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Food Consumed Away from Home Can Be a Part of a Healthy and Affordable Diet[1,2]

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Abstract

The benefit calculation of the Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program, is based primarily on results of the Thrifty Food Plan (TFP) developed by the USDA. By using a nonlinear mathematical programming approach, the TFP provides a dietary pattern recommendation that deviates the least from low-income consumers' consumption pattern, meets dietary guidelines, and is economical. The TFP stipulates that all foods should be purchased at stores and prepared at home [food at home (FAH)] and excludes an important part of current consumers' diet, food away from home (FAFH). Our purpose was to evaluate the feasibility and nutritional impact of adding a FAFH dimension into the TFP model framework. Measures of energy density, nutrients and food group composition, and the overall diet quality measured by the Healthy Eating Index 2005 were calculated and compared across the TFP, the TFP with FAFH, and low-income consumers' diet pattern. Our results indicated that considering moderate FAFH in the TFP yielded similar nutrient and food group composition as the original TFP while greatly increasing the practicality and adaptability of the recommended dietary pattern. These findings may be used by nutrition educators to develop healthful FAFH choices for individuals receiving SNAP benefits. J. Nutr. 139: 1994–1999, 2009.

Introduction

The typical American diet is energy-rich but nutrient-poor (1,2) and a link between suboptimal dietary patterns and many chronic diseases (e.g. cancers, cardiovascular diseases, diabetes) has been established (3,4). Diet quality has been positively associated with socioeconomic status (5); thus, individuals in low-income groups are at increased chronic disease risk.

The Supplemental Nutrition Assistance Program (SNAP),[7] formerly the Food Stamp Program, is the largest domestic food and nutrition assistance program administered by the USDA, Food and Nutrition Service. The original goal of SNAP was to fight hunger (6). However, food provision alone does not necessarily lead to healthy dietary intake. With welfare reform and the changing food environment, a major problem facing those in poverty is the overconsumption of energy-dense, nutrient-poor foods (7,8). Nutrition education programs aimed at improving SNAP participants' nutrition knowledge are in place. However, consistent improvements in diet quality have not been reported (9). Thus, educational messages promoting the health benefits of foods and dietary patterns, without considering other contributing and competing factors, are unlikely to be effective (5,10–14).

Consumption of food away from home (FAFH; including eating on and off premises) has increased substantially in recent years (15). FAFH as a percentage of total household food expenditure rose from 17% in 1929 to 49% in 2007 (**Fig. 1**). The need for convenience, taste, and variety (attributes of FAFH) is sizable across all income strata: The typical low-income household spent ~27% of their total food dollars away from home and another 12% on prepared foods, while higher income households spent ≥50% of their total food dollars on FAFH (17). It may be unrealistic to assume that low-income families have the adequate time, skills, and food access to prepare only healthy homemade meals (5,17). To be effective, nutrition interventions should consider a role for consumption of FAFH and provide guidance on healthy FAFH selections (15). Furthermore, the economic stimulus package recently signed into law raised the maximum SNAP allotment by 13.6%; this level is expected to remain constant for the next 3–5 y. This increase in SNAP benefits may free portions of participants' own money that they can use freely in FAFH. Meanwhile, during this current economic downtime, money-saving and convenient diets that are still nutritious will be more applicable, especially for the low-income families.

The objective of this study was to examine the feasibility and nutritional implications of incorporating FAFH into a healthful

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[7] Abbreviations used: CNPP, Center for Nutrition Policy and Promotion; DRI, Dietary Reference Intake; ED, energy density; FAFH, food away from home; FAH, food at home; HEI, Healthy Eating Index; SNAP, Supplemental Nutrition Assistance Program; TFP, Thrifty Food Plan; TFP_FAFH, Thrifty Food Plan allowing food away from home.
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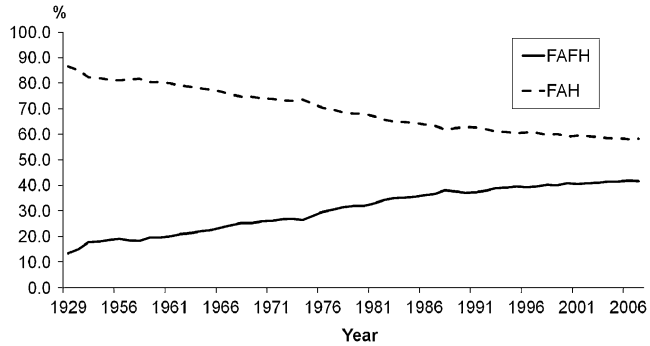

FIGURE 1 Mean family food expenditure shares: FAH vs. FAFH. Source data were from USDA-Economic Research Service (16).

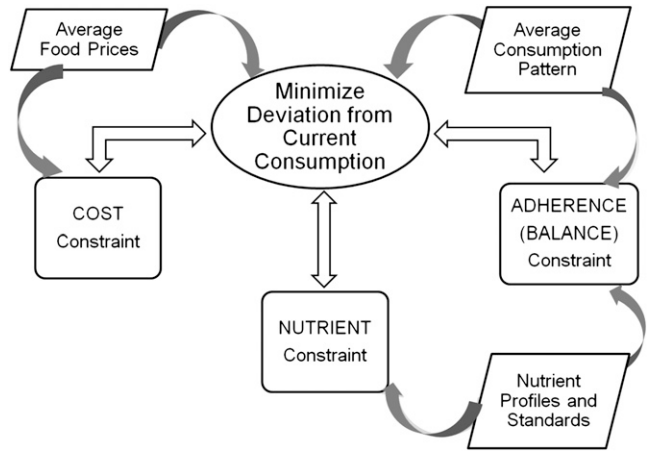

FIGURE 2 TFP math program model structure flow chart. Shapes represent different component of the math programming model. Oval, Objective function; squares, constraints; parallelogram, input data. One-way arrows show those model components where input data are functioning.

yet economical diet. To achieve this goal, we expanded a nonlinear mathematical programming model, the Thrifty Food Plan (TFP), to consider FAFH choices and the associated nutrient profiles and costs, which is referred to as TFP_FAFH. The TFP model is designed to be updated through time to consider inflation, food price changes, and nutrition guideline updates. Therefore, our new model will also be able to reflect recent changes in economy through time.

The TFP is used to provide annual updates to the maximum allotments for SNAP benefits. The model provides a dietary pattern recommendation that is as similar as possible to low-income consumers' diets while meeting nutrient guidelines and being economical (18). The major limitation of the TFP is that it assumes all foods consumed are prepared at home. As a result, taste, variety, and cost are only partially considered in the model. The current TFP has allowed several prepared foods (i.e. frozen dinners and partially prepared ingredients, e.g. marinara sauce, frozen/canned vegetables); however, it still excludes FAFH, because SNAP benefits cannot be used to purchase food from vendors other than stores or farmer's markets.

To assess nutritional implications, energy density (ED), nutrients and food group composition, Healthy Eating Index 2005 (HEI 2005) scores were examined. These findings provide insights into the recommended proportion of FAFH that may be included within a balanced, low-cost diet, as well as impacts on the diet quality. This information may be used to facilitate the design of educational messages that can guide low-income individuals in achieving a healthy diet while considering current trends in food consumption.

Model and data

The TFP_FAFH model utilized the TFP model structure and the same data sources. The TFP model and datasets are first described and the incorporation of FAFH is then presented.

The TFP model structure, data, and concerns. Details about the TFP model are presented in the TFP 2006 report (18). A visual representation of the TFP model framework is presented (**Fig. 2**). The middle oval shape depicts the objective function that was subject to 3 sets of constraints: cost (meeting the goal of being economical: the maximum costs should not exceed the inflation adjusted costs from the previous year); nutrients (imposing nutrient standards: upper and/or lower bounds); and adherence (imposing MyPyramid guidelines; achieving reasonable and palatable diets). The TFP has a total of 15 models, 1 for each age-gender group, with a total of 58 food groups.

The TFP model aims to achieve a familiar diet that is nutritious and economical. Familiarity is achieved through the objective function of minimizing the weighted deviations between the TFP suggested diets and the current diet pattern of the poor. Deviations are weighted by the expenditure share of each food group to reflect the food group's relative importance in the current diet. Smaller deviation suggests familiarity and easier adaptation. However, the strictly at-home food preparation assumption limits the adaptability of the TFP. The TFP objective function is as follows:

$$\underset{X_f}{Min} \sum_f BS_f(\ln X_f - \ln Current_f)^2. \qquad \text{(Eq . 1)}$$

The subscript $_f$ represents each of the 58 food groups, BS_f is the percent of the total food budget used for food group f (budget share), X_f is the TFP recommended consumption level for food group $_f$, and Current$_f$ is the current low-income consumers' consumption level for food group $_f$ (current refers to 2001–2002 data). The deviations are squared to penalize large deviations and achieve higher adaptability.

The TFP model has similar input components to the standard diet models: consumption, food prices, nutrient profiles, and Pyramid equivalent profiles. Current food consumption and nutrient profiles were generated from 24-h dietary recalls obtained in the 2001–2002 NHANES, whereas the Pyramid profiles were from the Pyramid Equivalents database. Dietary standards were based on the 1997–2004 Dietary Reference Intakes, 2005 Dietary Guidelines for Americans, and the 2005 MyPyramid Food Guidance System (18). Appropriate energy levels for each age-gender group were determined by the median weight and height of the group and the "low active" physical activity level defined by the Institute of Medicine (18). At-home national food price data were from the 2001–2002 Center for Nutrition Policy and Promotion (CNPP) Food Prices Database (19).

By expanding the TFP model to allow for FAFH, concerns raised in the literature were addressed by our analysis: the reliance on nonmonetary resources of low-income families (e.g. time, cooking skills) (5,14,17) and the important role of the FAFH in everyday food choices (5,15).

The TFP_FAFH model structure, data, and merits. Dietary recommendations of the TFP_FAFH model may be closer to "real-life" scenarios by allowing consumers to select foods from both food at home (FAH) and FAFH to meet their nutrient

needs. The TFP_FAFH model had a similar framework as the TFP model but considered FAFH choices and the associated nutrient profiles and costs. Each element in the model had 2 dimensions instead of one: FAH and FAFH. The objective function of the TFP_FAFH considered additional deviations from current low-income consumers' FAFH diet patterns. The objective function is:

$$\underset{(X_f^{fah},X_f^{fafh})}{Min}\{\sum_f BS_f^{fah}(\ln X_f^{fah}-\ln Current_f^{fah})^2 + \sum_f BS_f^{fafh}[\ln(X_f^{fafh}+0.00001)-\ln Current_f^{fafh}]^2\}. \quad \text{(Eq. 2)}$$

The second summation in Equation 2 is the additional weighted FAFH deviation. The addition of 0.00001 is to enable the model to suggest zero consumption in the FAFH dimension, because it is not possible to take the log of zero. The nutrient and adherence constraints of the TFP_FAFH model account for nutrient profiles of both FAH and FAFH and impose standards on total nutrient intakes of the recommended diet (FAH + FAFH). To compare with the TFP results, the TFP cost constraint was kept in the TFP_FAFH model. Maximum cost allowances of the TFP were increased by small increments (i.e. $0.10 at a time) until feasible solutions were reached.

A major task involved in incorporating the FAFH into the TFP was to construct the input data (i.e. prices, nutrient, and consumption) for the FAFH dimension. The 2 models used the same data sources and only differed in how these data sets were utilized. NHANES data include a variable identifying where food was consumed; this variable was used to identify FAH and FAFH and to calculate current food consumption, nutrient, and MyPyramid profiles. However, NHANES data does not account for possible differences in preparation methods between home and commercial establishments; the nutrient profiles are similar for many foods regardless of where it was consumed. Thus, we were able to consider differences in food selection, but not potential differences, in preparation techniques.

The CNPP food price database only contains at-home food prices and a national FAFH price database does not currently exist. In this study, FAFH food prices were assumed to be above FAH prices by a constant factor. USDA Economic Research Service maintains a price database, including the relative prices of food (restaurant, retail store, and manufacturers' and shippers' prices) (20). In 2007, restaurant food prices were 77% above retail store prices. This figure reflects recent price changes from 2000 to 2007 as well as the relative price gap between FAH and FAFH. For simplicity, the same 77% mark-up was used to derive FAFH prices for all 58 food groups.

Results and Discussion

The 58 food categories in as-consumed form were regrouped into the 7 MyPyramid food groups using MyPyramid Equivalents data (21) and results were presented at this aggregated level. The TFP_FAFH and the TFP both produced results for 15 age-gender groups; results for the TFP Reference Family of Four are presented as the summation of 2 adults (a male and a female aged 20–50 y) and 2 children (aged 9–11 and 6–8 y). ED, nutrient composition, and overall health profile of the TFP_FAFH plan as determined by the HEI-2005 (22,23) were assessed and the results were compared with the TFP and the current observed consumption pattern of low-income Americans. Descriptive statistics and simple correlational analyses (Pearson's *r*) were performed on dietary variables using statistical analysis software (SPSS v. 12.0).

ED. Dietary ED (kJ/g food) is as an important factor in body weight management (24–26), which is particularly relevant to low-income populations who are at increased risk for obesity and its comorbidities (25). Low-ED diets are generally low in fat and high in moisture and fiber and may be more satiating than high-ED diets, which are likely to have a higher fat content (24). The TFP_FAFH and TFP plans were comparable in ED (4.26 and 4.13 kJ/g, respectively); both were below that of the current low-income consumers' diet (4.61 kJ/g). Therefore, introducing the FAFH dimension into the TFP could be accomplished without greatly affecting dietary ED.

Nutrient and food group composition. The nutrient composition of the TFP_FAFH and TFP were compared with the current diet pattern of the poor, as well as the TFP nutrient target range (**Table 1**). These 2 plans appeared comparable in terms of nutrient composition and both were below mean consumption levels of 3 nutrients that Americans are advised to limit:

TABLE 1 Daily nutrient intake levels for SNAP reference family of 4[1,2]

	Target range[3]				
Nutrients	Minimum	Maximum	TFP_FAFH	TFP	Current[4]
Energy, *kcal*	8170	9030	8572	8536	8651
Carbohydrate, *kcal*	2993	5870	4522	4570	4580
Protein, *kcal*	665	2709	1446	1422	1267
Total fat, *kcal*	1663	3161	2805	2751	2918
Saturated fat, *kcal*	0	903	762	744	978
Linolenic acid, *kcal*	40	108	59	69	51
Linoleic acid, *kcal*	333	903	708	708	502
Cholesterol, *mg*	0	1200	902	865	1101
Fiber, *g*	120	∞	124	125	59
Vitamin A, *μg*	2600	8600	4456	5170	2160
Vitamin B-6, *mg*	4	300	10.3	10.0	6.8
Vitamin B-12, *μg*	8	∞	22.0	23.1	19.8
Folate, *μg*	1300	3000	2087	2335	2179
Riboflavin, *mg*	4	∞	10.1	10.3	8.2
Thiamin, *mg*	4	∞	7.0	7.4	6.4
Niacin, *mg*	50	105	93.9	90.5	85.4
Vitamin E, *mg*	48	2900	41.5	40.9	25.5
Vitamin C, *mg*	235	5850	427	427	348
Calcium, *mg*	4100	10000	4665	4684	3472
Copper, *mg*	3	28	6.7	7.2	4.8
Magnesium, *mg*	1110	∞	1877	1813	999
Phosphorus, *mg*	3150	15000	7085	6930	5139
Zinc, *mg*	32	115	56	54	47
Iron, *mg*	44	170	60	64	62
Potassium, *g*	17.7	∞	15.9	15.7	9.8
Sodium, *g*	0	12	11.7	11.0	13.4

[1] SNAP reference family of 4 consists of 2 adults (a male aged 20–50 y and a female aged 20–50 y) and 2 children (a child aged 9–11 y and a child aged 6–8 y) and the results presented in this paper are the summation of those 4 age-gender groups.
[2] SI unit conversion: 1 kcal = 4.184 kJ.
[3] The targets for the TFP and TFP_FAFH models were derived from the Dietary Guidelines for Americans 2005 (28) and the DRI (29). Numbers presented in this table are the summation of the 4 age-gender groups. We use median weight/height levels of each 1 of the 4 age-gender groups and a low active physical activity level (30) to define the energy level for each age-gender groups.
[4] Current refers to the current observed low-income family food consumption pattern.

saturated fat, cholesterol, and sodium. The 3 dietary patterns were compared for percentage of the Dietary Reference Intake (DRI) for micronutrients (**Fig. 3**). The TFP with and without FAFH achieved ~190% of total micronutrient DRI and the DRI content of each plan was correlated with absolute DRI micronutrient recommendations (TFP_FAFH: $r = 0.972$; TFP: $r = 0.965$; $P < 0.001$). The nutrient constraints in both plans ensured the achievement of nutrient adequacy for most micronutrients with few exceptions (i.e. vitamin E and potassium) and both plans exhibited a more favorable nutrient profile than the current observed intake pattern.

The addition of FAFH could be controversial due to the types of foods often selected, as FAFH are perceived to be high in total and saturated fat and low in dietary fiber, calcium, and iron (15). Although FAFH could be a part of an economical and healthful diet, the relatively higher levels of sodium, cholesterol, and saturated fat of the TFP_FAFH suggest that limiting FAFH may be important for those at risk for obesity and related comorbidities (27).

The food group composition of the TFP and the TFP_FAFH were compared with MyPyramid recommendations (**Table 2**). The adherence constraints in both plans ensured the achievement of the guidelines. Thus, if FAFH are carefully selected, the resulting overall dietary pattern could achieve nutritional adequacy. Compared with current low-income consumers' patterns, both plans recommended an increase in consumption of fruits, vegetables, milk, and oils and a decrease in consumption of discretionary energy.

Overall health profile: HEI-2005. The HEI-2005 is recommended for evaluating diet quality for nutrition and economic research (22). This current index overcomes limitations of previous methods that did not account for diet quantity (i.e. energy content) and permits the evaluation of a total diet as opposed to a single food group or nutrient (22,23,31). HEI-2005 assesses 12 dietary components, with a maximum score of 100 points (32). The Dietary Approaches to Stop Hypertension and the AHA No Fad Diet score in the 90–100 range and populations with known poor dietary quality receive scores of ~45 (22).

HEI-2005 scores for the TFP, the TFP_FAFH, and current low-income diet patterns were compared (**Table 3**). Both plans

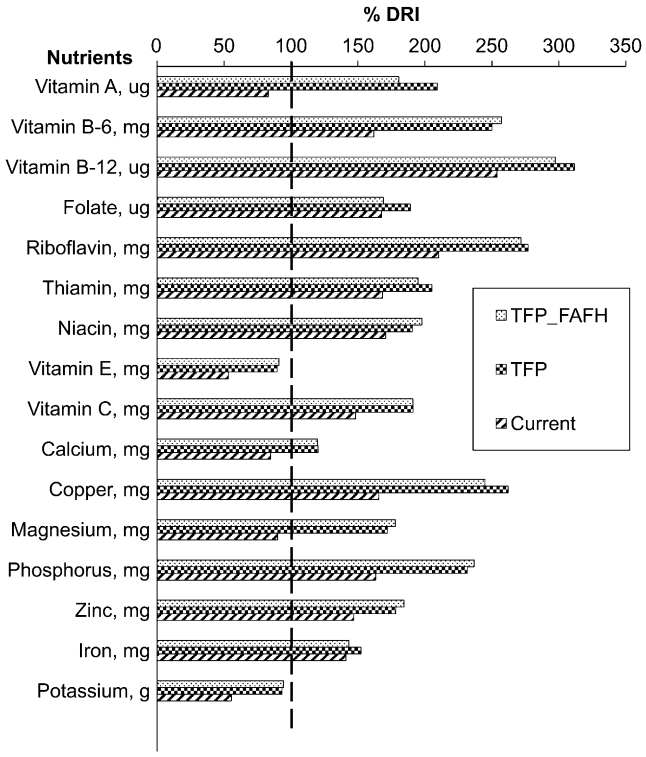

FIGURE 3 Micronutrient Percentage of the DRI provided by the TFP model with and without FAFH dimension and the current observed low-income family food consumption pattern. For range DRI, the median values were used and some after conversion to energy.

TABLE 2 Daily food group intakes for SNAP reference family of 4[1,2]

Food groups	MyPyramid standard	TFP_FAFH	TFP[3]	Current[4]
Grains,[5] *ounce eq*	25.5	29.4	29.9	29.1
Vegetables, *cup*	11.5	12.0	12.8	5.4
Fruits, *cup*	8.0	8.4	8.4	3.9
Milk products, *cup*	11.0	11.8	11.7	6.9
Meat and beans,[6] *ounce eq*	23.0	24.7	24.7	23.1
Oils,[7] *g*	112.0	119.7	124.6	65.2
Discretionary energy, *kcal*	1115	1261	1225	3049

[1] SNAP reference family of 4 consists of 2 adults (a male aged 20–50 y and a female aged 20–50 y) and 2 children (a child aged 9–11 y and a child aged 6–8 y) and the results presented in this paper are the summation of those 4 age-gender groups.
[2] SI unit conversions: 1 kcal = 4.184 kJ, 1 ounce = 28 g, 1 cup = 250 mL, 1 teaspoon = 5 mL, 1 tablespoon = 15 mL.
[3] The TFP results presented here are reproduced by the authors and are comparable to the TFP 2006 report.
[4] Current refers to the current observed low-income family food consumption pattern.
[5] The following each count as 1-ounce equivalent of grains: 1/2 cup cooked rice, pasta, or cereal; 1 ounce dry pasta or rice; 1 slice bread; 1 small muffin (1 ounce); 1 cup ready-to-eat cereal flakes (28).
[6] The following each count as a 1-ounce equivalent of: 1 ounce lean meat, poultry, or fish; 1 egg; 1/4 cup cooked dry beans or tofu; 1 tablespoon peanut butter; 1/2 ounce nuts or seeds (28).
[7] 1 g of vegetable oil = 0.2 teaspoon (21).

TABLE 3 HEI-2005 Scores: Total and Components Scores for SNAP Reference Family of Four[1,2]

Components	Maximum	TFP_FAFH	TFP	Current[3]
Total score	100.0	92.7	95.1	58.0
Adequacy				
Total fruit	5.0	5.0	5.0	2.8
Whole fruit	5.0	5.0	5.0	3.2
Total grains	5.0	5.0	5.0	5.0
Whole grains	5.0	4.4	5.0	0.6
Milk	10.0	10.0	10.0	6.1
Meat and beans	10.0	10.0	10.0	10.0
Total vegetable	5.0	5.0	5.0	2.8
Dark green and orange vegetables and legumes	5.0	4.0	5.0	1.3
Oils	10.0	10.0	10.0	6.3
Moderation				
Saturated fat	10.0	8.7	8.9	5.9
Sodium	10.0	5.6	6.3	4.0
Discretionary energy	20.0	20.0	20.0	9.8

[1] SNAP reference family of 4 consists of 2 adults (a male aged 20–50 y and a female aged 20–50 y) and 2 children (a child aged 9–11 y and a child aged 6–8 y) and the results presented in this paper are the summation of those 4 age-gender groups.
[2] SI unit conversions: 1 kcal = 4.184 kJ, 1 ounce = 28 g, 1 cup = 250 mL, 1 teaspoon = 5 mL, 1 tablespoon = 15 mL.
[3] Current refers to the current observed low-income family food consumption pattern.

scored >90, which is far better than the current consumption pattern. Thus, it is feasible to meet dietary recommendations when allowing FAFH as part of an economically constrained dietary plan, although it is recognized that nutrition educators working with low-income families must address the topic of healthy FAFH choices.

Implications for nutrition education. The objective function in TFP model depicted the deviation of the diet recommendation from the current diet pattern. The TFP had a deviation of 103.39, whereas the TFP_FAFH reduced the deviation to 52.21, signifying the relative ease achieved in adopting the TFP_FAFH recommendations. However, FAFH choices should be carefully selected to meet dietary recommendations. The TFP_FAFH recommended plan reduces current FAFH consumption in all food groups except oils (**Table 4**). For example, the TFP_FAFH grains group recommendation was 24.3 ounce equivalents (1 ounce = 28 g) from FAH and 5.1 from FAFH, compared with 19.5 and 9.5 for the current consumption. In addition, discretionary energy (i.e. extra energy from solid fats, added sugars, alcohol, or additional food from any group) choices would be reduced from both FAFH and FAH sources (from 1093 to 124 kcal for FAFH and from 1957 to 1137 kcal form FAH; 1 kcal = 4.184 kJ). Educational messages should emphasize moderating consumption of fats, added sugars, and alcohol consumption.

In response to public health concerns about obesity, the commercial food service industry has increased healthful FAFH options, which may ease the adoption of TFP_FAFH by low-income consumers. This underscores the importance of effective nutrition education programs that guide wise FAFH choices and balance between FAH and FAFH to achieve a healthy eating goal.

Cost is an important factor to consider. Based on the 2001–2002 CNPP price data and our models' results, the weekly cost of the TFP recommendation for a reference family of 4 calculated by our study was $106.00 compared with the 2001 median low-income family weekly cost of $106.70 (33). Under the assumption of a 77% mark-up of FAFH prices, the weekly cost of the TFP_FAFH recommendation for the reference family of 4 was $113.00 (i.e. a 7% increase).

In summary, the typical SNAP program family has sufficient monetary resources to eat a healthful diet (i.e. to follow the TFP recommendations) (17,33). However, monetary resources and nutrition education do not necessarily translate into improved dietary behaviors (17,34). Low-income consumers' diet patterns mirror those of high-income individuals in terms of valuing convenience and taste (17). An improvement in diet quality cannot likely be achieved through advocating health merits while ignoring practical issues such as time availability, food accessibility, and cooking skills. The American Dietetic Association (13) advocates a total diet approach in stating that: "the total diet or overall pattern of food eaten is the most important focus of a healthful eating style. All foods can fit…if consumed in moderation with appropriate portion size and combined with regular physical activity." Our findings suggest that moderate consumption of FAFH can be a part of a minimal-cost nutritious diet. The FAFH dimension adds flexibility into the recommendation and may improve its likelihood of adoption. Therefore, instead of merely suggesting that FAFH is "bad," effective interventions should consider incorporating FAFH in advice about healthy food choices. Nutrition educators may find this information useful for developing messages about FAFH food choices.

Several limitations of this analysis should be acknowledged. As stated before, NHANES data are based on USDA food databases, which accounts for the different foods chosen at home compared with away from home but not differences in preparation techniques. Thus, the resulting nutrient profile of FAFH may not be fully representative. In addition, this analysis provided information about the nutrient and food composition for FAH and FAFH sources, but this must be translated by nutrition educators into actual foods and meal plans, which may be used to guide food selections by low-income consumers. Nevertheless, these findings suggested that considering moderate FAFH in the TFP yielded similar nutrient and food group compositions as the original TFP while greatly increasing the practicality and adaptability of the recommended dietary pattern.

TABLE 4 Comparison of FAFH and FAH for SNAP reference family of 4: TFP_FAFH compared with current low-income consumption[1,2]

	TFP with FAFH		Current[3]	
Food groups (daily)	FAH	FAFH	FAH	FAFH
Grains,[4] *ounce eq*	24.3	5.1	19.5	9.5
Vegetables, *cup*	10.8	1.2	3.7	1.7
Fruits, *cup*	8.3	0.1	2.6	1.3
Milk products, *cup*	11.5	0.3	4.8	2.1
Meat and beans,[5] *oz eq*	21.5	3.2	15.1	8.0
Oils,[6] *g*	83.2	36.5	39.3	25.9
Discretionary energy, *kcal*	1137.0	123.8	1956.6	1092.7

[1] SNAP reference family of 4 consists of 2 adults (a male aged 20–50 y and a female aged 20–50 y) and 2 children (a child aged 9–11 y and a child aged 6–8 y) and the results presented in this paper are the summation of those 4 age-gender groups.
[2] SI unit conversions: 1 kcal = 4.184 kJ, 1 ounce = 28 g, 1 cup = 250 mL, 1 teaspoon = 5 mL, 1 tablespoon = 15 mL.
[3] Current refers to the current observed low-income family food consumption pattern.
[4] The following each count as a 1-ounce equivalent of grains: 1/2 cup cooked rice, pasta, or cooked cereal; 1 ounce dry pasta or rice; 1 slice bread; 1 small muffin (1 ounce); 1 cup ready-to-eat cereal flakes (28).
[5] The following each count as a 1-ounce equivalent of: 1 ounce lean meat, poultry, or fish; 1 egg; 1/4 cup cooked dry beans or tofu; 1 tablespoon peanut butter; 1/2 ounce nuts or seeds (28).
[6] 1 g vegetable oil = 0.2 tsp (21).

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Literature Cited

1. Drewnowski A. Concept of a nutritious food: toward a nutrient density score. Am J Clin Nutr. 2005;82:721–32.
2. Guthrie JF, Morton JF. Food sources of added sweeteners in the diets of Americans. J Am Diet Assoc. 2000;100:43–8,51.
3. WHO. Diet, nutrition and the prevention of chronic diseases. Report of a joint WHO/FAO expert consultation. World Health Organ Tech Rep Ser. 2003;916.
4. Brunner EJ, Mosdol A, Witte DR, Martikainen P, Stafford M, Shipley MJ, Marmot MG. Dietary patterns and 15-y risks of major coronary events, diabetes, and mortality. Am J Clin Nutr. 2008;87:1414–21.
5. Darmon N, Drewnowski A. Does social class predict diet quality. Am J Clin Nutr. 2008;87:1107–17.
6. 2008 Farm Bill. Food and nutrition act of 2008 [cited 2008 Dec 20]. Available from: http://www.fns.usda.gov/FSP/rules/Legislation/pdfs/PL_110–246.pdf.
7. Block G. Foods contributing to energy intake in the US: data from NHANES III and NHANES 1999–2000. J Food Compost Anal. 2004;17:439–47.
8. Kantor LS. A dietary assessment of the U.S. food supply: comparing per capita food consumption with Food Guide Pyramid Servings Recommendations. Agricultural Economic Report No. 772. Washington, DC: USDA, Economic Research Services; 1998.

9. Gleason P, Rangarajan A, Olson C. Dietary intake and dietary attitudes among Food Stamp participants and other low-income individuals. Alexandria (VA): USDA-FNS; 2000.
10. Drewnowski A, Darmon N. The economics of obesity: dietary energy density and energy cost. Am J Clin Nutr. 2005;82:S265–73.
11. Drewnowski A, Darmon N. Food choices and diet costs: an economic analysis. J Nutr. 2005;135:900–4.
12. Frazao E, Allshouse J. Strategies for intervention: commentary and debate. J Nutr. 2003;133:S844–7.
13. American Dietetic Association. Position of the American Dietetic Association: total diet approach to communicating food and nutrition information. J Am Diet Assoc. 2007;107:1224–32.
14. Rose D. Food stamps, the Thrifty Food Plan, and meal preparation: the importance of the time dimension for US nutrition policy. J Nutr Educ Behav. 2007;39:226–32.
15. Guthrie JF, Lin BH, Frazao E. Role of food prepared away from home in the American diet, 1977–78 versus 1994–96: changes and consequences. J Nutr Educ Behav. 2002;34:140–50.
16. USDA-Economic Research Services. Food CPI, prices and expenditures: food service as a share of food expenditures [cited 2008 19 Nov]. Available from: http://www.ers.usda.gov/briefing/cpifoodandexpenditures/data/table12.htm.
17. Stewart H, Blisard N. The Thrifty Food Plan and low-income households in the United States: what food groups are being neglected? Food Policy. 2006;31:469–82.
18. Carlson A, Lino M, Juan WY, Hanson K, Basiotis P. The Thrifty Food Plan, 2006 (CNPP-19). Alexandria (VA) USDA, Center for Nutrition Policy and Promotion; 2007.
19. Carlson A, Lino M, Juan WY, Marcoe K, Bente L, Hiza HAB, Guenther PM, Leibtag E. Development of the CNPP price database. USDA Center for Nutrition Policy and Promotion. CNPP-22, May 2008.
20. Economic Research Services, USDA. Food CPI, prices and expenditures: relative prices of food at three stages of the system [cited 2008 Nov 19]. Available from: http://www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/Data/table13.htm.
21. USDA Agricultural Research Service. MyPyramid Equivalents Database for USDA Survey Food Codes version 1.0 [cited 2009 Feb 6]. Available from: http://www.ars.usda.gov/Services/docs.htm?docid=8503.
22. Guenther PM, Reedy J, Krebs-Smith SM, Reeve BB. Evaluation of the Healthy Eating Index-2005. J Am Diet Assoc. 2008;108:1854–64.
23. Guenther PM, Reedy J, Krebs-Smith SM. Development of the Healthy Eating Index-2005. J Am Diet Assoc. 2008;108:1896–901.
24. Ello-Martin JA, Ledikwe JH, Rolls BJ. The influence of food portion size and energy density on energy intake: implications for weight management. Am J Clin Nutr. 2005;82 Suppl:236S–41S.
25. Drewnowski A, Spector SE. Poverty and obesity: the role of energy density and energy costs. Am J Clin Nutr. 2004;79:6–16.
26. Ledikwe JH, Blanck HM, Kettel Khan L, Serdula MK, Seymour JD, Tohill BC, Rolls BJ. Dietary energy density by eight calculation methods in a nationally representative United States population. J Nutr. 2005;135:273–8.
27. Bell AC, Adair LS, Popkin BM. Understanding the role of mediating risk factors and proxy effects in the association between socio-economic status and untreated hypertension. Soc Sci Med. 2004;59:275–83.
28. U.S. Department of Health and Human Services and USDA. Dietary guidelines for Americans, 2005. 6th ed. Washington, DC: U.S. Government Printing Office; January 2005.
29. Institute of Medicine, Food and Nutrition Board. DRI reports [cited 2009 Feb 6]. Available from: http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=3&tax_subject=256&topic_id=1342&level3_id=5141.
30. Institute of Medicine, Food and Nutrition Board. Dietary reference intakes for energy, carbohydrate, fiber, fatty acids, cholesterol, protein, and amino acids. Washington, DC: National Academies Press; 2002.
31. Dixon LB. Updating the Healthy Eating Index to reflect current dietary guidance. J Am Diet Assoc. 2008;108:1837–42.
32. Juan WY. Healthy Eating Index-2005 development and evaluation technical report support files. Center for Policy and Promotion, USDA [cited 2008 Dec 22]. Available from: http://www.cnpp.usda.gov/HealthyEatingIndex-2005report.htm.
33. Nord M, Andrews M, Carlson S. Household food security in the United States, 2003, Food Assistance and Nutrition Research Report No. 42. Washington, DC: Economic Research Service, USDA; 2004.
34. Fox MK, Hamilton W, Lin BH. Effects of food assistance and nutrition programs on nutrition and health. 3rd vol. Literature review. Food Assistance and Nutrition Research Program. Washington, DC: USDA-ERS; 2004.