 years
- Type 2 diabetes
- 70/30 a.m. and p.m.
- Daily hypoglycemia following exercise
  - Snacked before exercise/treated hypoglycemia after
- Small, consistent weight gain
- Solution: Basal-bolus
BG Lowering Medications Effects

Unlikely to Cause Hypoglycemia

- **Biguanides:** metformin (Glucophage)
- **Thiazolidinediones (TZDs):** pioglitazone (Actos), rosiglitazone (Avandia)
- **Alpha-glucosidase inhibitors:** acarbose (Precose), miglitol (Glyset)
- **DPP-IV inhibitors:** sitagliptin (Januvia), saxagliptin (Onglyza)
- **Injectables:** Exenatide (Byetta), Pramlintide (Symlin)

Can Cause Hypoglycemia

- **Sulfonylureas:** glicl indemine (Glucotrol), glyburide (Diabeta, Micronase), glimepiride (Amaryl)
- **Meglitinides:** nateglinide (Starlix), repaglinide (Prandin)
- **Insulin:** all types

Does eating frequently really boost metabolic rate?

PAPER

Compared with nibbling, neither gorging nor a morning fast affect short-term energy balance in obese patients in a chamber calorimeter

MA Taylor\(^1\) and JS Gamony\(^2\)

**OBJECTIVE:** To test if a diet of 4,274 kJ/24 h as six isocaloric meals would result in a lower subsequent energy intake, or greater energy output than a 4,274 kJ/24 h in two isocaloric meals or (3) a morning fast followed by free access to food.

**DESIGN:** Subjects were assigned to the Metabolic Unit from 19:00 h on day 1 to 09:30 h on day 6. Each day they had a fixed diet providing 4,274 kJ with three pairs of meal patterns which were offered in random sequence. These were: six meals vs two meals without access to additional foods (5x6), or six meals vs two meals with access to additional food (6+6x2), or six meals vs four meals without access to additional food (6+6x4). In the MARKET condition the first two meals of the day were omitted to reduce daily intake to 2,184 kJ and to create a morning fast, but additional food was accessible thereafter. Patients were confined in the chamber calorimeter from 19:00 h on day 2 until 09:30 h on day 4, and then from 07:00 h on day 4 to 09:30 h on day 6. The order in which each meal pattern was offered was balanced over time.

**CONCLUSION:** In the short term, meal frequency and a period of fasting have no major impact on energy intake or expenditure, but energy expenditure is delayed with a lower meal frequency and a higher meal frequency. This might be attributed to the thermogenic effect of food continuing into the night when a large meal is given. A morning fast resulted in a diet which tended to have a lower percentage of energy from carbohydrate than with no fast.

Potential role of meal frequency as a strategy for weight loss and health in overweight or obese adults

Michelle C. Kulakow Ph.D., 1,3 Lee E. Klodzki Ph.D., 1,3 Christine Menzie Ph.D., 1,3 Ann L. Gibson Ph.D., 1,3 Carole A. Conlin Ph.D., 1,3 Deborah Klimaney M.S., 1,3 Chad M. Kerstic Ph.D. 1,3

Improved dietary strategies for weight loss are necessary to decrease metabolic disease risk in overweight or obese adults. Varying meal frequency (MF, i.e., increasing or decreasing eating occasions beyond the traditional pattern of three meals daily) has been thought to have an influence on body weight regulation, hunger control, and blood markers of health. It is common practice for weight management clinicians to recommend increasing MF as a strategy for weight management and to improve metabolic parameters. However, limited research exists investigating the effect of MF during controlled hypocaloric dietary interventions. Furthermore, MF literature often speculate with regard to efficacy of MF treatments based on research using normal weight, overweight/ obese, or some combination, where much diversity exists within these various populations. In this review, we suggest that normal-weight and overweight/obese populations, as well as free-living versus investigator-controlled research trials, should be studied independently. Therefore, the objective of the present review is to survey the literature to assess whether the alteration of MF influences body weight regulation, hunger control, and/or blood markers of health in overweight/ obese participants undergoing a controlled hypocaloric diet to induce weight loss. Findings of this review indicate that there is uncertainty in the literature when interpreting the optimal MF for obesity treatment, where reduced MF may even show more favourable glycemic profiles in obese individuals compared with increased MF. Furthermore, the simple relationship of comparing MF with body fatness or body mass index should also consider whether eating frequency is associated with other health factors (e.g., increased physical activity).

To Snack or Not to Snack: What should we advise for weight management?

Michelle A. PALMER 1, Sandra CAPRA 1 and Surinder K. BAINES 1

1 Griffith University, Gold Coast, University of Queensland, Brisbane, Queensland, and University of Newcastle, Callaghan, New South Wales, Australia

Abstract

Aims: Although our current weight management guidelines suggest eating regularly, speculation about whether snacking outside of managing weight occurs widely among the media, weight loss clients and health professionals. We aim to examine whether there is adequate scientific evidence available to support the manipulation of eating frequency for improving body weight, diabetes and cardiovascular risk markers, and theories that risk eating frequency with weight management.

Methods: Relevant papers from nutrition and dietetics journals and other sources were used to assess the association between eating frequency and weight and health.

Results: Longer-term evidence suggests eating frequency does not affect weight, glucose, insulin control, hunger, or energy expenditure in intentional weight loss and maintenance. There is consistent short-term evidence of an inverse association between blood lipid levels and eating frequency during weight maintenance. Many of the common theories that suggest manipulating eating frequency for weight management are not supported by the literature. Sustaining a change to eating frequency also may be challenging over the longer term.

Conclusions: Overall current evidence does not suggest that manipulating eating frequency greatly benefits weight and health. Health professionals may not need to manipulate eating frequency for weight management.

Metabolic Effects

1-day study, 12 subjects with type 2 diabetes, 6 small meals vs. 2 large meals

Bentzelion IC et al., Diabetes Care. 1993 16 (1):1-7
**Metabolic Effects**

1-day study, 11 subjects with type 2 diabetes, "nibbling diet" (13 snacks) vs. 3-meal diet (plus 1 snack)

<table>
<thead>
<tr>
<th></th>
<th>Nibbling Diet</th>
<th>3 meal Diet</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Glucose (mmol/L)</td>
<td>9.6</td>
<td>11.11</td>
<td>12.7%</td>
</tr>
<tr>
<td>Serum Insulin (mmol/L)</td>
<td>276</td>
<td>336</td>
<td>20.1%</td>
</tr>
<tr>
<td>Serum TG (mmol/L)</td>
<td>3.32</td>
<td>3.63</td>
<td>8.4%</td>
</tr>
</tbody>
</table>


**Metabolic Effects**

4-week study, 13 subjects with type 2 diabetes, 3 meals (plus 1 snack) vs. 9 meals

Conclusions: No advantages, No adverse events

<table>
<thead>
<tr>
<th></th>
<th>3 meals/d</th>
<th>9 meals/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C (%)</td>
<td>7.56</td>
<td>8.08</td>
</tr>
<tr>
<td>Glucose (mmol/L)</td>
<td>7.48</td>
<td>7.58</td>
</tr>
<tr>
<td>Insulin (mU/ml)</td>
<td>21.53</td>
<td>21.01</td>
</tr>
<tr>
<td>T. Chol (mmol/L)</td>
<td>5.88</td>
<td>5.88</td>
</tr>
<tr>
<td>LDL-Chol (mmol/L)</td>
<td>3.98</td>
<td>4.03</td>
</tr>
<tr>
<td>HDL-Chol (mmol/L)</td>
<td>1.09</td>
<td>1.05</td>
</tr>
<tr>
<td>Triglyceride (mmol/L)</td>
<td>1.86</td>
<td>1.85</td>
</tr>
</tbody>
</table>


**Snack Options**

15 g CHO (1 carb choice)

- Triscuit Thin Crisps, 11
- Light yogurt
- Small fruit (tennis ball size)
- Vegetable juice, 12 ounces

Very low carbohydrate

- 2% cottage cheese
- Lettuce wraps w/vegetables & turkey
- Edamame beans
- Nuts
- Hard-boiled egg w/veggies
**Substantial Snack Options**

- ½ - 1 sandwich (nut butter, tuna, chicken) on high-fiber, whole-grain bread
- Hummus, veggies and pita
- 2% cottage cheese, salsa, veggies
- English muffin or portobello “pizza”
- Vegetable-bean soup
- Apple with nut butter

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**Snacking: It’s a Choice**

**Pros:**

- Fill in nutritional gaps
- Control or stave off hunger
- Possibly prevent hypoglycemic/hyperglycemia

**Cons:**

- Pack on extra calories
- Increase medication needs
- Displace nutritious foods at meals
- Discourage listening to hunger cues
- Possibly contribute to hypoglycemic/hyperglycemia

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**The Effects of Weight Loss**
What Does Weight Loss Do?

- Lowering of high blood pressure
- Lowered LDL cholesterol
- Reduced risk of CVD
- Improved blood glucose
  - May reduce meds, prevent increased meds
- Reduced risk of type 2 diabetes
  - 58% in 3 years, 34% in 10 years

- More fun/active
- ENERGY
- Fun clothes
- Confidence
- Comfort
- Better Sleep


Early Weight Loss

“In a retrospective cohort study, a weight loss pattern after the new diagnosis of type 2 diabetes predicted improved glycemic and blood pressure control despite weight regain.”

- ADA Guide to Nutrition Therapy for Diabetes

Bariatric Surgery

- Diabetes Remission
  - Varies with definition
  - ADA consensus group: FBG < 100 mg/dl and A1C < 6%, 1 year, no meds
- Complete remission: 34% of 209 subjects
  - Roux-en-Y Gastric Bypass (RYGB): 40.6%
  - Vertical Sleeve Gastrectomy (VSG): 26%
  - Adjustable Gastric Band (AGB): 7%
- Much greater remission rates compared to intensive lifestyle therapy

Vetter et al. Diabetes Spectrum 2012  25;4
Surgery vs Conventional Therapy in Type 2 Diabetes

- 137 patients, mean age: 48 years
- BMI > 35, A1C > 7%
- MNT (with conventional medical therapy), RYGB or Sleeve Gastrectomy
- Endpoint: A1C < 6.0% with or without diabetes medications at 3 years post randomization
- Results:
  - RYGB: 38% at 3 years, 24% relapse since year 1
  - SG: 24% at 3 years, 50% relapse since year 1
  - Average combined A1C decrease: 2.5%
  - MNT: 5% at 3 years, 80% relapse since year 1
  - Average A1C decrease: 0.6%

Schauer et al. NEJM March 31, 2014

Predictors of Remission

- Greater weight loss
- Medical treatment without insulin
- Smaller preoperative waist circumference
- Shorter duration of diabetes
  - < 8 – 10 years
- Greater glycemic control


Weight Loss & Meds

- Fear of medications
  - Extreme dieting
  - Extreme carbohydrate restriction
- Medications with weight loss effects
  - Victoza & Byetta
  - Metformin
    - Lowers A1C by 1 – 2%, FBG by 60 – 70 mg/dl
  - Modest weight loss
  - Improved endothelial function, insulin resistance, dyslipidemia
  - Persistent benefits: diabetes-related endpoints, all-cause mortality, MI (UKPDS)

Weight Loss Outcomes

- 11 study review
- 70% completions rate, >1 year
- Weight loss: 1.9 – 8.4 kg at 1 year
- Mediterranean-style diet: 6.2 kg (3.8 kg at 4 years)
  - A1C: -1.2%
- Intensive Lifestyle Therapy/Look AHEAD: 8.4 kg (4.7 kg at 4 years)
  - A1C: -0.64%
- 5 trials compared varying macronutrient percentages: 1.9 – 4.0 kg, NS
- All eating plans are equally effective
- CALORIE RESTRICTION RULES OVER THE SCALE

Jill Weisenberger, MS, RDN, CDE
jillweisenberger.com
jill@jillweisenberger.com
757-969-8385

Upcoming Books
The Overworked Person’s guide to Better Nutrition
21 Things You Need To Know About Diabetes And Your Heart