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WILL THE 2010 DIETARY GUIDELINES FOR AMERICANS BE ANY MORE EFFECTIVE FOR CONSUMERS?

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The Dietary Guidelines for Americans 2010 (DGA 2010) form the basis for federal nutrition policy for the next five years. The goal of the DGA 2010 is to promote wellness, and decrease the risk of dietary and obesity related diseases such as diabetes, some cancers, and heart disease. This analysis emphasizes the potential consumption impacts of the DGA 2010, which sets the stage for subsequent analysis by Ribera, Yue and Holcomb (2012) of the potential geographic impacts in this issue. The DGA 2010 recommendations for each food group total are very similar and consistent with the previous DGA 2005. That is, they both promote the consumption of fruits and vegetables, fish and seafood products and emphasize the need to exercise to prevent or reduce the risk of chronic diseases. There are, however, some important differences in the DGA 2010 within each food group.

Table 1 provides a side-by-side comparison of the 2010 and 2005 DGAs based on the recommended diet for 2,000 calories per day intake. The 2,000 calorie per day equivalent has been the standard level of intake used by researchers to be consistent across the DGAs and also with all Nutrition Facts Labels on packaged foods (Buzby, Wells, and Vocke, 2006). However, since the DGAs are weight, age, and physical activity specific, analysts need to be careful in interpreting both the DGAs and food labels.

The 2010 total recommendations for fruits and vegetables remained the same at two cups per day for fruits and 2.5 cups per day for vegetables. However, vegetable sub-categories were broken down into sub-groups and minimum recommendations were adjusted within each group. The DGA 2010 vegetables were adjusted to include dark green vegetables, red and orange vegetables, legumes, starchy vegetables and other vegetables with weekly recommendations designed to maintain a dietary balanced vegetable consumption. The largest recommended change was moving red vegetables from the "other" category and combining it with orange to form one single sub-category. This explains, at least in part, the reduction in the other category of 2.5 cups per week with the red and orange vegetables now being 5.5 cups per week. Dark green vegetables and legumes recommendations were each reduced by 1.5 cups per week. Starchy vegetable consumption recommendations were reduced by two cups per week.

The largest overall recommended DGA 2010 change was in the protein group. The DGA 2005 made no specific subgroup recommendations for seafood; meat, poultry, and eggs; or nuts, seeds, and beans. The effect of adding specific recommendations of eight ounces per week of fish and four ounces per week of nuts, seeds, and beans was to materially reduce the recommendation for the meat, poultry and egg protein sub-category. The term discretionary calorie allowance used in the 2005 DGA was changed to maximum solid fats and added sugars (SoFAS) and it was decreased from 267 calories to 258 calories per day. The recommendations for fruit, grains, dairy, and oils remained the same as the 2005 DGA recommendations.

The DGA 2010 compares the typical American diet with the recommended intake levels or limits. This comparison is shown in Figure 1. The bars show average intake levels, for all individuals ages one or two and older, as a percent of the recommended intake level or limit. In summary, for the current American average 2,594 calorie intake, the DGA 2010 recommend large increases in consumption of fruit; vegetables; whole grains; fat-free or low fat milk (1%); fish; and nuts, seeds, or beans. They recommend substantial reductions in consumption of refined grains; meat, poultry and eggs; oils, fats and sugars; sodium; and sugary drinks. The percentage levels of food available for consumption versus recommended intake indicate the following food groups are below the recommended levels by the following percentages: fruit (42%), vegetable (59%), whole grains (15%), dairy (52%), seafood (44%), and oils (61%). The following foods exceed the recommended intake levels by the following percentages: meat, poultry and eggs (110%), calories from SoFAS (280%), refined grains (200%), and saturated fat (110%).

Table 1**Side by Side Comparison of the 2005 and 2010 Dietary Guidelines for Americans, 2,000 Calorie Intake Level.**

Food Group	Units	DGA 2010	DGA 2005	Difference
<i>Fruits</i>	Cups/wk	14.0	14.0	0.0
<i>Vegetables</i>	Cups/wk	17.5	17.5	0.0
Dark Green	cups/wk	1.5	3.0	-1.5
Beans and Peas (legumes)	cups/wk	1.5	3.0	-1.5
Red and Orange	cups/wk	5.5	2.0	3.5
Starchy Vegetables	cups/wk	5.0	3.0	2.0
Other	cups/wk	4.0	6.5	-2.5
<i>Grains</i>	oz-eq/wk	42.0	42.0	0.0
Whole Grains	oz-eq/wk	21.0	21.0	0.0
Enriched Grains	oz-eq/wk	21.0	21.0	0.0
<i>Protein Foods</i>	oz-eq/wk	38.0	38.0	0.0
Seafood	oz/wk	8.0	n.s	n.s
Meat, Poultry and Eggs	oz/wk	26.0	n.s	n.s
Nuts, Seeds, Soy Products	oz/wk	4.0	n.s	n.s
<i>Dairy</i>	cups/wk	21.0	21.0	0.0
<i>Oils</i>	grams/wk	189.0	189.0	0.0
<i>Maximum SoFAS</i>	calories/day	258.0	267.0	-9.0

Source: Dietary Guidelines for Americans, 2005 and 2010. 1 Red vegetables were in the "other" category in the 2005 DGA and were moved to "red and orange" in the DGA 2010. 2 Protein foods were called lean meat and beans in the 2005 DGA. The sum of protein sub-categories were used as total protein recommendations; in the DGA 2010 they do not add up due to rounding. 3 Soy products include beans and peas, which are also part of the vegetable group, but they should only be counted in one group. 4 Maximum solid fats and added sugars (SoFAS) were called discretionary calorie allowance in the 2005 DGA. n.s. is not-specified.

Analysis of fats, oil, and sugar recommendations and their potential implications present some unique challenges. The DGA 2010 recommend a 27 gram daily limit of oil consumption and a maximum of 258 calories or 13% of caloric intake derived from solid fats and added sugars for the 2,000 caloric intake level. Oils include soft margarines and vegetable and nut oils that have no trans-fats. It is worth noting that the solid fats and added sugars are grouped into one category with a recommendation for a maximum amount of calories derived from it. The major sources of solid fats for Americans are cakes, cookies, other desserts, pizza, cheese, processed and fatty meats, and ice cream. Because oils, fats, and added sugars are usually consumed in conjunction with other food groups—for example, meat, poultry, whole milk, cheese—the implications of reducing the caloric intake from these groups needs to be taken into account. Therefore, the likely impact of the reduction can be expected to be higher for animal sources of fat than for vegetable sources. This is an area that merits further research, with significant implications for the pricing of food components such as butterfat, which will be discussed subsequently.

If Americans were to change their food consumption habits and adopt, at least in part, the recommendations of the DGA, there would be significant impacts for U.S. agriculture. However, to date, very little research has been conducted about the potential impacts of the DGA for agriculture and policy implications. More information is needed to answer relevant questions that are important for making policy decisions, such as: Will there be any changes in consumption as a response to the DGA? How much more food would be needed to satisfy the recommended levels of consumption? Where is the food going to come from? Are there any policies that will motivate changes in consumption? What is the likely impact by commodity groups and regions? Which commodities will be impacted positively and negatively? This paper and the following one by Ribera et al. only begin to scratch the surface in answering these questions.

Changes in Consumption in Response to Past DGAs

Figure 2 shows per capita consumption, adjusted for loss, from 2000-2009, for selected food groups. Based on the ERS food consumption data system, there have only been very minor changes in consumption levels for the general population following the release of the 2000 and 2005 DGA. As Buzby, Wells, and Vocke (2006) point out, it is unrealistic to assume a full adoption of the dietary recommendations.

While Americans, in general, are not meeting the dietary guidelines, people who live in low-income households are less likely to meet dietary recommendations for fruit, vegetable, and fiber than higher income consumers (Satia 2009; Casagrande et

al. 2007). For example, 10% of upper income adults eat three or more servings of whole grains each day compared to 5% for low-income adults (Cleveland et al. 2000). Adults in households with incomes above the 1.25 poverty ratio eat 36% more vegetables than Supplemental Nutrition Assistance Program (SNAP) households and 15% more than households below the 1.25 poverty ratio who do not participate in the SNAP program (Table 2). SNAP, formerly known as the Food Stamp Program, is the largest federal food assistance program. It provides participants with a monthly supplement that can be used to purchase a variety of foods from authorized retailers including supermarkets, grocery stores, convenience stores—provided they stock certain foods, and many farmers' markets. In 2011, average monthly participation was 45 million persons and program costs exceeded \$75 billion (USDA 2012a).

Figure 1: Comparison of a Typical American Diet to Recommended Intake Levels or Limits of the DGA 2010. Source: DGA, 2010.

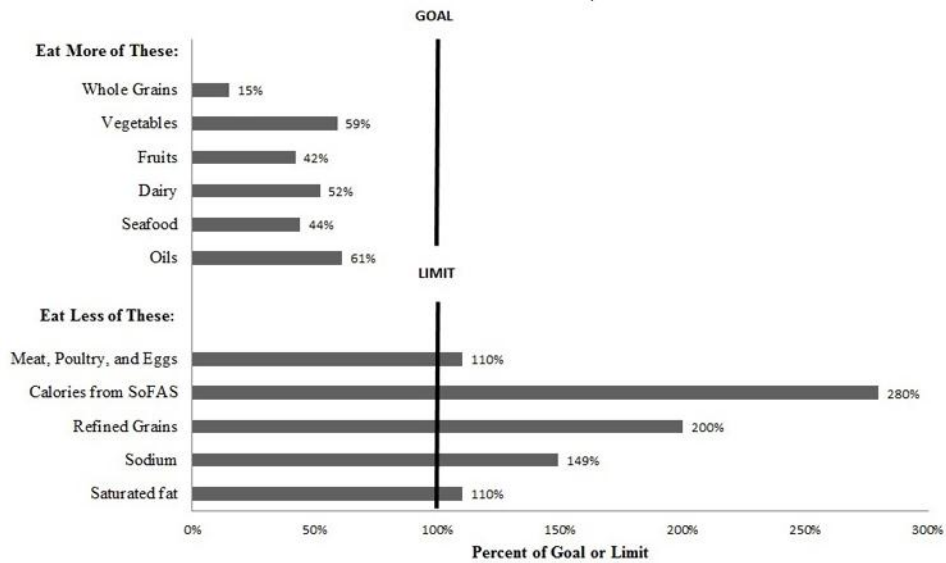
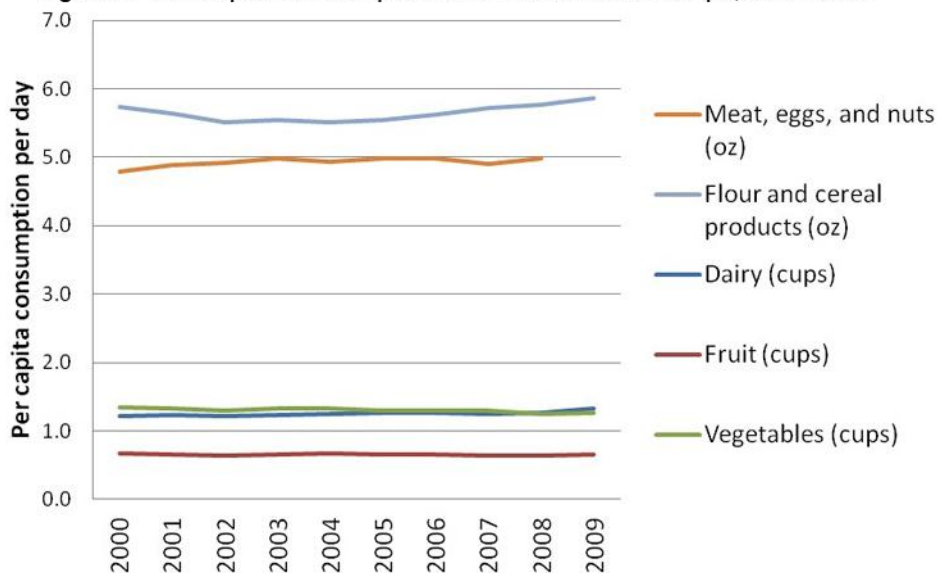


Figure 2: Per Capita Consumption of Selected Food Groups, 2000-2009



Adults in households above the 1.25 poverty ratio eat 1.69 servings of vegetables while adults in SNAP households eat only 1.25 servings a day. Adults in households below the 1.25 poverty ratio but not receiving SNAP benefits consume 1.47 servings of vegetables a day. The results are similar for the remaining vegetable categories except dark green vegetables. Adults living in households over the 1.25 poverty ratio consume almost three times the amount of dark green vegetables as adults living in households that receive SNAP benefits.

This same pattern is duplicated with respect to fruit consumption. Adults in SNAP households have the lowest fruit consumption at 0.88 servings a day. Adults living in households below the 1.25 poverty ratio consume 0.95 fruit servings per day while adults who live in households with income greater than the 1.25 poverty ratio consume over 1.11 servings of fruit per day.

An analysis of the National Health and Nutrition Examination Survey 2003-2004 data (USDHHS 2005) also shows that adults who live in lower-income households are less likely to consume any fruits and vegetables, and have fewer

Table 2**Total Consumption of Fruits and Vegetables by Category, SNAP Participation and Income Level for Adults, 2003-2004.**

All Adults	All	SNAP Adults	Less than 1.25 poverty level/not on food stamps	Over 1.25 poverty level
(observations)	5266	222	1581	3463
Total vegetable, excl legumes	1.63	1.25	1.47	1.69
Dark Green	0.11	0.04	0.08	0.12
Deep yellow and red	0.45	0.34	0.42	0.46
Starchy	0.49	0.42	0.48	0.49
Other	0.59	0.45	0.49	0.62
Total Fruit	1.07	0.88	0.95	1.11

Source: National Health and Nutrition Examination Survey, 2003-2004. USDHHS (2005).

people who meet minimum recommendations for adults. Almost 10% of adults who live in SNAP households do not consume any vegetables and 36% do not consume any fruit. When vegetable categories are broken down further, over 88% of adults living in SNAP households do not consume any dark green vegetables. Almost 62% do not consume any dark yellow or red vegetables, 51% do not consume starchy vegetables, and 24% do not consume other vegetables. In contrast, less than 5% of adults in households with income above the 1.25 poverty ratio do not consume any vegetables and 23% do not consume any fruit.

Even though many households receiving SNAP benefits do not eat any fruits and vegetables, a larger percentage do meet the minimum dietary recommendations (Table 3). Just over 16% of adults in households receiving SNAP benefits meet the recommendations for vegetables and about 20% meet the recommendations for fruit. For adults in households below the 1.25 poverty ratio, but not participating in SNAP, 21% meet the dietary recommendation for vegetables and over 17% meet the recommendations for fruit. The figures continue to improve for adults living in households above the 1.25 poverty ratio compared to adults in lower-income households. Over 25% of adults in the above 1.25 poverty ratio group meet the recommendations for vegetable consumption and about one in five meet the fruit recommendations.

Table 3**Percentage of Adults who Meet the Minimum Recommendations by Food Group, Income and SNAP Participation Status, 2003-2004.**

	All Adults	SNAP	Not currently on SNAP but under 1.25	Over 1.25 poverty ratio
	%	%	%	%
Total Vegetables	23.81	16.22	21.06	25.56
Dark Green	12.70	7.21	9.11	14.70
Dark yellow and red	7.70	5.86	7.31	8.00
Starchy	26.97	23.42	26.00	27.63
Other vegetables	34.62	22.52	28.91	38.00

Source: National Health and Nutrition Examination Survey, 2003-2004. USDHHS (2005).

Effects of Full DGA 2010 Implementation

Very few studies have looked at the potential impacts of the DGA for U.S. agriculture. Buzby, Wells and Vocke (2006) are a notable exception. They looked at the potential impacts to agriculture from full adoption of the 2005 DGA using a linear extrapolation of the data. They concluded that in order for Americans to meet the fruit, vegetable, total grain, and whole grain recommendations, domestic crop acreage would have to increase by an estimated 7.4 million harvested acres or 1.7% of total U.S. crop land in 2002. They also found that U.S. dairy producers would need to increase annual production of milk and milk products by 108 billion pounds. They assumed the same ratio of share in domestic production and imported foods and hence the additional food amounts required to fill the gap will come from both domestic and foreign sources.

When looking at the potential impacts to agriculture and the increase in agricultural output required to fully satisfy the dietary recommendations of the DGA 2010, the use of a 2,000 calorie per day intake level makes the interpretation of the findings less intuitive and adds more complexity. In 2009, the average American consumed 2,594 calories. Our analysis uses a different approach, by interpolating the DGA recommendations to the actual average per capita food intake level of 2,594 calories per day in 2009. The actual levels of consumption by food

group are obtained from the Economic Research Service food consumption data system. This data series records per

Table 4**Changes Needed to Meet the Full Recommendation Levels for the Average American Intake Level, 2,594 Calories Per Day.**

Food Group	Units	DGA Recommendation	Food Available for Consumption	Change needed to meet Guidelines	
					percent
<i>Fruits</i>	cups/wk	14.0	6.0	8.0	134.1
<i>Vegetables</i>	cups/wk	24.4	11.4	12.9	113.2
Dark Green	cups/wk	2.5	1.0	1.5	151.1
Beans and Peas	cups/wk	2.5	0.7	1.8	266.6
Red and Orange	cups/wk	7.0	2.1	.9	
Starchy Vegetables	cups/wk	7.0	3.9	3.1	79.2
Other	cups/wk	5.5	3.8	1.7	45.2
<i>Grains</i>	oz-eq/wk	62.8	57.5	5.3	9.2
<i>Seafood</i>	oz/wk	10.0	3.2	6.8	208.3
<i>Meat, Poultry and Eggs</i>	oz/wk	31.0	39.6	-8.6	-21.7
<i>Dairy</i>	cups/wk	21.0	12.1	8.9	73.7
<i>Oils</i>	grams/wk	237.3	285.6	-48.3	-16.9
<i>Max SoFAS</i>	cal/day	361.0	668.8	-307.8	-46.0

1 Units were converted to weekly equivalents for comparison across food groups except for maximum SoFAS where the recommendation is a percentage of total calorie intakes. 2 The amounts recommended represent the average American intake level of 2,594 calories per day in 2009, and they were interpolated from the DGA recommendations for 2,400 and 2,600 calories. 3 Food available for consumption obtained from the ERS food consumption data. 4 Grain available includes 7.6 ounce equivalent per day from ERS and 0.6 oz eq missing whole grain per day estimated by Putnam, Allshouse, and Kantor (2002) and used by Buzby, Wells and Vocke (2006). 5 Maximum SoFAS are daily calorie intake from solid fats and added sugars.

capita food availability adjusted for nonedible parts and loss or spoilage and converts that information to servings as specified in the DGA 2010. Even though these data do not measure actual food intake, they provide information about food availability for human consumption in the United States (ERS 2012; Buzby, Wells, and Vocke 2006). The recommended weekly amounts by food group for a 2,594 calorie per day intake level are then compared with food available for consumption, and the change in food availability needed to meet the recommendations for the average American are calculated.

This analysis keeps the level of calorie intake at the current consumption level of 2,594. The DGA 2010, however, also recommends a reduction in the amount of food intake. Hence these results represent minimum adjustment levels for a balanced diet with the current intake levels for the average American. As shown in Table 4, most food groups require substantial increases in consumption levels to satisfy the DGA 2010 recommendations. An increase in consumption of fruits (134.1%), vegetables (113.2%), grains (9.2%), seafood (208.3%) and dairy (73.7%) are required. Meat, poultry, and eggs consumption requires a reduction of 21.7%. Oil consumption needs to be reduced by 16.9%, while solid fats and added sugars need to be reduced 46%. This analysis does not account for any tradeoffs consumers may make to offset an increase for certain food categories by reducing others. The analysis also shows a need for reduction in the amount of food consumed by the average American. The magnitude of the reduction should be of at least 307 calories, which corresponds to the number of calories over the suggested limit for solid fats and added sugars, suggesting at least a reduction in the total calorie intake for the average American to 2,286 calories per day.

Nutrition Policy Incentives Role in Adopting the DGA 2010

With small changes in dietary behaviors from previous DGA, and income and prices being a determining factor in healthy eating behaviors, public policies may play a mediating role in improving the dietary quality of Americans. For

those food groups where a reduction in consumption is required—including meat, poultry, and eggs; fats and oils; and added sugars—price may play a bigger role in the consumers' decision making. Fluid milk is a good example, with the same current retail prices for whole milk and low-fat milk. While it is true that processing whole milk may pose additional costs for the processor, the cream obtained as a sub-product is used in the elaboration of other higher-valued dairy products with higher content of fat. From the consumer standpoint there are no price incentives to switch to a lower level of fat content in fluid milk. A pricing system similar to the producer level pricing, where price is a function of the fat content of the milk, could result in a greater consumer response. However, if consumers demanded more low-fat dairy products, it would likely increase the amount of butterfat available and hence the supply of higher fat content dairy products at potentially lower prices.

In addition to price, income also plays a role in consumer's adoption of the DGA recommendations. There are some potential DGA 2010 adoption impacts for low-income consumers who participate in food assistance programs. In 2008, in response to the 2005 DGA, the Food, Nutrition and Conservation Act authorized funding to evaluate a pilot program on the effects of providing a 30% cash bonus on purchases of fruits and vegetables. Under this policy participants would receive a credit of 30% of the total cost of fruits and vegetables on their Electronic Benefit Transfer Card. Previous studies have estimated the potential effects of financial incentives on healthy eating for SNAP participants. Jetter (2011) estimated that a price discount of 25% for SNAP participants would increase the consumption of fruits and vegetables by 6.9%. Dong and Lin (2009) estimated that a price discount of 10% could increase fruit and vegetable consumption by 2.1% to 5.2% and program costs could increase by \$310 million for fruits and \$270 million for vegetables.

The SNAP program provides a stipend that allows people to pick and choose the variety of foods they want to consume. In contrast, several other food assistance programs such as the Supplemental Food Assistance Program for Women, Infants and Children (WIC) and the Food Distribution Program on Indian Reservations (FDPIR) provides vouchers for only certain types of foods (WIC) or delivery of specific foods (FDPIR). The WIC program provides supplemental foods designed to meet the specific nutritional needs of low-income pregnant, breast feeding, non-breast feeding post-partum women, infants and children up to five years of age who are at nutritional risk. Participants use vouchers, or increasingly an electronic benefit card, to make purchases of authorized foods at authorized centers—supermarkets, local food outlets, WIC stores. In 2011, the average monthly participation was 9 million people and budget costs were about \$7 billion (USDA 2012b). Until recently, WIC foods included whole milk, cheese, eggs, peanut butter, baby cereals, formula, iron fortified cereals for mothers, dried peas and beans, and canned fruits, vegetables, and juices. Starting in 2006, following the publication of the 2005 DGA, a policy change to the content of the WIC food package was made to include fresh fruits and vegetables, brown rice, whole grains, tofu, soy milk, low-fat or non-fat milk, and baby food. Participants could also purchase fresh produce at farmers markets that accepted the WIC vouchers. In a pilot study on the effectiveness of using a fresh produce voucher at farmers' markets for six months, the results showed that six months after the voucher program ended, study participants still had significant increases in their fruit and vegetable consumption (Herman et al. 2008).

The National School Lunch Program is a federally assisted program that provides nutritionally balanced low-cost or free lunches to over 101,000 public and nonprofit private schools. Children from families with incomes at or below 130% of the poverty level (\$29,055 in 2012) are eligible for free meals, and those with income between 130%-185% of the poverty level (\$41,348 in 2012) are eligible for reduced-price meals. Participation levels in 2010 were over 31.7 million children for a total cost of \$10.8 billion (USDA 2012c). The objective of the program is to reduce obesity rates among children and to promote healthier eating habits. Under this program, school districts must increase the health content of the products they offer. Just and Wansick (2009) used behavioral economics to offer low-cost options for school districts to encourage children to buy more of the nutritional items and less of the less nutritional items. Some of these options include rearranging items to make it easier for children to purchase healthier items, and more difficult to purchase undesirable items. However, mandating the implementation of DGA 2010 recommendations has become a politically charged issue.

The Food Distribution Program on Indian Reservations provides a USDA commodity package of foods to 275 Indian Reservations, pueblos, Rancherias, and Alaska Native villages. The program has a monthly average enrollment of about 84,000 people and a budget of \$97 million in 2011 (USDA 2012c). This program is an alternative to the SNAP program for eligible households living in rural areas with limited access to stores that sell a variety of foods. The package provides a selection of about 100 commodities of mostly dried, canned or frozen goods, with some fresh produce available through the Department of Defense. Participants may either pick up their commodity package once a month from the distribution center, or have it delivered if they live at a tailgate site. Whole grain products in the form of whole grain rotini—starting in 2008—and whole wheat flour are also available, though not always at tailgate sites. The current allocation of canned or fresh produce is equal to about 1.25 servings a day for fruit and 1.5 servings of vegetables (USDA 2011). Prior to the 2005 DGA the commodity package provided about half the recommended amounts of fruits and vegetables. No significant policy recommendations were made for changes in the composition of the FDPIR commodity package in response to the 2005 DGA.

The programs discussed above provide food, electronic funds, or vouchers to purchase food and have successfully improved food security and the nutritional quality of foods consumed for participants. However, continuing income disparities may indicate the need for further policy change to improve dietary quality in response to the DGA 2010. One policy change could be to improve the ability of SNAP and WIC beneficiaries to purchase foods on-line for home delivery. Low-income households prefer to shop at supermarkets and grocery stores rather than other neighborhood stores such as specialty and convenience stores due to generally lower prices (Ohls et al. 1999). Often these stores are located outside the core neighborhoods where the family lives. Food stamp participants also tend to do most of their food shopping at the beginning of the month whether the purchases are paid with an EBT card or some other means (Hastings and Washington 2008; Wilde and Ranney 2000). Expenditures decrease over time during the month though, mostly due to a decrease in quantity purchased, rather than substitutions from generic items. The participants also tend to make only one or two major shopping trips, if living in a neighborhood located far from large supermarkets and bulk food stores.

As a result of these shopping patterns, it is difficult to stock up on perishables such as fresh produce and milk. Traditionally, however, neighborhood convenience stores have offered milk, bread, cheese and eggs. Due to the perishability of most fresh produce however, these stores seldom stock it. By developing the means to use EBT cards, make on-line purchases from stores that deliver, or increase the availability of local foods, purchases may be able to be made frequently enough to encourage greater consumption of healthier, though more perishable, food. This may be especially important for those people who are homebound—such as some seniors and disabled persons—and rely on food assistance programs.

Change may be overdue to the FDPIR commodity package to bring it more into compliance with the DGA 2010. The number of servings of fresh produce and whole grain provided in the package would need to be increased. Because FDPIR participants can only pick up commodities once month, they face the same constraints in buying and storing fresh produce over a month as SNAP participants living far from supermarkets. Thus, they are unable to have sufficient fresh produce to consume throughout the month. Some policy alternatives may be to provide seeds in the commodity package for those interested in gardening. Vouchers to be used for fresh produce purchases may also be provided in commodity packages.

In Summary

The DGA 2010 recommendations are designed to promote wellness and decrease the risk of chronic diseases through a balanced diet and exercise. However, when looking at consumption trends for the main food groups, no significant changes in consumption or shifts from one food group to another have been observed in the last few years. If policies were implemented as an incentive for Americans to change their diets and adopt the recommendations from the DGA, there would likely be some impacts on agriculture. The magnitude of the impacts to U.S. agriculture, for every food group, will depend on any changes in demand and the amount of food produced domestically, as well as the share of consumption derived from imports. If a *status quo* of the current policies is maintained for the DGA 2010, then it is reasonable to expect similar results to those from previous DGA released in 2005 and 2000. With only very minor changes in consumption and no significant shifts from one food group to another, the impacts on agriculture in terms of increased acreage, trade effects, and changes in prices are expected to be minimal. Food policies need to consider the positive effects in consumption of promoting certain desirable food groups, and also the potential negative effects of discouraging the consumption of less desirable foods.

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