



Research DIGEST

*Published quarterly
by the President's Council
on Fitness, Sports & Nutrition
Rockville, MD*

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Combining the U.S. Dietary Guidelines and Physical Activity Guidelines to Achieve a Healthy Lifestyle

Abstract

The 2010 U.S. Dietary Guidelines for Americans represent the translational recommendations derived from the 2010 U.S. Dietary Guidelines Advisory Committee report. This reflects the work of a panel of 13 experts in various aspects of nutrition that included one member who also served on the 2008 Physical Activity Guidelines for Americans committee. Together they reviewed the literature and, with the guidance of the Nutrition Evidence Library, systematically evaluated, ranked, and classified these results to produce the most timely, evidence-based, and practical recommendations possible. First published in 1980, the *Dietary Guidelines for Americans* are updated and published every five years, pending the panel's decision that the new evidence published since the last set of guidelines warrants a thorough review. The goals of the Dietary Guidelines include defining a healthy diet, providing options for how to achieve it, promoting healthy choices, and generally increasing public

awareness of the importance of good nutrition. The Dietary Guidelines provide the foundation for the federal nutrition programs to assure a unified message for establishing policy that can be applied by educators, health professionals, and policy makers. When taken together, the Dietary and Physical Activity Guidelines can help provide the best lifestyle approach to balancing dietary energy intake and physical activity energy expenditure for purposes of controlling body weight. Understanding calorie balance is key to this process. The 2010 Dietary Guidelines emphasized the importance of preventing obesity, starting in childhood and also among pregnant women. By combining and applying these principles, all individuals



"The 2010 U.S. Dietary Guidelines offer evidence-based recommendations for healthy eating with a strong focus on the importance of weight control and energy balance across all ages. Combined with the Physical Activity Guidelines, these two reports offer a wealth of science aimed at improving the health of the nation, but practical application is key to their success. This paper intends to offer some insights on how best to achieve just that."

across diverse age, gender, and ethnic groups should be able to practice and model healthy lifestyles for themselves and their families. The purpose of this paper is to combine and help translate these guidelines into practical approaches aimed at advancing healthy lifestyles and improving public health outcomes.

What Are the U.S. Dietary Guidelines?

Beginning in 1980, the *Dietary Guidelines for Americans* have provided science-based recommendations for reducing risk of chronic diseases by promoting health through optimal dietary intake and regular physical activity. These Dietary Guidelines are typically focused on the healthy public over the age of two years, but the 2010 U.S. Dietary Guidelines Advisory Committee's (DGAC) review of evidence overwhelmingly recognized that the majority of the American public is overweight or obese, including young children. There is an urgent need to halt and reverse this obesity epidemic; thus, the DGAC report was written from this perspective. Also, evidence increasingly documents an association between nutrition and health beginning in utero, thereby justifying the importance of achieving energy balance throughout the lifecycle, including in pregnant women, children, and older individuals. The DGAC recommendations were written within that context.

The Dietary Guidelines are updated every five years, based upon the existence of new research and compelling evidence that merits review and consideration. Compared to the 2005 dietary guidelines, the 2010 Dietary Guidelines Advisory Committee determined an abundance of new data had been published in the interim between reports, raising many new questions and requiring new consideration. The 2010 DGAC committed 20 months to this process, resulting in a report submitted to the secretaries of the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS). The report targeted recommendations that were considered essential to halting and reversing the obesity problem by implementing evidence-based, prevention-oriented strategies and approaches. Population groups of particular concern included children, pregnant and lactating women, and older adults. The data show that currently, children consume too many energy-dense, nutrient-poor calories and that the incidence of chronic diseases such as type 2 diabetes (T2D) have increased significantly over time [1]. Up to 50 percent of new cases of T2D occur in youth, and primary prevention of obesity could effectively address this problem. Likewise, the majority of women are overweight or obese at the time of conception and gain more than the recommended amount of weight during gestation [2]. Furthermore, maternal diet quality influences the nutrient composition of breast milk and this, too, can result in increased risk of adiposity of the offspring [3]. Also, the population aged 65 years and older is expected to double over the next 20 years, thereby increasing the number of adults with chronic conditions



such as T2D, cardiovascular disease (CVD), hypertension (HTN), arthritis, and cancers that are all adversely affected by overweight and obesity [4].

The U.S. Dietary Guidelines underlie federal nutrition education, research, and outreach programs and constitute the basis for nutrition assistance programs such as SNAP (formerly Food Stamps) and the National School Lunch and School Breakfast programs. The Dietary Guidelines work in tandem with other national programs, such as the inaugural 2008 *Physical Activity Guidelines for Americans* released by HHS.

The purpose of this report is threefold:

- To summarize the evidence contributing to the U.S. Dietary Guidelines, specifically related to the chapter on energy balance
- To identify especially relevant aspects of the Dietary Guidelines that intertwine with and evolve from the 2008 Physical Activity Guidelines Advisory Committee (PAGAC) *Report on Physical Activity* [5]
- To provide practical considerations regarding effective strategies and approaches, including the common theme of calorie balance, that can have synergistic benefits on public health [5]

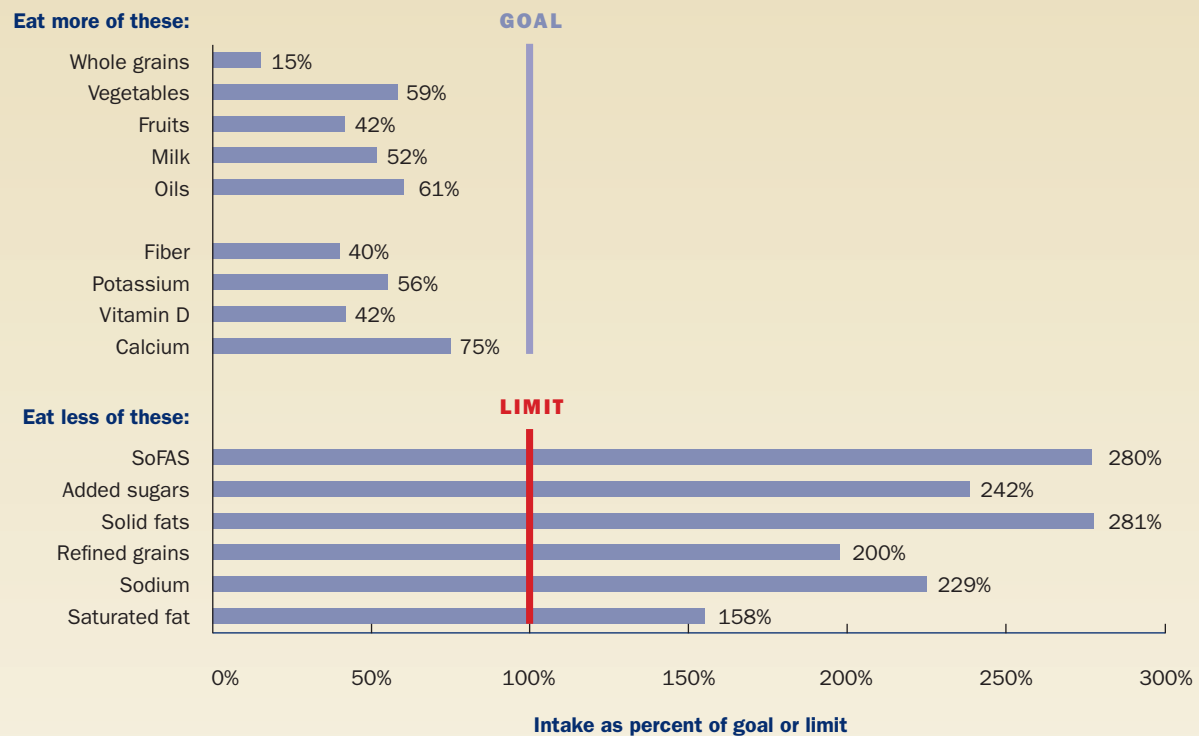
Finally, some areas for future research and gaps in the literature are summarized.

What Do the 2010 U.S. Dietary Guidelines Recommend?

Advances in science and data analyses have fostered new breakthroughs in documenting and identifying key dietary factors that will enhance overall nutrient composition. The 2010 U.S. DGAC advocated a nutrient-dense total diet approach that would meet nutrient needs without exceeding energy needs.

Emphasis was on foods, portion size, and whole meal patterns, rather than a more traditional nutrient-specific approach. In Figure 1, dietary intakes are shown in comparison to recommended intake levels or limits. [6]

Figure 1.
Dietary Intakes in Comparison to Recommended Intake Levels or Limits



Note: Bars show average intakes for all individuals (ages 1 or 2 years or older) as a percent of the recommended intake level or limit. Recommended intakes for food groups and limits for refined grains, SoFAS, solid fats, and added sugars are based on the USDA 2000-calorie food patterns. Recommended intakes for fiber, potassium, vitamin D, and calcium are based on the highest AI for ages 14 to 70 years. Limits for sodium are based on the AI and for saturated fat on 7 percent of calories.

Adapted from U.S. Dietary Guidelines Advisory Committee Report. Data source: What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES) 2001–2004 or 2005–2006.

The intakes of whole grains, vegetables, fruits, milk/dairy, and unsaturated fatty acids fall far short of the recommended intakes and this translates into inadequate intake of dietary fiber, potassium, vitamin D, and dietary calcium. These foods and nutrients are essential in preventing chronic diseases such as T2D, CVD, and osteoporosis, among others. Conversely, the public consumes more than double the recommended limit of solid fats, added sugars, refined grains, sodium, and saturated fatty acids. These dietary behaviors contribute to development of risk for chronic diseases and often represent excess calorie intake as well.

For the first time, evidence from studies that incorporated whole food patterns, such as the Dietary Approaches to Stopping Hypertension (DASH) [7, 8] and the Mediterranean diet [9], as well as vegetarian diets [10–13], documented benefits related to reduced risk of chronic diseases. On the basis of these findings, the 2010 U.S. Dietary Guidelines Advisory Committee advocated a Total Diet approach that was rich in plant-based foods: fruits, vegetables, whole grains, and vegetable proteins. The USDA Food

Patterns were further developed to provide practical approaches to meeting the nutrient and calorie needs at different energy levels in order to satisfy various age/gender/activity needs across the population.

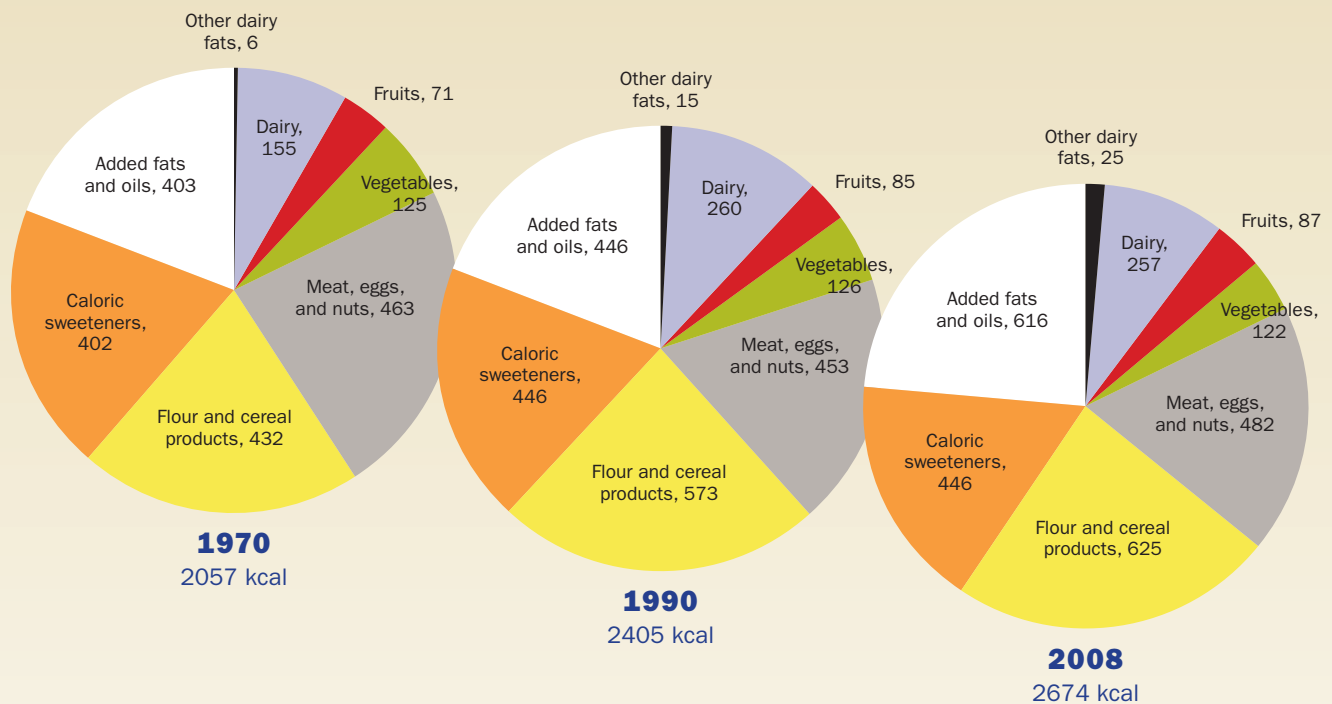
Summary of Energy Balance and Weight Management

The concept of energy balance is essential to weight control. It is the achievement of energy (calorie) intake that does not exceed total energy needs based on metabolic and activity expenditure.

Put simply, it is energy intake that does not exceed energy output. Because of the obesity epidemic, there is a recognized need to tip the energy balance toward reducing sedentary behavior and achieving an energy intake that is less than energy output, thereby enhancing the opportunity for weight loss among adults. Figure 1 illustrates the increasing number of calories consumed over the past four decades. From 1970–2008 the mean intake has increased over 600 calories/day, thereby explaining,

Figure 2.

Average Daily Per Capita Calories from the U.S. Food Availability in 1970, 1990, and 2008, Adjusted for Spoilage and Other Waste



Adapted from the U.S. Dietary Guidelines Advisory Committee report. Data source: ERS Food Availability (Per Capita) Data System
www.ers.usda.gov/Data/FoodConsumption/

at least in part, the accompanying weight gain in this country. Figure 2 shows the average daily per capita calories from the U.S. food availability in 1970, 1990, and 2008, and illustrates the average calorie increase over this time [6].

While there are many factors that appear to contribute to these extra calories, including larger portion sizes and more frequent fast food, snack food, and sugar-sweetened beverage intakes, the overarching goal to reduce overweight and enhance healthy lifestyle involves eating foods that are nutrient dense in order to meet nutrient needs without exceeding calorie needs.

Because data show there is a range of energy intake that accompanies energy output across different age and gender groups, the exact number of calories needed may vary across individuals. This is where physical activity can offer some flexibility. While physical activity without reduced energy intake is usually inadequate to produce and sustain substantial weight loss, the inclusion of regular physical activity was the primary recommendation of the PAGAC report, and this is further reinforced by the U.S. Dietary Guidelines as well.

Currently, grain-based desserts rank highest in mean energy intake among all persons constituting the U.S. population, followed by yeast breads, chicken and chicken dishes, soda, and pizza. Among boys ages 2–18 years, pizza, grain-based desserts, and sugar-sweetened soda represent the top three contributors [6]. Table 1 provides details by age for the top ten contributors. Table 1 illustrates the mean intake of energy and mean contribution (calories) of various foods among U.S. populations [6].

Physical Activity: The Benefits of Counterbalance

The DGAC report summarized the evidence regarding relationships between physical activity, body weight, and other health outcomes. There was strong, consistent evidence that people who are physically active are at reduced risk of developing obesity. Even among overweight or obese people, those who are more active have less risk of chronic disease, similar to that of normal weight people [5, 6].

Similar to the DGAC, the PAGAC report was developed by 13 experts in physical activity who conducted a rigorous

systematic review of the evidence regarding the role of physical activity and health across different age, gender, and special needs groups. The DGAC report noted that the PAGAC report highlighted four distinct points that were especially relevant to understanding physical activity and energy balance.

1. Achieving energy balance and a healthy weight depend on both energy intake and expenditure.
2. The effect of caloric deficit on weight does not depend upon whether the deficit is produced by reducing intake, increasing expenditure, or both; however, research studies that include the proportion of caloric deficit due to physical activity are rare.

3. Bouts of moderate- to vigorous-intensity aerobic physical activity that contribute to meeting physical activity guidelines are not the only source of physical activity energy expenditure. Any movement throughout the day that replaces seated activity contributes to the totality of energy expenditure.
4. Even among people at a healthy body weight, regular physical activity is required to maintain health and prevent disease.

Regarding the last point, accumulating data document the fact that sedentary behavior is, in itself, a risk factor for all individuals [14, 15].

Table 1.
Mean Intake of Energy and Mean Contribution (kcal) of Various Foods Among U.S. Population, by Age,
NHANES 2005–06

		All Persons	Age 2–18	Age 2–3	Age 4–8	Age 9–13	Age 14–18	Age 19+	Age 19–30	Age 31–50	Age 51–70	Age 71+
Sample Size		8549	3778	497	899	1047	1335	4771	1310	1537	1224	700
Mean Intake of Energy (kcal)		2157	2027	1471	1802	2035	2427	2199	2407	2354	2020	1691
Rank	Food Group											
1	Grain-based desserts	138	138	68	136	145	157	138	128	145	134	141
2	Yeast breads	129	114	65	98	109	151	134	120	128	149	141
3	Chicken and chicken mixed dishes	121	113	59	92	122	143	123	154	141	97	67
4	Soda/energy/sports drinks	114	118	23	50	105	226	112	186	121	73	33
5	Pizza	98	136	47	95	128	213	86	129	108	48	21
6	Alcoholic beverages	82	6	-	-	-	18	106	120	135	82	40
7	Pasta and pasta dishes	81	91	86	97	101	78	78	92	81	75	50
8	Mexican mixed dishes	80	63	26	40	76	86	85	146	99	48	9
9	Beef and beef mixed dishes	64	43	19	23	42	70	71	81	78	58	55
10	Dairy desserts	62	76	40	93	86	64	58	48	58	59	78

Adapted from the National Cancer Institute (NCI). Food sources among U.S. populations, 2005–06. Risk factor monitoring and methods branch website. Applied Research Program. National Cancer Institute 2010a.

Amount of Physical Activity Needed to Maintain Healthy Body Weight

As adopted from the PAGAC, the DGAC indicated that clear, consistent evidence reports that physical activity is beneficial for weight stability. The PAGAC recommended amounts are as follows:

To Maintain Weight

For Children/Adolescents: 60 minutes or more of moderate-to-vigorous physical activity per day

For Adults: 150–300 minutes per week of moderate-intensity physical activity or 75–150 minutes per week of vigorous intensity physical activity, or an equivalent combination of the two

To Lose Weight

For Overweight/Obese Adults (> 5% of body weight): Combine calorie restriction with at least 300 minutes per week of moderate-intensity physical activity or 75–150 minutes of vigorous-intensity activity, or a combination of the two.

To Avoid Regaining Weight After Weight Loss

Accumulating scientific evidence documents the need to maintain efforts to avoid positive energy balance after weight loss [16].

The available research indicates that prevention of substantial weight regain over six months or longer requires more than 300 minutes per week of moderate-intensity or 150 minutes a week of vigorous-intensity aerobic activity, or an equivalent combination of the two, to avoid weight gain.

Intriguing data are only now accumulating that help explain the possible contributors to the weight regain that so often accompanies a period of successful weight loss. For example, some investigators point to an “energy gap” that exists among previously overweight people, who require fewer calories to remain in energy balance than their same-weight counterparts who have never been overweight. The mechanisms and contributors to this phenomenon require further exploration.

Putting It All Together: It's All about Calories

The U.S. Dietary Guidelines and the Physical Activity Guidelines provide the best evidence-based recommendations regarding the health benefits of a nutrient-dense diet and an active lifestyle. Such a dietary approach can help prevent cardiovascular disease, hypertension, T2D and certain cancers [7, 17–19]. Likewise, a physically active, minimally sedentary lifestyle has also been associated with reduced risk of developing these same chronic diseases [20]. In both cases, the single most powerful approach to reducing risk of chronic disease is prevention or reduction of obesity. This involves eating fewer calories than an individual burns. While it is tempting to think that being more physically

active allows unlimited or unrestricted food intake, the fact is that most people can easily eat more calories than they can burn by doing physical activity and this is a major contributor to weight gain.

As illustrated in Table 1, grain-based desserts are the number one-ranked contributor of calories to the diet of the U.S. population. This includes cake, cookies, pie, granola bars, etc. On average, people across all age groups eat 138 calories per day from such foods. These are energy- (calorie-) dense foods with few nutrients. Likewise, on average, people consume 114 calories from sugar-sweetened beverages that contribute few, if any nutrients. On average, people consume an estimated 98 calories per day from foods (like pizza) that are high in fat, salt, and refined carbohydrates and are inconsistent with the majority of the Dietary Guidelines recommendations. Taken together, these foods contribute approximately 350 calories per day that, for many individuals, exceed the daily limits needed to lose excess weight or maintain ideal weight. People who wish to consume such foods on a regular basis and not gain weight should consider increasing physical activity beyond the PAG to accommodate the extra calorie intake. As recommended, adults need at least two hours and 30 minutes each week of aerobic physical activity at a moderate level OR one hour and 15 minutes each week of aerobic physical activity at a vigorous level. This represents, on average, between 85 and 95 calories per day of moderate to vigorous physical activity to maintain weight at current levels, but to lose weight, a deficit of approximately 500 calories per day is needed in order to lose about one pound per week. This formula will not achieve the same results for everyone since age, gender, and current body weight will influence how many calories are burned per hour [21], but the principles provide context for recognizing the energy costs required for balancing intake and output. Table 2 illustrates the caloric expenditure represented by various forms of physical activity based on an average man.

How Many Calories Does Physical Activity Use?

Energy (in the form of calories) is expended on the basis of the intensity (how vigorous) and the duration (how long) of an activity. The number of calories spent depends on the size, gender, age, and general health status of an individual. The following example was provided by the PAG:

A 154-pound man who is 5' 10" tall will use up about the number of calories listed doing each activity below. *Those who weigh more will use more calories, and those who weigh less will use fewer.* The calorie values listed include both calories used by the activity and the calories used for normal body functioning. Table 2 illustrates the number of estimated calories burned at different intensities of physical activity [5]. Recognizing the number of calories burned during various physical activities can help a person monitor their energy balance on a daily basis, while taking into consideration the average recommendations provided by the national guidelines.

Table 2.
Number of Estimated Calories Burned at Different Intensities of Physical Activity

Physical activities		Approximate calories used by a 154-pound man	
Moderate physical activities		In 60 minutes	In 30 minutes
Hiking		370	185
Light gardening/yard work		330	165
Dancing		330	165
Golf (walking and carrying clubs)		330	165
Bicycling (< 10 mi/hr)		290	145
Walking (3.5 mi/hr)		280	140
Weight training (general light workout)		220	110
Stretching		180	90
Vigorous physical activities		In 60 minutes	In 30 minutes
Running/jogging (5 mi/hr)		590	295
Bicycling (> 10 mi/hr)		590	295
Swimming (slow, freestyle laps)		510	255
Aerobics		480	240
Walking (4.5 mi/hr)		460	230
Heavy yard work (chopping wood)		440	220
Weight lifting (vigorous effort)		440	220
Basketball (vigorous)		440	220

Adapted from USDA's MyPlate.gov

Table 3.
Comparison of Lower, Nutrient Dense vs. Higher, Empty Calorie Food Choices

Food	Total calories	Empty calories	Calories in solid fats	Calories in added sugars	Saturated fat (g)	Sodium (mg)
Apple pie, one crust (1/8 of 9" pie)	363	221	110	111	3	299
Apple, medium	72	0	0	0	0	1
French fries (1 small order of fast food)	271	117	117	0	3	164
Baked potato, with peel (1 medium, 3") with 1 oz nonfat yogurt	179	0	0	0	0	140
Potato chips (1 oz)	152	0	0	0	1	147
Air popped popcorn (1 cup), with 1 TB parmesan cheese	57	0	0	0	0	77
Peanut butter cheese crackers (1 oz)	171	42	28	14	3	231
Rice cake, no salt (1 cake) with 1 TB peanut butter	125	4	1	2	0	75
Cookie, chocolate sandwich type (2)	95	61	31	30	1	85
Graham cracker (2 rectangles)	59	27	11	16	0	85

Adapted from USDA's SuperTracker website: www.choosemyplate.gov/SuperTracker/foodtracker.aspx

Foods Lower in Calories

To consume fewer calories each day, it is recommended that nutrient-poor (empty calorie) foods contributing solid fats and added sugar be reduced or avoided in favor of foods that are nutrient-dense and lower in calories. In general, ounce for ounce, fruits, vegetables, and whole grain foods such as oatmeal, brown rice, quinoa, and whole grain breads, offer fewer calories per serving. These foods can also contribute satiety, or a sense of fullness, that can help to reduce hunger. For example, Table 3 illustrates some comparisons regarding lower versus higher calorie foods.

Choosing foods that are higher in fiber and nutrients and lower in sugar and solid fats closely resembles the DASH diet that has been shown to be associated with reduced blood pressure and risk for T2D. When further accompanied by weight loss, the benefits can be substantial and help to model the proper balance in eating and activity that should be instilled among healthy children to help prevent them from becoming overweight or obese.

Needs for Further Research and Next Steps

Both the DGAC and PAGAC reports contribute greatly to the understanding of diet and activity needs for reducing risk for chronic disease. Both reports emphasize the critical need to halt and reverse the obesity epidemic with special emphasis on primary prevention, starting with children.

However, both reports also point out major gaps in the evidence and the need for additional research to more fully and conclusively address and advance these areas.

Some key areas of needed research cited were:

1. Well-controlled studies with adequate sample size and prospective designs to characterize the associations between specific dietary factors and childhood adiposity.
2. Studies testing interventions likely to improve energy balance in children at increased risk of childhood obesity, especially measuring dietary approaches to reduce energy density, total energy, dietary fat, and sugar-sweetened beverages, as well as enhancing intake of fruits and vegetables.

3. Document positive and negative impacts of environment on weight control.
4. Research the effect of local and national food systems on dietary intake.
5. Study other behaviors that might influence eating practices.
6. Examine snacking behavior, meal frequency, and body weight.
7. Conduct randomized controlled trials that compare and combine diet and physical activity patterns that influence weight control.
8. Conduct studies on gestational weight gain and how to achieve appropriate levels.
9. Improve pre-pregnancy BMI and gestational weight gain monitoring and surveillance in the U.S.
10. Conduct longitudinal studies with adequate designs to further examine the association between breastfeeding and postpartum weight changes in mothers and offspring.
11. Determine isocalorically how solid foods and liquids influence satiety and weight control long term.
12. Study approaches to helping people understand and apply the concept of energy balance on a daily basis.

These and other areas of research remain unexplored and data are badly needed in order to effectively succeed in reducing the risk and incidence of overweight and obesity in this country.

Overall, both diet and physical activity are important influences on health and risk for disease.

There is an especially strong need to introduce effective strategies that can prevent the risk of developing obesity in children, in order to help reduce and reverse the disturbing trends of development of chronic disease at younger and younger ages. This requires partnership across government and private sectors, parents, and providers in order to take effect.

Some helpful websites include:

MyPlate

www.choosemyplate.gov/

2008 U.S. Physical Activity Guidelines for Americans

www.health.gov/paguidelines/report/

www.health.gov/paguidelines/toolkit.aspx

2010 U.S. Dietary Guidelines Advisory Report

www.cnpp.usda.gov/DGAs2010-DGACReport.htm

2010 U.S. Dietary Guidelines

www.cnpp.usda.gov/dietaryguidelines.htm

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