Joanne Slavin, PhD, RD, Disclosures

<table>
<thead>
<tr>
<th>AFFILIATION/FINANCIAL INTERESTS (past 12 months)</th>
<th>CORPORATE ORGANIZATION</th>
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<tr>
<td>Grants/Research Support</td>
<td>Mushroom Council, Nestle, DSM, USDA, ILSI, PepsiCo</td>
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<tr>
<td>Scientific Advisory Board/Consultant</td>
<td>Kerry, Atkins, Tate and Lyle, Midwest Dairy Association</td>
</tr>
<tr>
<td>Stock Shareholder</td>
<td>1/3 interest in Slavin Sisters Farm, 119 acres, Walworth, WI</td>
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Learning Objectives

After completing this continuing education course, nutrition professionals should be able to:

1. Discuss the latest science behind carbohydrate recommendations.
2. Understand the key guidance relating to carbohydrates in the DGAs.
3. Identify regulations that have been implemented relating to carbohydrates in foods.
4. Communicate to patients evidence-based recommendations for consuming carbohydrates.
Outline

• The science behind carbohydrate recommendations
• Dietary guidance for carbohydrates
  – 2015 DGAs
• Regulations for carbohydrates
  – Added sugars on Nutrition Facts panel
  – Changes in fiber
• Communicating carbohydrates

From the Science to Me

Carbohydrates in the Diet

• Vegetables, fruits, grains, legumes, and milk are main food sources of carbohydrates
• Grains and certain vegetables (potatoes, corn) high in starch (glucose) – except sweet potatoes (sucrose)
• Fruits and green vegetables contain little starch – fruits mostly sugar
  – Apples and pears high in fructose (66%), most other fruits 50/50 glucose/fructose (sucrose); milk 50/50 glucose/galactose
• Sugar can be isolated from sugar beets, sugar cane or manufactured from starch (corn sugar)
Differences in Carbohydrates

- Chemical structure – mono, di, polysaccharide
  - Mono: few in food supply; fructose in apples and pears
  - Di: sucrose (glucose, fructose) and lactose (glucose, galactose)
  - Poly: starch
- Digestible vs. non-digestible
- Speed of digestion and absorption – Glycemic index
- Physical structure – in solution, part of a food, associated substances (protein), part of a seed or grain, particle size

US Carbohydrate Label

- Total carbohydrate – measured by difference
- Lists sugar – total – although movement to list added sugar
- List dietary fiber – soluble and insoluble
- No information on glycemic index, resistant starch, sugar alcohols, whole grain – unless provided by manufacturer

Dietary Reference Intakes (DRIs) for CHO

- RDA of 130 grams of carbohydrate per day
- 45%–65% of calories should come from carbohydrate
- Acceptable Macronutrient Distribution Range (AMDR)
- Carbohydrates are the fill after protein needs are met – high-calorie diets should be high in carbohydrate (sports nutrition)
- Added sugar – 25% or less of calories – based on nutrient dilution, not link to negative health status
Calcium Intake in Children 4-8 Y as a Function of Added Sugar Intake

Intrinsic vs. Extrinsic Sugars

- Intrinsic sugar – sugars that are naturally occurring within a food
- Extrinsic sugars – those added to food AKA “added sugar”
- No difference in the molecular structure of sugar molecules, whether they are naturally occurring in the food or added to the food
- No analytical method to differentiate between added sugar and intrinsic sugar

Added Sugar

- Measurement of “added sugar” in studies is inconsistent making study comparisons difficult – easier to count SSBs
- Added sugar not different than other extra calories in the diet for energy intake and body weight
- Added sugar reduction – based on calorie reduction, not association of added sugar and health outcomes
The Dietary Guidelines for Americans: The Cornerstone of US Nutrition Policy & Regulation

The Purpose of the Dietary Guidelines for Americans

• “Designed for professionals to help all individuals ages 2 years and older ... consume a healthy, adequate diet.”

• "Develop food, nutrition and health policies and programs."

The Science Behind the Guidelines

Dietary Guidelines Advisory Committee considers:

- Original systematic scientific reviews
- Existing systematic reviews, meta-analyses and scientific reports
- Dietary data analyses
- Food pattern modeling analyses

Issues technical report with nutrition and health recommendations

DHHS/USDA uses technical report and comments to develop updated Dietary Guidelines

* Scientific rationale based on various research methods:
Evidence Analysis Methodology

- Rigorous
- Minimizes bias
- Transparent
- Accessible to stakeholders and consumers

Defines state of the science
Foundation for updates

Answers precise questions • Illuminates research gaps

Hierarchy of Evidence

Stronger Evidence

- RCT
- Double Blinded Intervention study
- Prospective, cohort study
- Clinical trial
- Cross-sectional study
- Case Report
- Expert Opinion

Weaker Evidence

Grade Strength of Evidence

- Quality
  - Scientific rigor and validity
  - Consider study design and execution
- Quantity
  - Number of studies/sample sizes
- Consistency of findings across studies
- Impact
  - Importance of studied outcomes/magnitude of effect
  - Magnitude of effect
- Generalizability

Grades: 1. STRONG; 2. MODERATE; 3. LIMITED
2015-2020 DGA: A Snapshot

Provides 5 Overarching Guidelines:
1. Follow a healthy eating pattern across the lifespan.
2. Focus on variety, nutrient density, and amount.
3. Limit calories from added sugars and saturated fats and reduce sodium intake.
4. Shift to healthier food and beverage choices.
5. Support healthy eating patterns for all.

A healthy pattern includes:
- A variety of vegetables
- Fruits, especially whole fruits
- Grains, at least half of which are WG
- Fat-free /low-fat dairy, including milk & yogurt
- A variety of protein foods
- Oils

A healthy pattern limits:
- Sat fat: <10% of calories/day
- Trans fat: keep as low as possible
- Added sugars: <10% of calories/day
- Sodium: < 2,300 mg of sodium/day

Shift from Individual Foods and Ingredients to Healthy Eating Patterns!

A Healthy Pattern Includes: Vegetables & Fruits

- What’s the recommendation?
  - 2½ cups vegetables; 2 cups fruits daily
  - Intakes remain significantly below recommended amounts
    - Vegetables: 87% have intakes below goal
    - Fruits: 75% have intakes below goal

- What’s changed since 2010?
  - Similar to 2010 recommendations:
    - Vegetables: A variety of vegetables from all subgroups – dark green, red and orange, legume, starchy and other
    - Fruit: especially whole fruit

A Healthy Pattern Includes: Grains

- What’s the recommendation?
  - At least half of grain intake should be whole grain
  - Continued imbalance of intake between refined grain and whole grain
  - Enriched/fortified grain recognized as important source of folate and
    - Recommendation for most adults: 6 ounce equivalents of Grain foods per day
      - At least 3 should be whole grain

- What’s changed since 2010?
  - Similar to 2010 recommendations:
    - At least half of grain intake should be whole grain
    - Differences from 2010 recommendations:
      - 16g whole grain = 1 whole grain ounce-equivalent
        - Progression from 2010!
      - Acknowledgement that whole grains vary in fiber content

- What’s the scientific basis?
  - Systematic Reviews, Modeling
A Healthy Pattern Includes: Dairy

- What’s the recommendation?
  - 3 cups for ages 9+
    - Choose fat-free or low-fat dairy, including milk, yogurt, cheese and/or fortified soy beverages
    - Almost everyone falls short!

- What’s changed since 2010?
  - Similar to 2010 recommendations:
    - 2 cups for ages 2-3 years, 2.5 cups for ages 4-8 years, 3 cups for ages 9+
    - Choose fat-free or low-fat dairy foods
    - Choose fat-free and low-fat dairy options with little to no added sugars
    - Choose milk and yogurt over cheese to reduce saturated fat and sodium

- What’s the scientific basis?
  - Systematic Reviews, Modeling

A Healthy Pattern Limits: Added Sugars

- What’s the recommendation?
  - Less than 10% calories per day from added sugar
    - Current intakes average >13% of calories, ~270 calories/day
    - Nutrient-dense foods with added sugars OK within limits (e.g. fat-free yogurt and whole grain breakfast cereals)

- What’s changed since 2010?
  - Similar to 2010 recommendations:
    - Reduce added sugar consumption
    - Differences from 2010 recommendations:
      - First-time quantitative number

- What’s the scientific basis?
  - World Health Organization Systematic Review, Modeling
  - Acknowledgement that evidence is still developing

Fiber Agreement

- Marker of a healthy diet
  - whole grains, fruits, vegetables, legumes

- Concept
  - carbohydrates and lignin that escape digestion in the upper GI tract but may be fermented in the gut

- Requirement in the diet
  - according to 2002 Dietary Reference Intakes (DRIs)

- Regulated
  - On the Nutrition Facts panel – 25 g Daily Value (DV)

- Health claims
  - oat bran, barley bran, and psyllium and CVD in US
**Dietary Fiber**

Dietary fiber – carbohydrates and lignin that are intrinsic and intact in plants

- Found in grains, vegetables, legumes, fruit
- Accepted physiological effects include laxation, attenuation of blood glucose, normalization of serum cholesterol
- Measured by challenging chemical methods

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**Functional Fiber**

Functional fiber – isolated or purified carbohydrates not digested and absorbed that confer beneficial physiological effects

- Laxation (wheat bran, psyllium)
- Normalization of blood lipid levels (oat bran, barley bran, psyllium)
- Attenuation of blood glucose (guar gum, psyllium)
- Other effects
  - Weight management – satiety, lower fat absorption, weight loss
  - Blood pressure control
  - Gut environment – microflora, fermentation, transit time

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**What Are the Health Benefits of Dietary Fiber?**

A moderate body of evidence suggests that dietary fiber from whole foods protects against cardiovascular disease, obesity, and type 2 diabetes and is essential for optimal digestive health.
Relative Risk of Death From CHD

<table>
<thead>
<tr>
<th>Total Energy-Adjusted Dietary Fiber Intake (g/d)</th>
<th>Relative Risk</th>
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<tbody>
<tr>
<td>&lt;12</td>
<td>1.0 ± 0.2</td>
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<tr>
<td>12 - 15</td>
<td>1.0 ± 0.2</td>
</tr>
<tr>
<td>15 - 18</td>
<td>1.2 ± 0.4</td>
</tr>
<tr>
<td>18 - 21</td>
<td>1.4 ± 0.6</td>
</tr>
<tr>
<td>21 - 24</td>
<td>1.6 ± 0.8</td>
</tr>
<tr>
<td>24 - 27</td>
<td>1.8 ± 1.0</td>
</tr>
<tr>
<td>&gt;27</td>
<td>2.0 ± 1.2</td>
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Pereira et al, Arch Intern Med, 2004

Can the Chemical Structure of Fiber Predict Physiological Effects?

- Original concept that solubility predicts physiological effects no longer accepted
- Viscosity – may predict some digestive effects, but inconsistent – and viscosity where?
- Fermentation – important, but difficult to study in vivo and does not predict physiological effects
- Physical structure – in solution, part of a food, associated substances (protein), part of a seed or grain, particle size

Prebiotic: a substance that is selectively utilized by host microorganisms conferring a health benefit

Gibson and Shepherd, Aliment Pharmacol Ther, 2005
**FODMAP – Acronym that stands for**

*Fermentable Oligo-, Di-, and Monosaccharides, And Polyols (FODMAP)*

Term coined in 2005 by Australian researchers who theorize that foods containing these carbohydrates worsen symptoms of digestive disorders: Irritable Bowel Syndrome (IBS) and Inflammatory Bowel Disease (IBD)

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**FODMAPs**

- Concerns with the FODMAP concept
  - Recommendations based on clinical observations; few research trials
  - Efficacy of FODMAP concept not documented
  - Grouping of all FODMAPs together, although perhaps easier for the patient, ignores physiological differences among FODMAPs
  - No regulatory guidance or official databases for FODMAP content
  - Low FODMAP diet is low fiber diet

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**Summary of Tolerance Data**

*(Grabitske & Slavin, 2009)*

- Dietary fiber – up to 80 g/d in vegetarians – no UL
- Resistant starch – 80 g
- Fructo-oligosaccharides – 10-15 g – diarrhea at 40 g
- FODMAP – fermentable oligo, di and mono-saccharides and polyols
  - Most of published studies from Australia – interest with low gluten and IBS patients
Proposed FDA Definition for Dietary Fiber

1. Non-digestible soluble and insoluble carbohydrates (with 3 or more monomeric units) and lignin that are intrinsic and intact in plants
2. Isolated and synthetic non-digestible carbohydrates (with 3 or more monomeric units) that FDA has granted be included in the definition of dietary fiber, in response to a petition submitted to FDA – process not determined
3. Isolated and synthetic non-digestible carbohydrates (with 3 or more monomeric units) that are the subject of an authorized health claim

Other Proposed Changes for Fiber

- Current regulations are 4 kcal/g for soluble and 0 kcal/g for insoluble fiber
- Proposed is 2 kcal/g for soluble and 0 kcal/g for insoluble fiber
- Proposed to increase DRV for fiber from 25 g to 28 g for 2000 kcal diet
- Soluble and insoluble fiber will continue to be voluntary on label
Dietary Fiber Intake is Low

- Typical fiber intake in US is 15 grams per day
- 95% of Americans don’t get recommended intake of fiber – nutrient of concern in Dietary Guidelines for Americans
- Most fiber-containing foods – 1 – 3 g of fiber
  - Apple – 2 grams
  - Lettuce – 1 gram
  - WW bread – 2 grams
  - Oatmeal – 3 grams
- Refined grains and white potatoes important fiber sources in the US diet because they are widely consumed
- Interest in the addition of functional fibers to the food supply to increase fiber intake

Food Advice: Evolution of USDA’s Food Guidance – Moderation & Variety

MyPlate.gov (6/2/11)
Conclusions

• Evidence-based reviews are limited in our ability to define “healthy foods”
• Healthy carbohydrates include foods rich in fiber and starch – whole grains, vegetables, and legumes
• Healthy carbohydrates also include foods rich in fiber and sugar – fruits, dairy products
• Expect to see a 10% DV for added sugars in 2019. The 2015 DGAC is the scientific support for such a recommendation.
• Nutrition Facts panel revision includes DV for added sugars (10%) and new rules for dietary fiber labeling including a new DV for total fiber (28 grams per day)

Questions?

Credit Claiming

You must complete a brief evaluation of the program in order to obtain your certificate. The evaluation will be available for 1 year; you do not have to complete it today.

Credit Claiming Instructions:
2. Click “Take Course” on the webinar description page.
3. Select “Start/Resume” Course to complete and submit the evaluation.
4. Download and print your certificate.

Please Note: If you access the Evaluation between 3-4 pm ET on 12/12, you may experience a slow connection due to a high volume of users.