

# **Lifestyle Approaches to the Prevention and Treatment of Diabetes**

November 14, 2013

**Presenters:**

**Marion J. Franz, MS, RD, CDE**

Nutrition Concepts by Franz, Inc – Minneapolis, MN

**Moderator:**

James M. Rippe, MD – Leading cardiologist, Founder and Director,  
Rippe Lifestyle Institute

# Webinar logistics

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Promoting dietary and related  
choices affecting wellness  
by linking  
evidence-based understanding  
with practice

# Today's Faculty

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▶ Marion J. Franz, MS, RD, CDE

Nutrition Concepts by Franz, Inc – Minneapolis, MN

▶ Moderator:

James M. Rippe, MD – Leading cardiologist,

Founder and Director, Rippe Lifestyle Institute

# Learning Objectives

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- ▶ List expected outcomes from diabetes nutrition therapy and when to evaluate outcomes
- ▶ Discuss the role of weight loss therapy across the continuum of diabetes
- ▶ List goals and evidence-based nutrition therapy priorities for type 1 and type 2 diabetes
- ▶ State evidence to support macronutrient intake recommendations for diabetes
- ▶ Select appropriate nutrition therapy interventions for persons with diabetes

# Lifestyle Approaches to the Prevention and Treatment of Diabetes

Marion J. Franz, MS, RD, CDE

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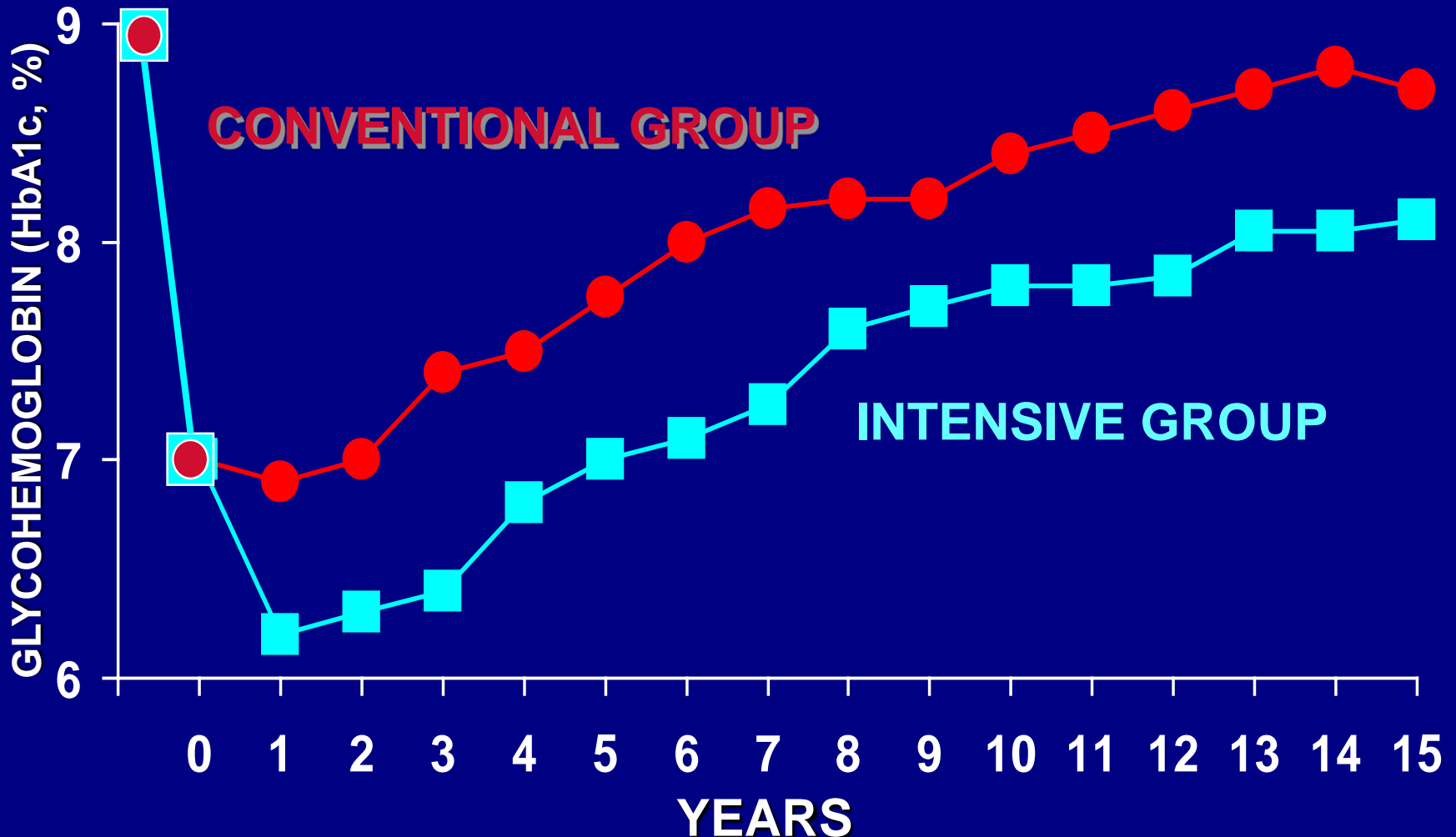


# Is Diabetes Nutrition Therapy Effective?

- Pre-diabetes outcomes
  - Nutrition therapy along with physical activity ↓ risk of type 2 diabetes by 58%; maintained up to 14 yrs
- Diabetes outcomes
  - Nutrition therapy provided by RDs: ave. ↓ in A1C 1% to 2% (ranging from 0.5 to 2.6%) depending on type, duration, and level of control of db
  - LDL-C ↓ by 15-25 mg/dl or by 7-22%
  - SBP and DBP ↓ on average by ~5 mmHg
  - Outcomes known by 6 weeks to 3 months



# United Kingdom Prospective Diabetes Study: A1C (pts newly diagnosed)





# Early ACTID (Early Activity in Diabetes)

- Newly diagnosed type 2 db (n=593) in England, usual care vs intensive nutrition intervention with or without a physical activity program
  - Baseline A1C: 6.7%, 6.6%, 6.7%
  - 6 mo maintained to 12 mo: no improvement in usual care, intervention groups A1C -0.3% ( $p < 0.001$ ), even with use of fewer diabetes drugs
  - Addition of physical activity: no added benefit



# Lifestyle Over and Above Drugs in Diabetes (LOADD) Study

- RCT in 93 pts type 2 db hyperglycemic (A1C>7%) despite optimized drug therapy
- Intensive MNT according to international nutrition management guidelines vs control
  - Ave duration of db: ~9 yrs
  - Intensive MNT—6 sessions with dietitian
  - A1C ↓ 0.4% vs control (P=0.007); comparable to adding new drug to conventional agents; cost-effective



# FIIT (Flexible Intensive Insulin Therapy) Using Insulin-to CHO Ratios

- Dose Adjusted for Normal Eating (DAFNE):
  - A1C ↓ 1% with no increase in severe hypoglycemia and quality of life ↑
  - 44-mo follow-up: continued improvement in A1C and quality of life
  - Concerns of excessive or unhealthy eating not observed; minimal eating changes made and some became more rigid in their eating habits
- Training programs in Germany (3-yr) and Australia (1-yr): improvements in A1C without increasing risk of hypoglycemia

•DAFNE Study Group. *BMJ* 325:746, 2002; Speight. *Diabetes Res Clin Pract* 89:22, 2010; Lawton. *Diabetes Res Clin Pract* 91:87, 2011; Samann. *Diabetologia* 48:1965, 2005; Lowe. *Diabetes Res Clin Pract* 80:439, 2008



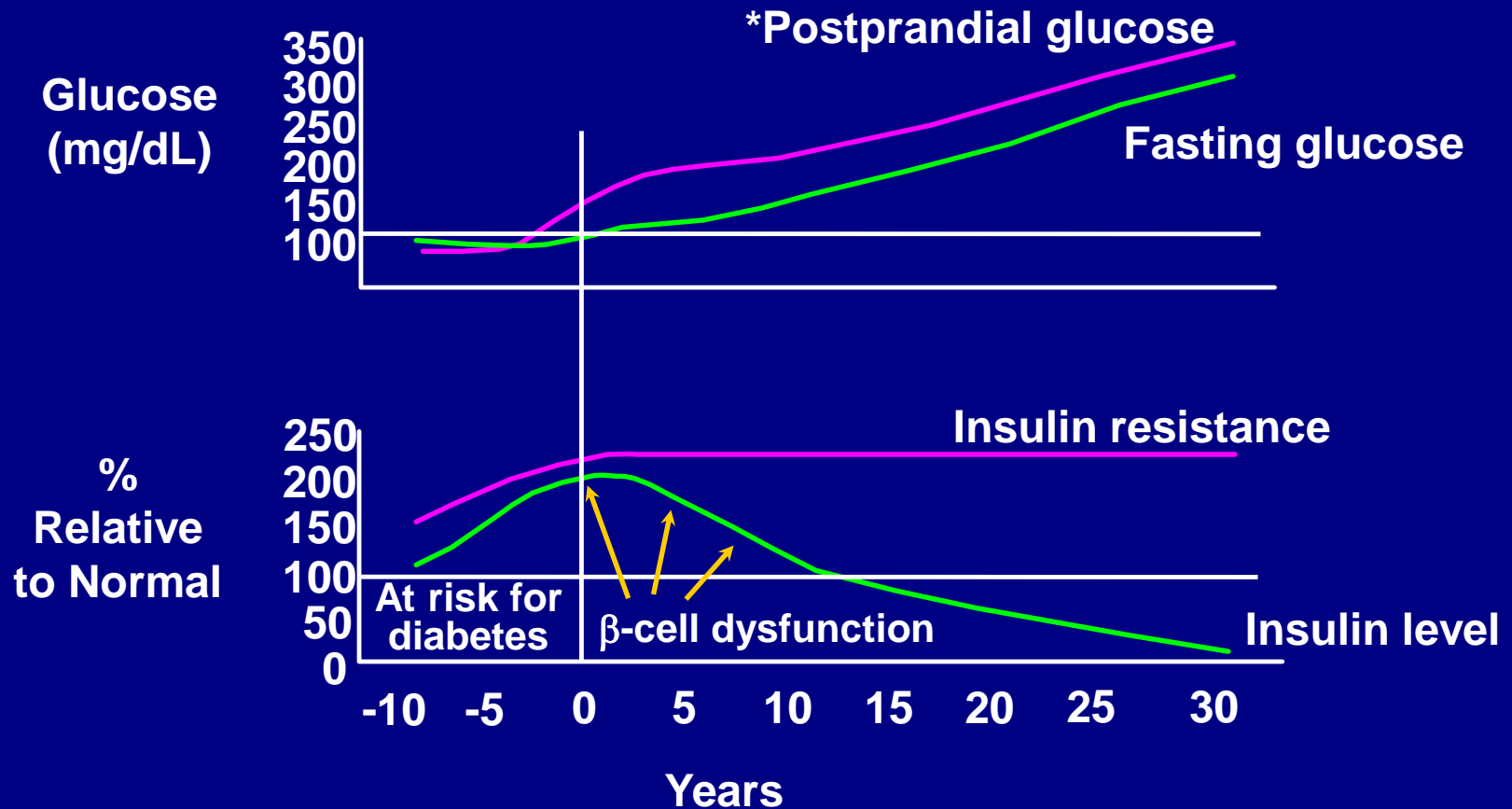
# What Nutrition Therapy Interventions Are Effective?

- A variety of nutrition therapy interventions, such as reduced energy/fat intake, carbohydrate counting, simplified meal plans, healthy food choices, exchange choices, insulin-to-carbohydrate ratios, physical activity, and behavioral strategies
  - Type 2 db: reduced energy intake
  - Type 1 db: matching insulin to CHO intake
- A number of initial individual or group sessions and follow-up encounters were implemented



# Type 2 Diabetes: A Progressive Disease

BG remains normal until insulin deficiency

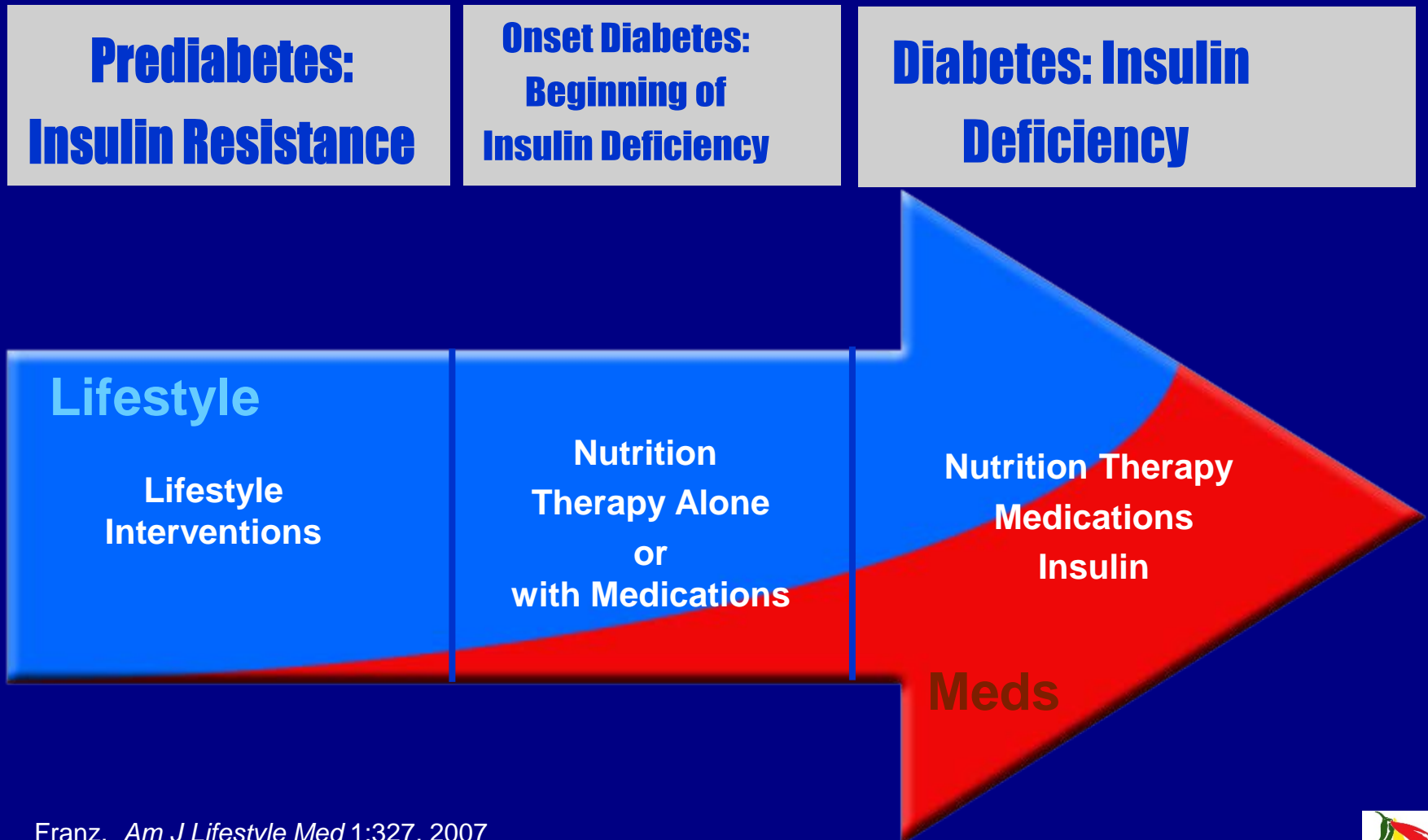


\* Post Prandial = 1-2 h ppg

Bergenstal RM et al. *Management of Type 2 Diabetes in Endocrinology*. 4th Edition; Philadelphia, 2001



# Type 2 Diabetes: A Progressive Disease



# The Dilemma of Weight Loss in Diabetes

- “Diet” doesn’t fail—the beta cells of the pancreas fail
- Insulin resistance
  - Modest amounts of weight loss (and physical activity) can prevent or delay type 2 diabetes
  - Weight loss may improve risk factors
- Insulin deficiency
  - Focus is on nutrition strategies for normalization of blood glucose levels, lipids and blood pressure
  - Results on glucose will be known by 6 weeks to 3 months



# What is Known About Weight Management?

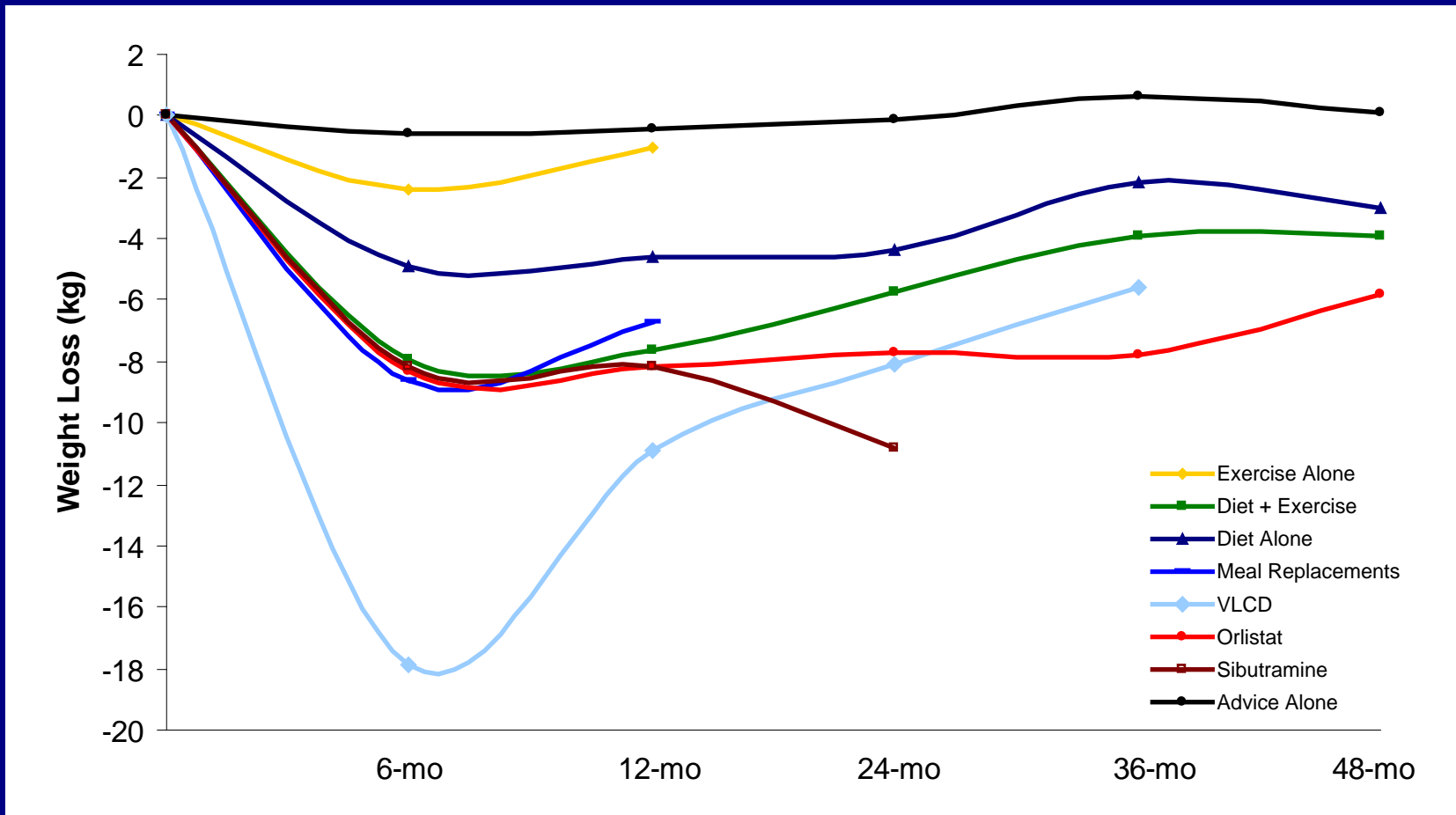
- At ~6 months individuals can lose 5% to 10% of their starting weight
- Regardless of the intervention, plateaus and regain of weight loss are expected; compensatory mechanisms protect against weight loss
- If treatment is discontinued, weight gain occurs
- With support, modest weight loss can be maintained





# Average Weight Loss Per Subject Completing a Minimum 1-Yr Intervention

80 studies; 26,455 subjects; 18,199 completers (69%)



# Why Weight Loss Is Difficult?

- Genetics - ~50% of variance genetics and 50% environment
- Weight tightly regulated by neural, hormonal, and metabolic factors
  - Hormonal adaptations (↓ leptin, peptide YY, cholecystokinin, insulin, and ↑ ghrelin, gastric inhibitory polypeptide, pancreatic polypeptide) that encourage weight gain after diet-induced weight loss remain 1-yr after initial weight reduction
  - Weight loss results in adaptive thermogenesis (↓ resting metabolic rate) up to 1-yr



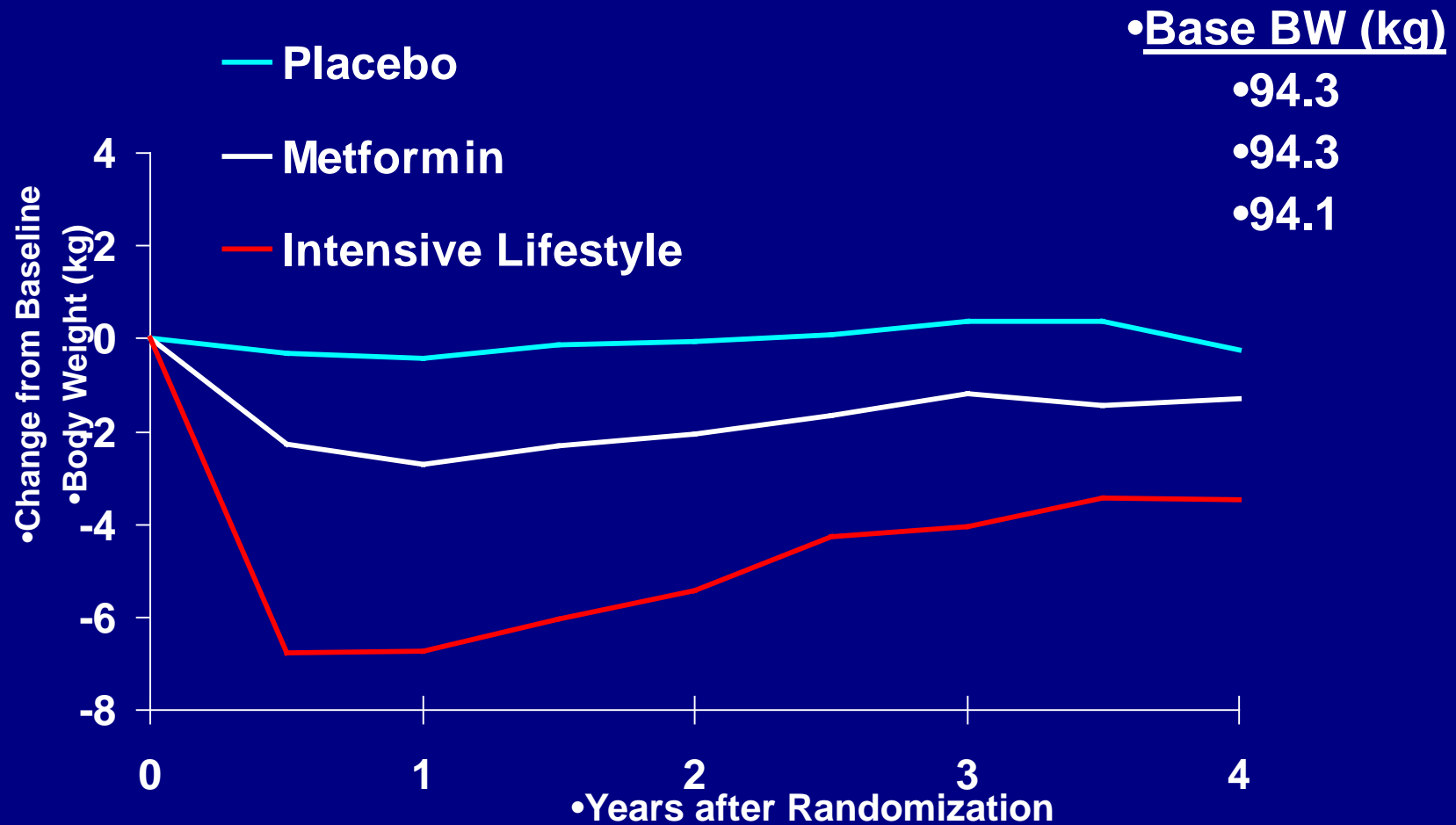
# What Are The Benefits From Modest Weight Loss (~5% of Initial Weight)?

- Prevention or delay of type 2 diabetes
- Decreases in systolic and diastolic blood pressure in dose-dependent fashion
- Decreases in circulating inflammatory markers (C-reactive protein and cytokines)
- Potential improvement in triglyceride levels, total and LDL cholesterol

Klein et al. Circulation 110:2952-2967, 2004



# Change in Body Weight and Prevention/Delay of Type 2 Diabetes



# Comparison of Weight-Loss Diets with Different Percentages of Fat, Protein, and Carbohydrates

- 811 adults (80% completers) randomized to 15% vs 25% protein, 20% vs 40% fat, 35% vs 65% CHO diets
  - At 6 mo subjects in each diet group lost an ave of 6 kg (7%) and began to regain weight after 12 mo
  - At 2-y, all completers lost an ave of 4 kg
  - Satiety, hunger, satisfaction with diet, and attendance at group sessions similar for diets
  - All diet improved lipid-related risks, fasting insulin levels, and ↓ BP 1-2 mm Hg



# Conclusions from Comparison of Weight Loss Diets

- Calories count—not macronutrients!!
- Multiple encounters are needed (59 group and 13 individual counseling sessions offered)
  - Attendance at group sessions predicted weight loss at 2-y
  - Attendance at 2/3 of the sessions = 9 kg weight loss
- “Any type of weight loss diet taught with enthusiasm and persistence can be effective.”
- “Thus, even these highly motivated, intelligent participants who were coached by expert professionals could not achieve the weight losses needed to reverse the obesity epidemic.”



# What Have We Learned About Weight Loss?

- Health care professionals do not prescribe drugs not proven to be efficacious, yet they write and recommend diet books not proven to be effective
- It's reduced energy intake and continued support that's important not macronutrients
- Weight loss diets are not likely to reverse the obesity epidemic, but—
- Modest weight loss/maintenance and increased physical activity have important health benefits!!



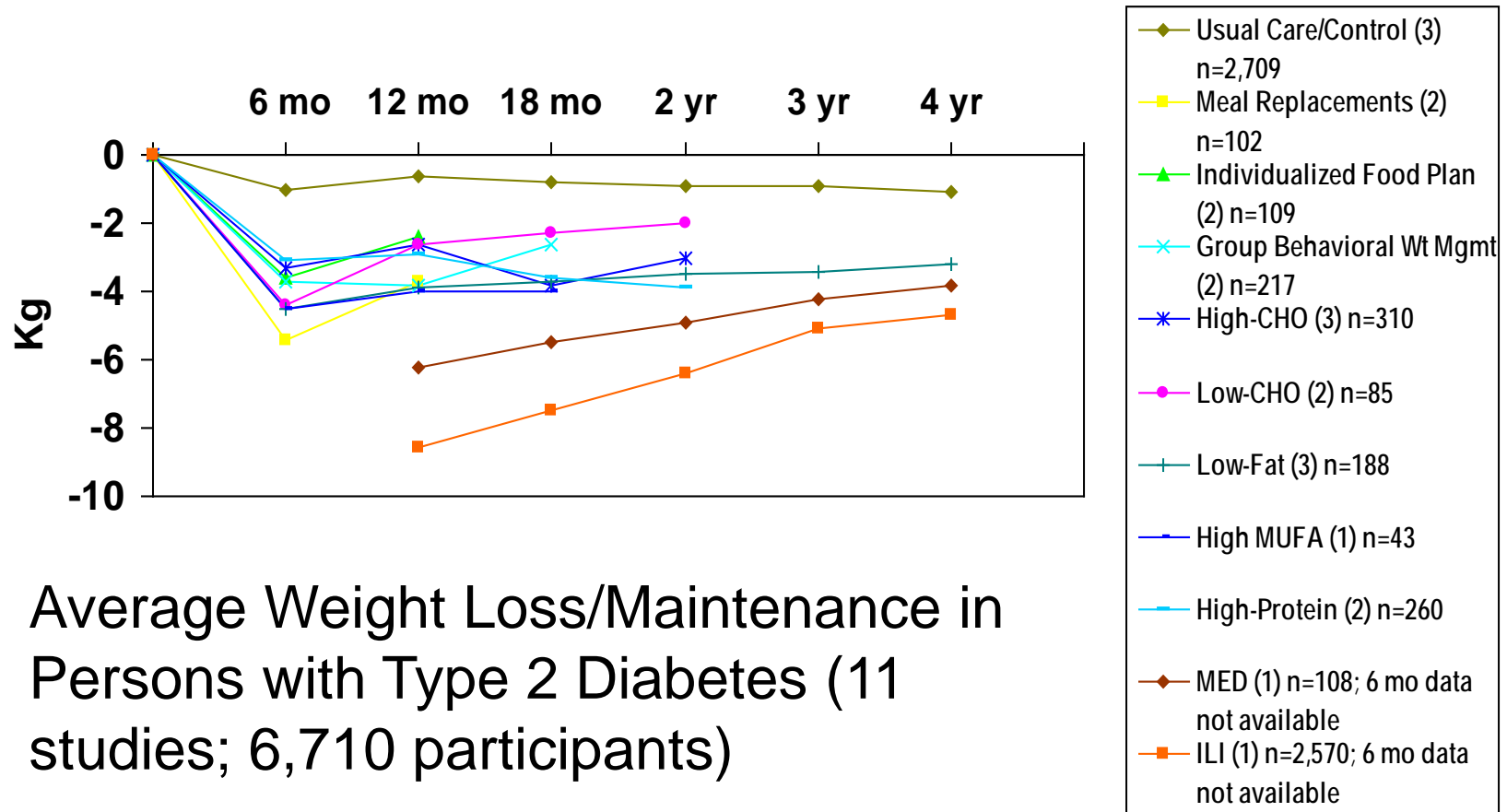
# Weight Loss Intervention Studies in Type 2 Db

- Systematic Review: 1-yr study duration; 70% completion rate; 2000 to 2013
- 11 studies (5 >1-yr): 8 compared weight loss interventions (WLI) and 3 compared WLI to usual care or control (19 WLI groups)
- Weight, A1C, lipid, and BP effectiveness
- Weight losses 1.9-8.4 kg at 1-yr
  - 17 interventions -1.9 to 4.8 kg
  - Mediterranean-style -6.2 kg; ILI -8.4 kg
  - Low carbohydrate -1.9 kg





# Weight Change Outcomes



## Systematic Review cont.

- 8 WLI improved A1C at 1-yr
  - Meal replacements, behavioral at 12 mo but not at 18 mo; high CHO, high protein, low-fat, MED, ILI
  - 3 with PA: MED ↓ 1.2%; ILI ↓ 0.6%; low-fat ↓ 0.6%
- 11 WLI reported NS changes in A1C at 1-yr
  - Individualized food plan; soy-meal replacement; high-MUFA; high-CHO; low-fat; high-protein
- Majority NS changes in lipids (10 ↑ HDL0)
- 7 WLI improved BP; 7 NS changes in BP



## Systematic Review cont.

- 5 studies compared macronutrients (all reported similar weight changes)
  - High MUFA vs high CHO (-4.0 vs -3.8 kg)
  - Low CHO vs low fat (2) (-3.1 vs -3.1 kg; -1.9 vs -3.9 kg)
  - High protein vs high CHO (2) (-3.2 vs 2.4 kg; 2.2 vs 2.2 kg)
- 8 WLI reported NS changes in A1C from baseline at 1-yr; 2 (1 high-protein, 1 high-CHO) reported improvement (-.2%)

•Brehm et al. *Db Care*. 2009;32:215; Davis et al. *Db Care* 2009;32:1147; Larsen et al. *Diabetologia* 2011;54:731; Krebs et al. *Diabetologia* 2012;55:905; Guldbrand et al. *Diabetologia*. 55:2118, 2012



# Intensive Lifestyle Intervention (ILI) in Look AHEAD Trial: 1-y and 4-y Results

- Objective: Can long-term weight reduction reduce CVD morbidity and mortality in persons with type 2 db? Trial stopped early in September 2012
- 5,145 subjects, 16 centers, RCT; ILI vs db education; planned to extend for ~11.5 y
  - Weight loss at 1-y: 8.6% (ILI) vs 0.7%
  - Weight loss at 4-y: 6.1% (ILI) vs 0.9%
  - A1C at 1-y: ↓ from 7.3 to 6.6% (ILI) vs 7.3 to 7.2%
  - A1C at 4-y: 7.0% (ILI) vs 7.2%
- Seen 3-4/mo yr 1; seen or contacted 2/mo yrs 2-4; meal replacements



# Look AHEAD Trial Summary

- Trial stopped in Sept. 2012 by NIH after 9.6 yrs:
  - “ILI did no harm but was not on a trajectory that would result in greater decreases in CV events relative to control”
  - Wt loss at study end: 6.0% vs. 3.5%
  - Greater ↓ in A1C (7.3% vs. 7.4%) and greater improvements in fitness and CV risk factors (except LDL)
- “An ILI focusing on weight loss did not reduce the rate of CV events in overweight or obese adults with T2DM.”

•The Look AHEAD Research Group. N Engl J Med. 2013;369:145



# Summary of WLI in Diabetes

- The ILI and MED (both included PA and pts in MED were newly diagnosed) WLI reported improvements in A1C, lipids, and BP
- All other WLI interventions reported minimal, if any, beneficial effects on A1C, lipids, and BP
- A weight loss of >6 kg (7-8.5%), regular physical activity, and frequent contact with RDs appears necessary for consistent beneficial effects
- How to achieve this weight loss in clinical practice remains unknown



# Why doesn't weight loss always lead to improved glycemia?

- Usual weight loss therapies do not lead to adequate weight loss

OR

- Persons are primarily insulin deficient—need medications to be combined with nutrition therapy

- OR

- Energy restriction leads to improved glycemia, not weight loss per se



# Carbohydrate

- There is no most effective mix of carbohydrate, protein, and fat that applies broadly; macronutrient proportions should be individualized and adjusted to meet metabolic goals and individual preferences of the person with diabetes.
- Monitoring carbohydrate, whether by carbohydrate counting, choices, or experience-based estimation, remains a key strategy in achieving glycemic control.

•Evert AB. *Diabetes Care* 2013;36:3821-3842

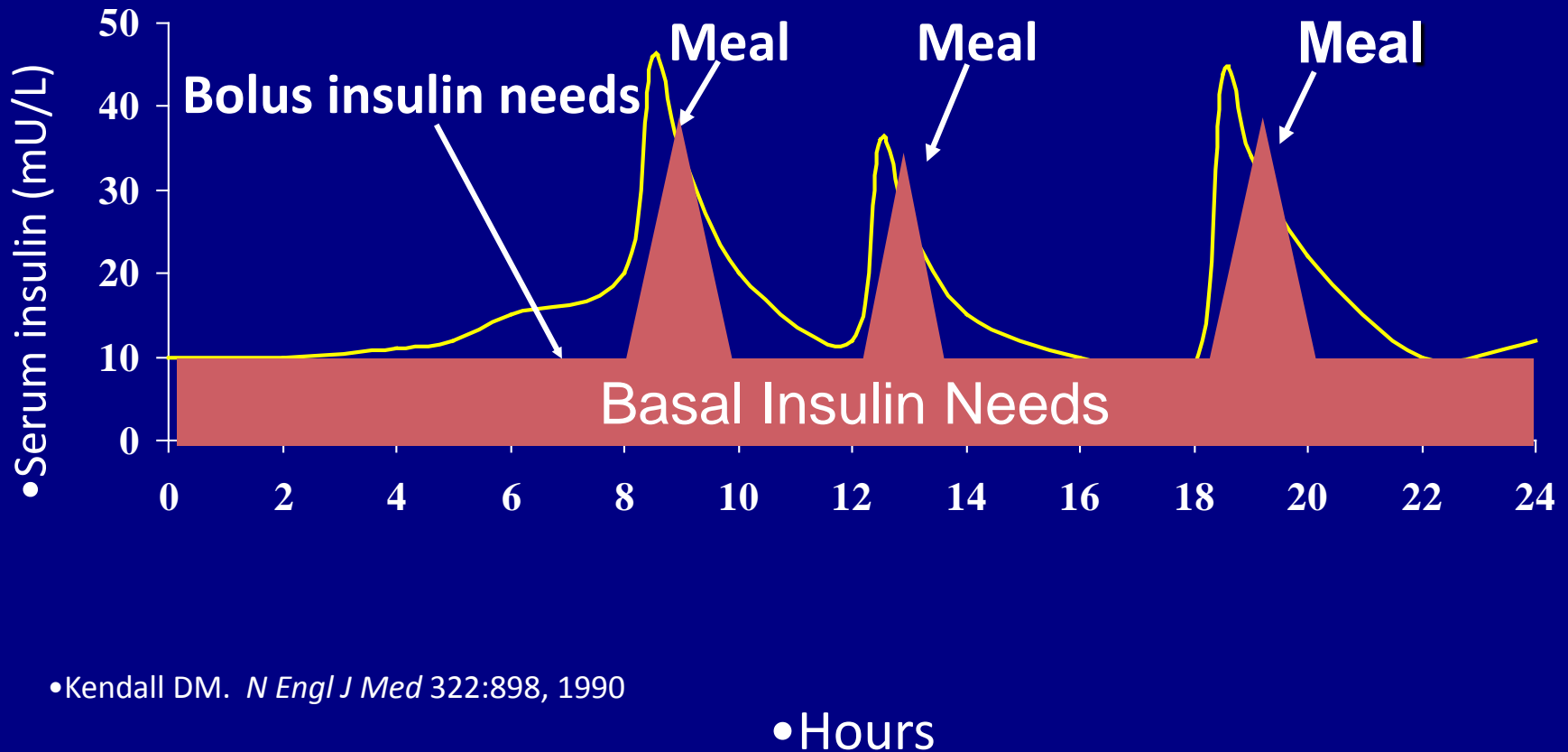




# Macronutrients and Insulin

Effect	Carbohydrates	Protein	Fat
Transport	Activates the transport system of glucose into muscle and adipose cells	Lowers blood amino acids in parallel with blood glucose levels	Activates lipoprotein lipase, facilitating transport of triglycerides into adipose tissue
Anabolic (promotes storage)	Facilitates conversion of glucose to glycogen for storage in liver and muscle	Stimulates protein synthesis	Facilitates conversion of pyruvate to free fatty acids, stimulating lipogenesis
Anticatabolic (prevents breakdown)	Decreases breakdown and release of glucose from glycogen in the liver	Inhibits protein degradation, diminishes gluconeogenesis	Inhibits lipolysis, prevents excessive production of ketones and ketoacidosis

# Normal Insulin Secretion



# Insulin by Injection or Pump

- Bolus or mealtime insulin dose covers need of carbohydrate for insulin (~1/2 of total insulin dose)
- Basal or background insulin dose covers need for protein and fat for insulin and other insulin needs (~1/2 of total insulin dose)



# Adjusting Premeal insulin Based on Carbohydrate Amounts

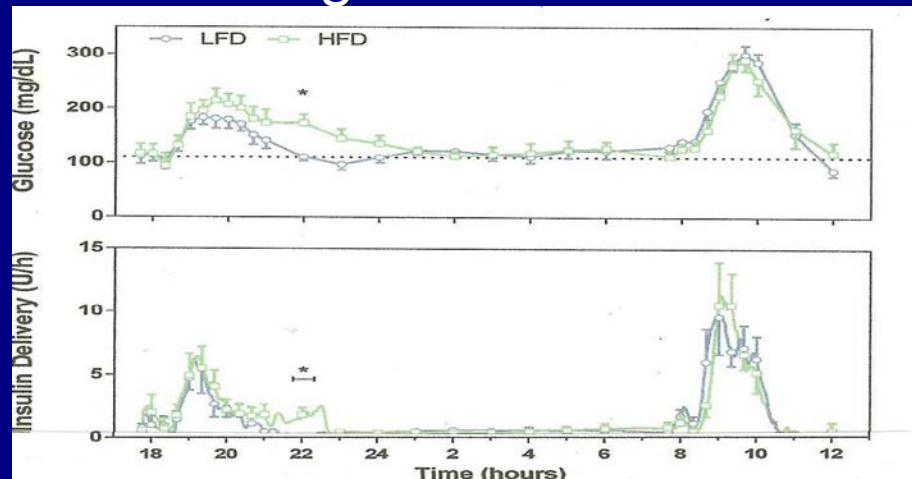
- High- (55%) and low- (40%) carbohydrate diets were compared in intensively treated persons (protein and fat similar)
- Amount of carbohydrate in the meal does not effect acute glycemic control, if premeal insulin is adjusted appropriately
- Premeal insulin algorithms are valid; variations in carbohydrate do not modify basal insulin
  - 1.5 U/10 g CHO at breakfast
  - 1 U/10 g CHO at lunch and dinner
- Variations in meal glycemic index, fiber, or caloric intake do not influence premeal insulin

Rabasa-Lhoret et al. *Diabetes Care*. 1999;22:667



# Dietary Fat: Glucose Response and Insulin Requirements in Type 1 Diabetes

- 50 g fat added to dinner (HF) with 10 g fat and identical CHO and protein amounts using a closed-loop system (CGM and a physiologic insulin delivery algorithm)
  - HF meal needed more insulin (12.6 vs 9.0 units)
  - Despite added insulin glucose AUC higher and higher insulin levels 5 to 10 hr after the meal
  - No effect on breakfast glucose and insulin

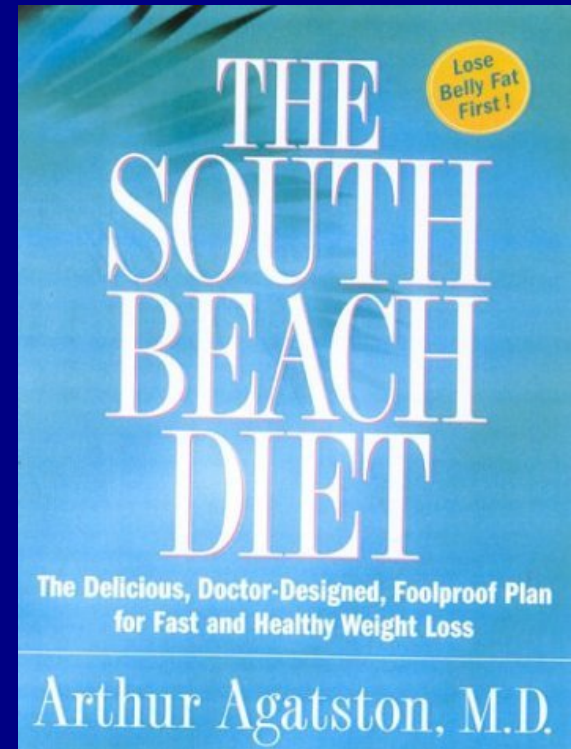


- Wolpert et al. Diabetes
- Care 36:810, 2013



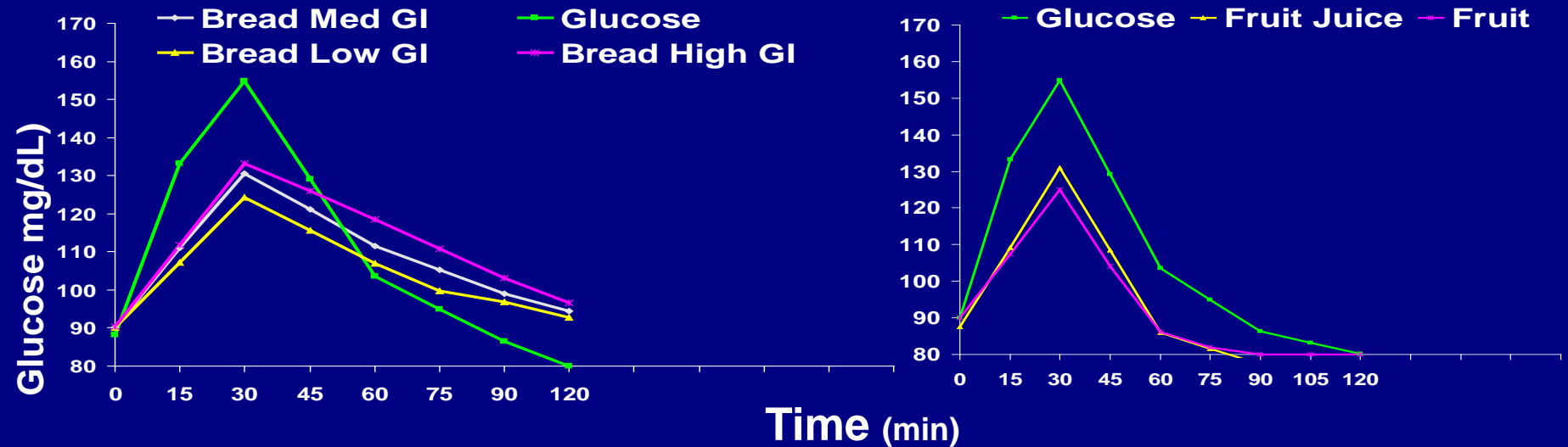
# How Important is the Glycemic Index of Food?

- Diet books define GI as measure of how rapidly a food raises blood glucose after eating
- Claims made by diet books:
  - *“Foods that are broken down and absorbed into the blood stream quickly require a lot of insulin...”*
  - *High levels of insulin cause blood glucose to drop so low that it triggers new cravings for food.”*
- No evidence given for these claims
- *This is NOT the correct definition of the GI*



# Glycemic Index: The GI Does Not Measure How Rapidly BG Increases!

The GI is the relative area under the postprandial glucose curve (AUC) comparing 50 g of digestible carbohydrate from a test food to 50 g of glucose



“No statistical difference in the glucose response curve from different foods...Low GI foods do not produce a slower rise in BG nor do they produce an extended, sustained glucose response.”



# ADA Macronutrient Review: GI and Carbohydrate Summary

- In general, there is little difference in glycemic control and CVD risk factors between low GI and high GI or other diets. Slight improvement in glycemia from lower GI diets confounded by higher fiber intake.
- Majority of individuals with diabetes have a moderate intake of carbohydrate (~45% of kcal); difficult to eat a high (or low) CHO diet
- Negotiate with patients; advise healthful CHO choices in appropriate amounts and portion sizes

•Wheeler et al. *Diabetes Care* 2012;35:434





# Is Fiber Beneficial?

- Diets containing 44 to 50 g fiber daily have been shown to have beneficial effects on glycemia; more usual amounts (up to 24 g/d) have not
- It is not known if such high levels of fiber intake can be maintained long term
- Diets high in total and soluble fiber can reduce total cholesterol by 2-3% and LDL-C up to 7%
- Recommendations for fiber for people with diabetes are the same as for the general public

Lafrance L et al. *Diabetes Med* 1998;15:972; Giacco R et al. *Diabetes Care* 2000;23:1461; Hollenbeck CB et al. *Am J Clin Nutr* 1986;43:16; Chandalia M et al. *N Engl J Med* 2000;342:1392; Brown L et al. *Am J Clin Nutr* 69:30, 1999; American Diabetes Association. *Diabetes Care*. 2009;32(Suppl 1):S23; American Dietetic Association. [www.adaevidencelibrary.com/topic.cfm?format\\_tables=0&cat=3252](http://www.adaevidencelibrary.com/topic.cfm?format_tables=0&cat=3252)

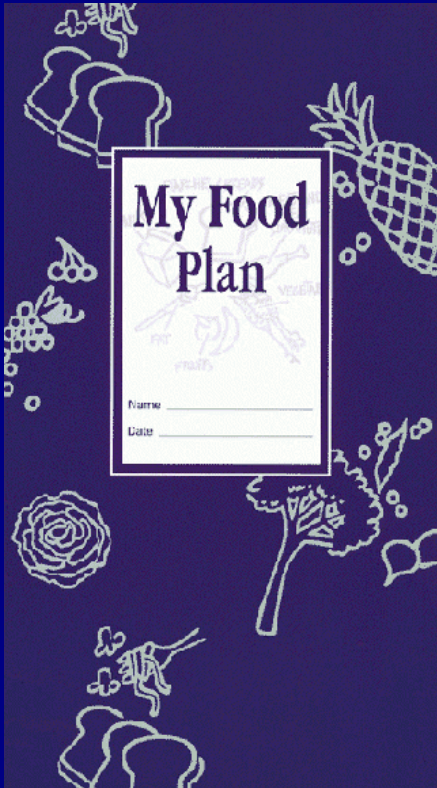


# Focus on Carbohydrate

- Carbohydrate Counting useful for all persons with diabetes
- Emphasizes total amount of carbohydrate not the source
- Based on 3 food groups:
  - Carbohydrate
  - Protein (meat and meat substitutes)
  - Fat



# Carbohydrate Counting



- Sources of carbohydrate are starches, fruits, milk, and desserts
- One carbohydrate serving = 15 grams of carbohydrate
- Most fresh vegetables are “free foods”



# Carbohydrate Counting Recommendations

- Start with 3 to 4 servings per meal for women, 4 to 5 for men; 1 to 2 for a snack
- Emphasize day-to-day consistency
- Test post-meal; goal blood glucose <160-180 mg/dL



# Carbohydrate: What's Important?

- Foods containing carbohydrate from fruits, vegetables, whole grains, legumes, and low-fat milk are important sources of vitamins and minerals and provide glucose for the brain
- No ideal percentage of macronutrients, total energy more important than CHO amount
- Monitoring total intake of carbohydrate is key strategy for achieving glycemic control
- Negotiate with patients; advise healthful CHO choices in appropriate amounts and portion sizes

Evert AB. *Diabetes Care* 2013;36:3821; Wheeler et al. *Diabetes Care* 35:434-445, 2012;  
•AmDietAssoc. [www.adaevidencelibrary.com/topic.cfm?=3252](http://www.adaevidencelibrary.com/topic.cfm?=3252)



# Protein and Diabetes

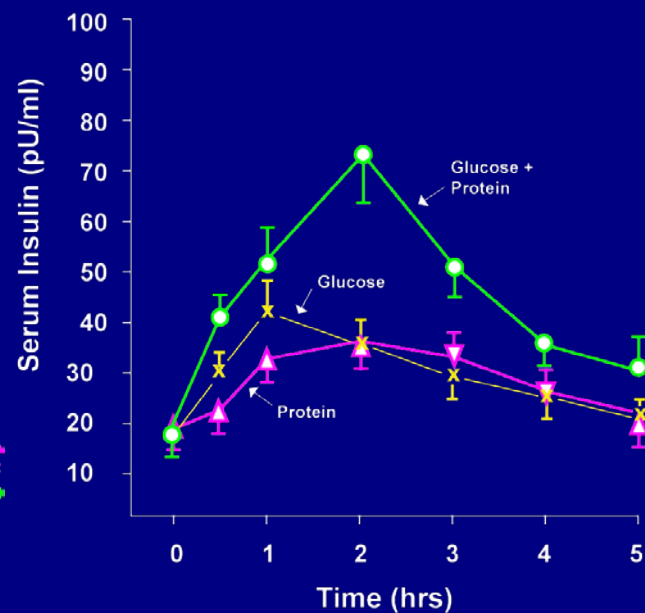
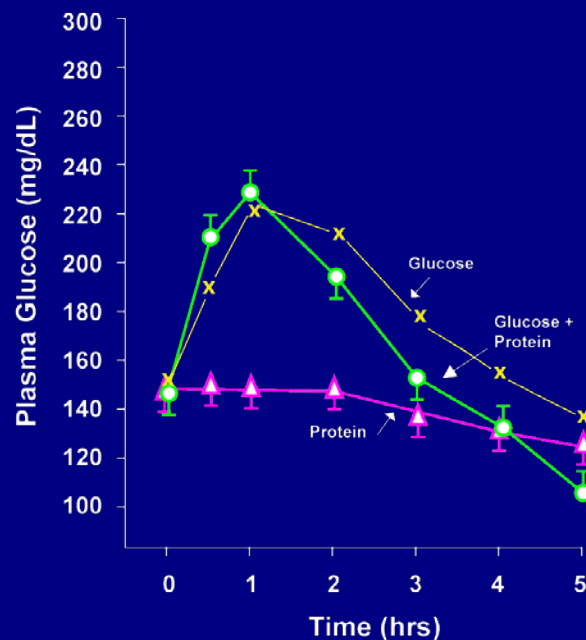
- In persons with type 2 diabetes, ingested protein does not increase plasma glucose levels but does increase insulin response
  - Therefore, protein should not be used to treat hypoglycemia or to prevent hypoglycemia
- In persons with normal renal function, usual protein intake (15-20%) does not need to be changed
- In persons with DKD (either micro- or macroalbuminuria), reducing the amount of protein is not recommended as this does not alter the course of the GFR decline



# Glucose and Insulin Response to 50 g Glucose, 50 g Protein, or Combination in Type 2 Diabetes

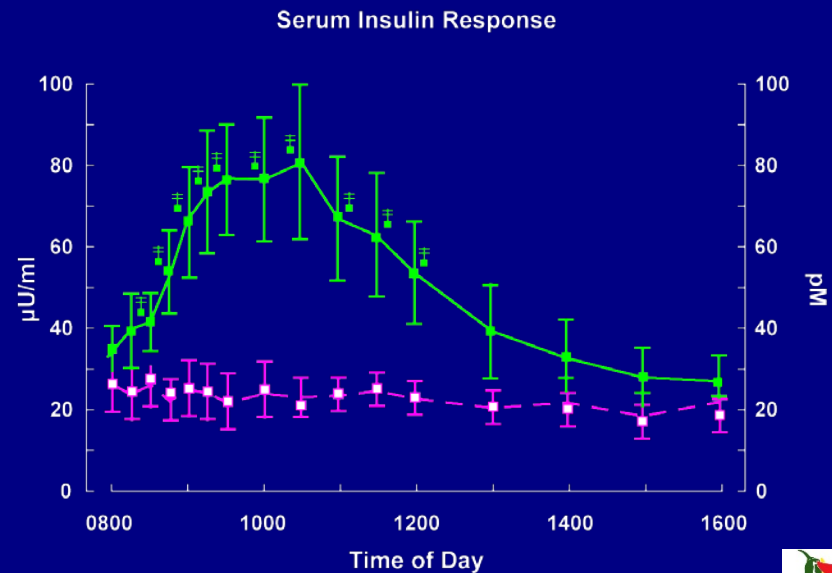
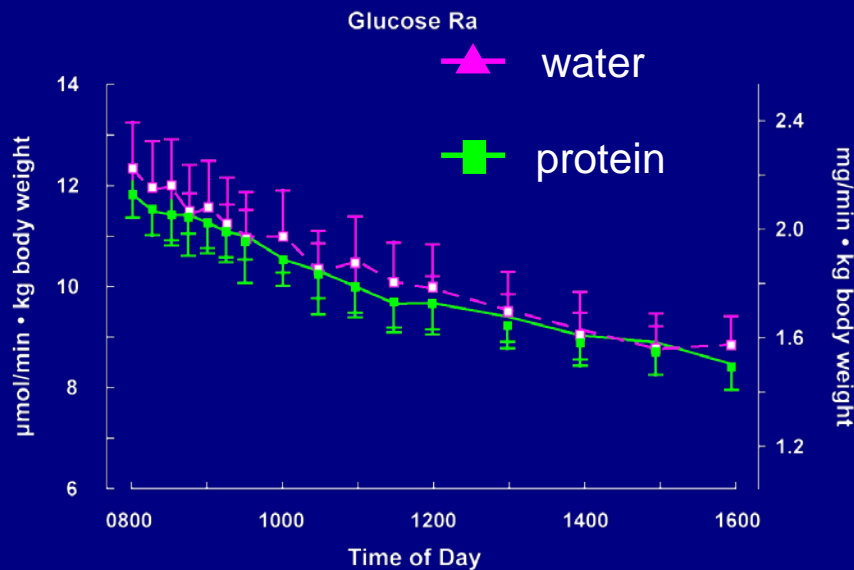
- Glucose response stable with protein alone
- Glucose peak response the same when protein given with glucose
- Insulin response double when protein combined with glucose

- ▲ 50 g protein
- 50 g glucose
- combined



# Glucose Appearance and Insulin Response to 50 g Protein or Water in Type 2 Diabetes

- 50 g protein (very lean beef) or water at 8 am and followed for 8 hrs
- Protein deaminated, ~20-23 g (changed into glucose in the liver)
- Amount of glucose appearing in circulation, >2 g
- Protein ingestion increased insulin levels



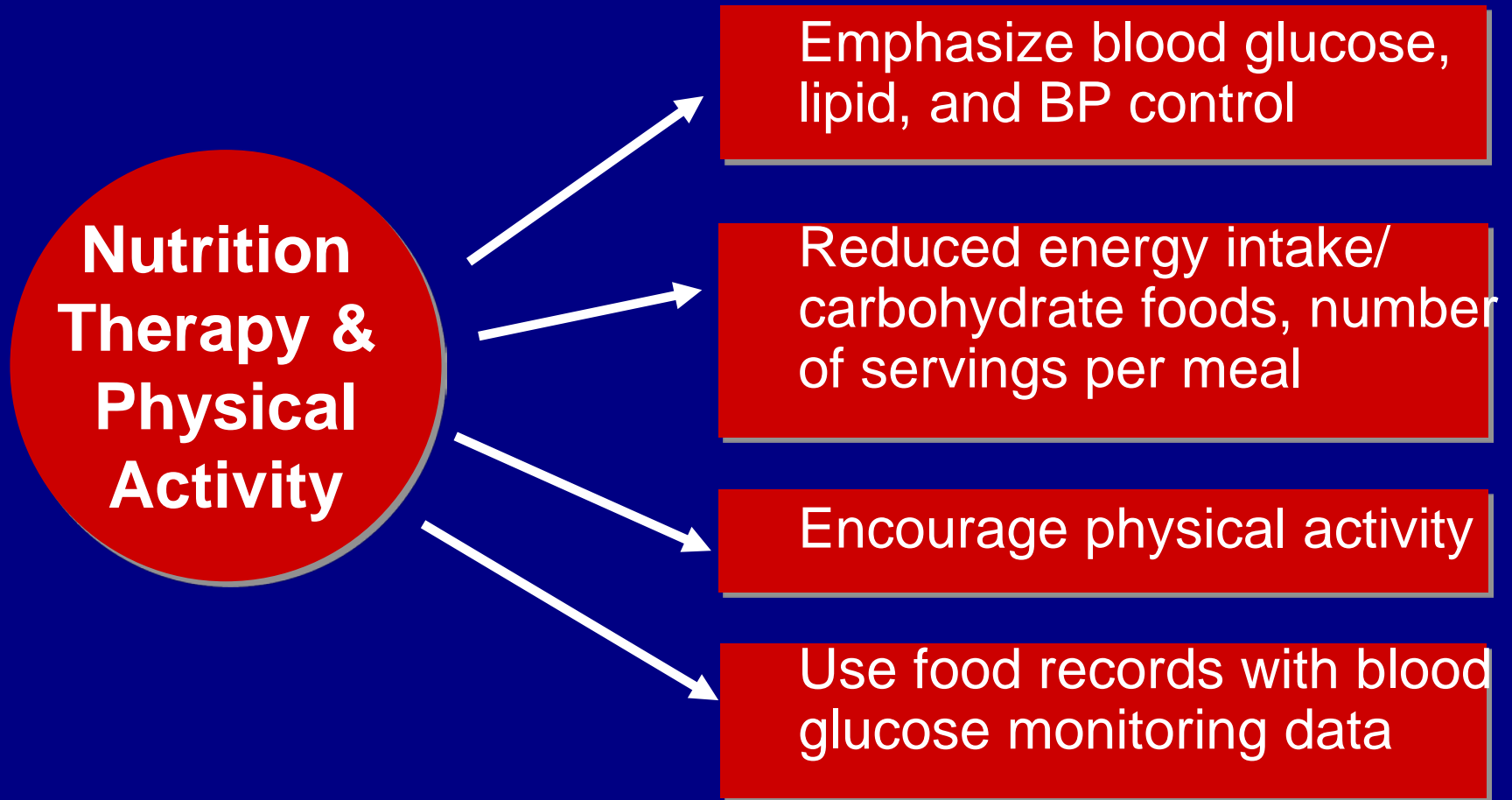


# Dietary Fats and Diabetes

- In animal and observational studies, higher intakes of total dietary fat, regardless of the fat type, produce greater insulin resistance
- In clinical trials saturated and *trans* fats shown to cause insulin resistance, whereas mono- and polyunsaturated and omega-3 fatty acids do not have an adverse effect
- High fat meals interfere with indexes of insulin signaling which results in a transient increase in insulin resistance



# Prioritizing Nutrition Messages



What's the best nutrition therapy intervention for diabetes?



# In An “Ideal” World

- People with type 2 diabetes:
  - Lose 5% to 10% of baseline weight
  - Eat a nutrient dense eating pattern in appropriate portion sizes
  - Participate in 150 min/wk of regular physical activity
- People with type 1 diabetes:
  - Count carbohydrates
  - Adjust insulin based on insulin-to-CHO ratios
  - Use correction factors



# In the “Real” World

- Facilitate behavior changes that individuals are willing and able to make based on proven lifestyle interventions
- A variety of nutrition therapy interventions can be implemented
- But lifestyle interventions for diabetes are effective!



## Key References

1. Evert AB, Boucher JL, Cypress M, et al. Nutrition therapy for the management of adults with diabetes. *Diabetes Care* 2013;36:3821-3842.
2. Pastors JG, Franz MJ. Effectiveness of medical nutrition therapy for diabetes. In: Franz MJ, Evert AB, eds. *American Diabetes Association Guide to Nutrition Therapy for Diabetes*. Alexandria, VA: American Diabetes Association; 2012:1-18.
3. Franz MJ, VanVormer JJ, Crain AI, et al. Weight loss outcomes: a systematic review and meta-analysis of weight-loss clinical trials with a minimum of 1-year duration. *J Am Diet Assoc* 2007;107:1755-1767.
4. Franz MJ. The obesity paradox and diabetes. *Diabetes Spectrum* 2013;26:145-151
5. Wheeler ML, Dunbar SA, Jaacks LM et al. Macronutrients, food groups and eating patterns in the management of diabetes: a systematic review of the literature. 2010. *Diabetes Care* 2012;35:434-334
6. Franz MJ, Powers MA, Leontos C, et al. The evidence for medical nutrition therapy for type 1 and type 2 diabetes in adults. *J Am Diet Assoc* 2010;110:1852-1889.



**Questions?**



# Lifestyle Approaches to the Prevention and Treatment of Diabetes

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## Based on this webinar, learners should be able to:

- ▶ List expected outcomes from diabetes nutrition therapy and when to evaluate outcomes
- ▶ Discuss the role of weight loss therapy across the continuum of diabetes
- ▶ List goals and evidence-based nutrition therapy priorities for type 1 and type 2 diabetes
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Wahida Karmally, DrPH, RD, CDE, CLS, FNLA

Associate Research Scientist

Lecturer in Dentistry

Director of Nutrition Irving Institute for Clinical and Translational Research

Columbia University

**Date: January 16, 2014**

2-3 pm EST/1-2 pm CST

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## Lifestyle Approaches to the Prevention and Treatment of Diabetes

Thank you!

