American Society of Sugar Beet Technologists
Biennial Meeting
March 5, 2011

Dietary Sugars and Diet Quality

Charles Baker
Executive Vice President & Chief Science Officer
Sugar Association
Background
Why is it necessary to eat less Meat and less Wheat Bread?

The United States Food Administration asks you to eat less meat and less wheat bread. The food situation is serious, and the United States must be able to feed its army and Navy overseas. Therefore, we must reduce our consumption of meat and bread to help the Allies win the war.

What the food situation is

The world is facing a serious food shortage. The United States, France, Italy, and Belgium are fighting for survival. The food situation is critical, and the United States must help other countries by reducing its consumption of meat and bread.

Why it is necessary to eat less meat

Meat is a valuable source of protein, but it requires a lot of feed and labor to produce. By eating less meat, we can help the Allies win the war by reducing our consumption of feed and labor.

Why it is necessary to eat less wheat bread

Wheat bread is an important source of energy, but it requires a lot of water and labor to produce. By eating less wheat bread, we can help the Allies win the war by reducing our consumption of water and labor.

How you can help

- Eat less meat
- Eat less wheat bread
- Use less sugar

Eat plenty, wisely, without waste, and help win the war.
Mindset of empowerment
GLOBAL STRATEGY ON DIET, PHYSICAL ACTIVITY AND HEALTH

In May 2004, the 57th World Health Assembly (WHA) endorsed the World Health Organization (WHO) Global Strategy on Diet, Physical Activity and Health. The Strategy was developed through a wide-ranging series of consultations with all concerned stakeholders in response to a request from Member States at World Health Assembly 2002 (Resolution WHA55.23).

The Strategy, together with the Resolution by which it was endorsed (WHA57.17), are contained in this document.
Previous Guidelines

The Dietary Guidelines for Americans are the cornerstone of Federal nutrition policy and nutrition education activities. Since 1980, the Guidelines have been jointly issued and updated every 5 years by the Departments of Agriculture (USDA) and Health and Human Services (HHS).

The 2010 Dietary Guidelines are the current guidance; for information on the previous six editions, click on the links below.

2005  2000  1995

1990  1980

Last Modified: February 09, 2011 10:15 AM
Nutrient Displacement Model
Nutrient Displacement Hypothesis


To the Secretary of Health and Human Services and the Secretary of Agriculture
Nutrient Displacement Hypothesis

Vitamins & Minerals
Sugar
Sugar
Calcium
Nutrient Displacement Hypothesis

Sugar
Calcium
Nutrient Displacement Hypothesis

Sugar

Calcium
Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids

Unlike vitamins and minerals, which sometimes perform unique functions to meet the body's needs, fats, carbohydrates, and proteins substitute for one another to some degree in meeting the body's energy needs. In a recent report released by the Food and Nutrition Board of the National Academies, acceptable ranges of intake for each of these energy sources are set, based on evidence that consumption above or below these ranges may be associated with nutrient inadequacy and increased risk of developing chronic diseases, including coronary heart disease, obesity, diabetes, and/or cancer. For example, studies have shown a connection between low-fat, and therefore, high-carbohydrate diets and decreased high-density lipoprotein cholesterol in the bloodstream, a physiological indicator associated with increased risk of coronary heart disease. Conversely, diets too high in fat may result in increased caloric intake, and therefore lead to obesity and its complications.

The report, titled Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids, is the sixth in a series providing Dietary Reference Intakes (DRIs) developed jointly by American and Canadian scientists, and focuses on carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids, collectively known as the macronutrients, as well as energy and physical activity. The report recommends that to meet the body's daily nutritional needs while minimizing risk for chronic disease, adults should consume 45 to 65 percent of their total calories from carbohydrates, 20 to 35 percent from fat, and 10 to 35 percent from protein. The acceptable ranges for children are similar to those for adults, except that infants and younger children need a somewhat higher proportion of fat in their diets. These ranges may be more useful and flexible for dietary planning than single maximum values recommended in the past.
Nutrient Displacement Hypothesis

Figure 1. Daily Added Sugars and Calcium Intakes
Children 4 to 8 Years of Age


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November 2002
Nutrient Displacement Hypothesis

Figure 1. Daily Added Sugars and Calcium Intakes
Children 4 to 8 Years of Age

Figure 4. Daily Added Sugars and Calcium Intakes
Males 14 to 18 Years of Age

Daily Adequate Intake

Median Intake

Calcium, mg/Day

0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35

0 - 5


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November 2002
Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids

Unlike vitamins and minerals, which sometimes perform unique functions to meet the body's needs, fats, carbohydrates, and proteins substitute for one another to perform similar tasks. The dietary reference intakes (DRIs) developed jointly by American and Canadian scientists and provide guidance for calorie intake based on nutrient adequacy and risk of developing chronic diseases, including heart disease, obesity, diabetes, and/or cancer. For example, studies have shown a connection between low-fat diets and low-carbohydrate diets, and therefore, high-carbohydrate diets and decreased high-density lipoprotein cholesterol in the bloodstream, a physiological indicator associated with increased risk of coronary heart disease. Conversely, diets too high in fat may result in increased caloric intake, and therefore lead to obesity and its complications.

The report, titled Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids, is the sixth in a series providing Dietary Reference Intakes (DRIs) developed jointly by American and Canadian scientists, and focuses on carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids, collectively known as the macronutrients, as well as energy and physical activity. The report recommends that to meet the body's daily nutritional needs while minimizing risk for chronic disease, adults should consume 45 to 65 percent of their total calories from carbohydrates, 20 to 35 percent from fat, and 10 to 35 percent from protein. The acceptable ranges for children are similar to those for adults, except that infants and younger children need a somewhat higher proportion of fat in their diets. These ranges may be more useful and flexible for dietary planning than single maximum values recommended in the past.

September 2002

INSTITUTE OF MEDICINE

Shaping the Future for Health

Dietary Guidelines for Americans 2005

U.S. Department of Health and Human Services
U.S. Department of Agriculture
www.healthierus.gov/dietaryguidelines

THE SUGAR ASSOCIATION
Nutrient Displacement Hypothesis

Total diet – not a single component – determines overall micronutrient intakes

*Published, peer-reviewed evidence*

Dietary Guidelines for Americans 2005

U.S. Department of Health and Human Services
U.S. Department of Agriculture
www.healthierus.gov/dietaryguidelines
Discretionary Calories Model
Discretionary Calories Hypothesis

Daily Added Sugars and Calcium Intakes
Males 19 to 50 Years of Age

Median Intake

Daily Adequate Intake

Maximum
Minimum


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November 2002
Discretionary Calories Hypothesis

Indecipherable Acronym – 2005

Solid Fats + Alcohol + Added Sugars + Sodium

NUTRIENTS TO AVOID
Discretionary Calories Hypothesis

Memorable Acronym – 2010

SoFAS

Solid Fats + Added Sugars

NUTRIENTS TO AVOID
### Discretionary Calories Hypothesis

Table 1. Estimated per capita calories from loss-adjusted food supply

<table>
<thead>
<tr>
<th>Calories</th>
<th>% of Total</th>
<th>% of 1970 – 2005 Calorie Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1970</td>
<td>2005</td>
</tr>
<tr>
<td>Added Fats</td>
<td>411</td>
<td>645</td>
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<tr>
<td>Added Sugars</td>
<td>402</td>
<td>480</td>
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<td>Total</td>
<td>2,172</td>
<td>2,718</td>
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Table 3. Estimated per capita calories from loss-adjusted food supply

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<th>% of 1970 – 2007 Calorie Increase</th>
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<td>2007</td>
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# Discretionary Calories Hypothesis

Table 1. Agricultural Research Service, US Department of Agriculture. What we eat in America, NHANES¹²³⁴

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<tr>
<th>Sex</th>
<th>Age Range, Years</th>
<th>Total Calories</th>
<th>Total Sugars, g</th>
<th>TS + TC</th>
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<th>AS + TC</th>
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<th>Total Sugars, g</th>
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</tbody>
</table>

¹NHANES = National Health and Nutrition Examination Survey; individual datasets available at http://ars.usda.gov/Services/docs.htm?docid=15044 (Reference 2)

²TC = Total Calories; TS = Total Sugars; TS + TC = (Total sugars grams converted to calories and divided by total calories); TS + TC = % of total calories attributable to total sugars

³Added Sugars = Total Sugars * 0.547 (Reference 10)

⁴TC = Total Calories; AS = Added Sugars; AS + TC = (Added sugars grams converted to calories and divided by total calories); AS + TC = % of total calories attributable to added sugars
Discretionary Calories Hypothesis

Daily Added Sugars and Calcium Intakes
Males 19 to 50 Years of Age


The Sugar Association, Inc. ©
November 2002

Published, peer-reviewed evidence
Report of the
Dietary Guidelines
Advisory Committee
on the
Dietary Guidelines for
Americans, 2010
Figure B2.1. What we eat versus recommended limits: Calories from Solid Fats and Added Sugars (SoFAS)
Discretionary Calories Hypothesis

- Significantly reduce intake of foods containing added sugars and solid fats ...
- Americans eat too many calories from foods high in solid fats and added sugars (SoFAS) that offer few or no other nutrients besides calories.
- Americans currently consume 35 percent of their total calories from SoFAS. This is too high. They should reduce intake of calories from SoFAS by 20 to 30 percent. This means that no more than 5 to 15 percent of total calories should be derived from SoFAS.
BALANCING CALORIES TO MANAGE WEIGHT

- Prevent and/or reduce overweight and obesity through improved eating and physical activity behaviors.
- Control total calorie intake to manage body weight. For people who are overweight or obese, this will mean consuming fewer calories from foods and beverages.
- Increase physical activity and reduce time spent in sedentary behaviors.
- Maintain appropriate calorie balance during each stage of life—childhood, adolescence, adulthood, pregnancy, and breastfeeding, and older age.

FOODS AND FOOD COMPONENTS TO REDUCE

- Reduce daily sodium intake to less than 2,300 milligrams (mg) and further reduce intake to 1,500 mg among persons who are 51 and older and those of any age who are African American or have hypertension, diabetes, or chronic kidney disease. The 1,500 mg recommendation applies to about half of the U.S. population, including children, and the majority of adults.
- Consume less than 10 percent of calories from saturated fatty acids by replacing them with monounsaturated and polyunsaturated fatty acids.
- Consume less than 300 mg per day of dietary cholesterol.
- Keep raw fatty acid consumption as low as possible by limiting foods that contain synthetic sources of these fats, such as partially hydrogenated oils, and by limiting other solid fats.
- Reduce the intake of calories from solid fats and added sugars.
- Limit the consumption of foods that contain refined grains, especially refined grains foods that contain solid fats, added sugars, and sodium.
- If alcohol is consumed, it should be consumed in moderation—up to one drink per day for women and two drinks per day for men—and only by adults of legal drinking age.1

1 See Chapter 4, Foods and Food Components to Reduce, for additional recommendations on alcohol consumption and specific population groups. There are many circumstances where people should not drink alcohol.
High – Intensity Sweeteners
Sweet Taste and Caloric Intake

Saccharin leads to overeating and extra weight gain

Sweet Taste and Caloric Intake

Artificial sweeteners stimulate long-term over-eating and extra weight gain

Sweet Taste and Caloric Intake

Artificial sweeteners trigger loss of ability to adjust to extra calories

*Figure: Calories consumed in response to premeal and chow consumption with and without artificial sweeteners.*

Sweet Taste and Caloric Intake

Increased Medical Research

Artificial sweeteners elicit insulin response

Sucralose increases glucose-induced insulin response

Sucralose triggers insulin

Sweet Taste and Caloric Intake

Artificial sweeteners magnify glucose uptake

Sweet Taste and Caloric Intake

**Food intake increases when brain senses no calories tied to sweet taste of artificial sweeteners.**
Sweet Taste and Caloric Intake

Table 2  Incremental AUC data for plasma hormones, glucose and appetite scores measured between 0 and 120 minutes (unless specified) and energy and water intake at the buffet meal

<table>
<thead>
<tr>
<th></th>
<th>W</th>
<th>WS</th>
<th>S</th>
<th>MD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin (0–10 min)</td>
<td>171 ± 60</td>
<td>235 ± 83</td>
<td>70 ± 25</td>
<td>68 ± 24</td>
</tr>
<tr>
<td>GLP-1 (0–10 min)</td>
<td>882 ± 113</td>
<td>948 ± 171</td>
<td>922 ± 132</td>
<td>658 ± 78</td>
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<tr>
<td>Glucose (nmol/min/l)</td>
<td>33.5 ± 6.9</td>
<td>51 ± 12.5</td>
<td>25.3 ± 20.4</td>
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<td>Insulin (pmol/l)</td>
<td>287 ± 331c</td>
<td>-471 ± 132c</td>
<td>-459 ± 352c</td>
<td>5669 ± 519</td>
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<tr>
<td>GLP-1 (pmol/l)</td>
<td>-675 ± 1610</td>
<td>-248 ± 784</td>
<td>-359 ± 401</td>
<td>415 ± 610</td>
</tr>
<tr>
<td>PYY (pmol/l)</td>
<td>-179 ± 119</td>
<td>-128 ± 119</td>
<td>-56 ± 192</td>
<td>283 ± 185</td>
</tr>
<tr>
<td>Hunger (mm/kg)</td>
<td>1724 ± 322</td>
<td>1641 ± 336</td>
<td>1993 ± 199</td>
<td>2017 ± 472</td>
</tr>
<tr>
<td>Desire to eat (mm/kg)</td>
<td>1376 ± 216</td>
<td>1128 ± 275</td>
<td>1330 ± 458</td>
<td>1441 ± 461</td>
</tr>
<tr>
<td>Prospective food consumption (mm/kg)</td>
<td>1318 ± 305</td>
<td>1623 ± 266</td>
<td>2062 ± 247</td>
<td>1070 ± 441</td>
</tr>
<tr>
<td>Energy intake (kcal)</td>
<td>2355 ± 227</td>
<td>2417 ± 222</td>
<td>2597 ± 277</td>
<td>2460 ± 167</td>
</tr>
<tr>
<td>Water intake (ml)</td>
<td>267.0 ± 69.0</td>
<td>250.7 ± 45.1</td>
<td>291.8 ± 49.8</td>
<td>303.0 ± 49.8</td>
</tr>
</tbody>
</table>

Artificial sweeteners trigger loss of ability to adjust to extra calories

Sweet Taste and Caloric Intake

Artificial Sweeteners Biologically Active

Two-Fold Increase in Diabetes
Thank you