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ECONOMICS, FOOD CHOICES, AND NUTRITION

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Consumers make dietary decisions based on economic, physiologic, psychologic, sociologic and even spiritual considerations, with hardly a nod to societal implications (see, for example, Nestle, et. al, 1998). Eating in a developed country such as the United States becomes a social and family event, an act of pleasure, that goes far beyond the ingestion of the necessary nutrients to sustain life. People eat for *both* pleasure and as a biological necessity. This must be remembered if we are to understand the complex world of food choices, dietary quality, and change.

Complexity necessitates simplification and abstraction. Human behavior is complex, economic relationships are complex, nutrition is complex; put them together and the entanglements are limitless. We must have a framework to help us sort through the possibilities; abstracting from the realities of life is a requirement, not a choice. Human behavior is so complex that to understand anything a great deal must be assumed. Differences of opinion are a natural outcome of intellectual inquiry. Joan Robinson probably said it best: "The analysis can be extended to any degree of refinement but the more complicated the question the more cumbersome the analysis. In order to know anything, it is necessary to know everything, but to talk about anything, it is necessary to neglect a great deal" (Robinson, 1941).

Many forces, most outside the consumer's direct control, shape food demand and food consumption behavior. In Senate testimony more than 20 years ago, Dr. Winikoff of the Rockefeller Foundation said of nutrition, "it is affected by governmental decisions in the area of agricultural policy, economic and tax policy, export and import policy, and involves questions of food production, transportation, processing, marketing, consumer choice, income and education, as well as food palatability and availability. Nutrition is the end result of pushes and pulls in many directions, a response to the multiple forces creating the 'national nutrition environment'" (Senate Report, 1977). We focus our attention on factors influencing consumer food choices.

Our objective is to examine empirical evidence on the role and influence of economic factors, defined rather broadly, on food choices and subsequent hence, nutritional outcomes. It is not an exhaustive review, but rather we focus on selected studies whose conclusions appear to be supported by a preponderance of the literature. Our goal is to do this in a non-technical fashion. We examine factors such as food prices, household income, nutrition knowledge and awareness, time constraints and time preferences. We do break with the central design of the paper in the last section where we discuss some new, as yet unpublished, findings.

The Basic Economic Framework

One tool frequently used by economists to examine how various factors affect consumer choices is the household production model. The basic idea is that households are producers as well as consumers. They maximize satisfaction by consuming commodities they produce by combining time, human capital, and purchased goods. For example, a household may purchase a variety of food items and combine them with cooking skills, nutrition knowledge, preparation time, and kitchen appliances to produce good nutrition. The objects of desire--nutrition or health--are produced with inputs of market goods and time. This model's success stems from its integration of biological, sociodemographic, and economic factors, all of which are at work in household consumption decisions (Becker's (1965), Lancaster (1966)).

In the household production model, production activities are always subject to available technologies, income, time constraints, and other household resources used to produce nutrition and health. Technology constraints introduce biological and sociodemographic factors into the household decision process. For example, each family member's health is produced by combining time, health inputs, the sociodemographic characteristics of the household, community characteristics, and the genetic endowment of the individual. These production processes are often interrelated because some intermediate goods produced by a household such as meals are often used as inputs into the production of a final commodity, like health.

The income constraint ensures that the household expenditure on purchased goods and services does not exceed money income. The time constraint ensures that the sum of all time inputs into the production of commodities plus leisure time and time spent at work does not exceed the total time available. The income and time constraints are also intertwined since labor earnings depend on time spent at work and the more time spent working means less time available for meal preparation and other household activities. These interlinkages are sometimes characterized in the old adage 'time is money.'

Households attempt to maximize their satisfaction by taking into account the prices of purchased inputs, wage rates, household income, as well as their sociodemographic characteristics to derive their demand for commodities (such as nutrition and health) and market goods (such as foods and medical services).

The use of the household production model to study the determinants of health, health behaviors, and health inputs was pioneered by Grossman (1977). Grossman's approach grew out of the recognition that many consumer choices, such as those relating to the amount of exercise, the nutritional quality of diets, and the purchase of medical services, are not made because consumers gain utility from these choices directly, but rather because these choices influence health. Health, in turn, is demanded because it is a source of utility and because it determines income, wealth, and overall well-being.

One distinctive element of the economic approach is the framework used to understand and quantify life's tradeoffs. In our view, consumers face four fundamental, but not necessarily mutually exclusive, tradeoffs in the food choice and nutrition arena. The first is between nutrition and taste. Can information or product development improve the terms of this tradeoff? The second tradeoff is between nutrition and costs -- the usual refrain that it costs too much to

eat healthily. In modern America, the tradeoff between nutrition and convenience is of paramount importance as incomes increase and time constraints become tighter. Time is, of course, the ultimate equalizer; everyone is limited to only 24 hours a day. The fourth tradeoff is between known short-term costs -- in terms of time, money, and perceived sacrifices in taste -- and the uncertain long-term benefits of healthy eating. Given this paradigm, what can economists contribute to solving the mystery of *why Americans with an abundance of nutrition information, high incomes, and low food prices don't eat better?*

The Old Standbys: Prices and Income

The Federal government has conducted many nutrition education campaigns to help consumers make healthy food choices, but economic factors such as food prices and consumer income are also important determinants of food choices with direct consequences for nutrient availability. For example, if the price of beef increases while the price of chicken remains the same, consumers will buy less beef and more chicken. However, other foods -- such as hamburger buns and cheese -- will also be affected. The same principle applies to consumer income. Consumers have budget constraints to live within -- one dollar spent on chicken is one less potential dollar for beef. Supermarkets often with more than 150,000 different brands and products available on their selves, are full of these potential tradeoffs for consumers (Gallo, 1996).

Rising income has been a major factor influencing food choices. In general, higher income has two results: it expands the set of potential purchases and earning it takes time. Consequently, income is inextricably linked to the demand for convenience foods and food away from home.

Over the past two decades, the overall price of food has risen about the same as that for nonfood while consumer incomes have risen dramatically (Putnam and Allshouse, 1997). Together this means that food is more affordable than ever -- Americans spend only about 11 percent of their incomes on food -- and higher incomes allow consumers to purchase higher quality foods, eat foods considered more enjoyable, and dine out more often (Putnam and Allshouse, 1997). The American Heart Association identified easily affordable food as one of the root causes of the over-consumption that is making obesity a major risk factor for heart disease (AHA press release, 1998). However, some people believe that food prices are still a barrier to healthy eating. A 1995 survey by the Food Marketing Institute and Prevention magazine found that 51 percent of consumers agreed with the statement "It costs more to eat healthy foods." In some ways this is true and may particularly impact low-income consumers. Frazao and Allshouse (1996) found that food products modified in fat, sodium or other food constituents generally cost more than their standard counterparts (See also Nestle, 1994). If consumers believe that dietary change requires using these specialty products, they will perceive change to cost more. Frazao and Allshouse also found that sales volume for all 37 food categories analyzed rose 10.9 billion pounds from 1989-93 with nutritionally improved versions contributing 78 percent of that increase. However, other research indicates that it is possible to eat healthy using standard products that are less expensive, but perhaps require some sacrifices in taste (McAllister et al. 1994).

Understanding Price Changes

Several recent studies have examined the complex changes in consumption that would result from price changes for various commodities and the subsequent impact on the availability of nutrients in the US food supply (Huang, 1993, 1996). These studies found, for example, that an increase in beef prices decreases daily availabilities of calories, total fat, cholesterol, protein, and saturated fat and increases the availability of vitamins A and E. However, it decreases the availability of calcium, iron, and fiber. These results highlight the interdependence among food choices. For example, an increase in the price of beef is associated with decreased consumption of some grains, fruits, dairy products, and vegetables, which explains the decreased availability of fiber and calcium. Because of the interdependence of food choices, well-intentioned proposals such as a “fat-tax” need to be carefully analyzed for any unintended implications.

Income and Convenience

Several economic studies have estimated the effects of economic, regional, and demographic variables on food expenditures (Blisard and Blaylock, 1993; Blaylock and Smallwood, 1986). The more recent analysis found that food away from home was 3 times more responsive to income changes than food at home but found mixed evidence that rising incomes increase the demand for individual high fat and cholesterol foods. The largest income response for an individual food was for “other dairy,” a mixture of low- and high-fat items. The second most responsive food was fresh fruit, very low in fat and cholesterol. However, cheese, a high-fat item, had a relatively high income response.

Comparing income responses between the two studies gives an indication of changing economic responses over time, which may be caused by changes in incomes or consumers perceptions of food qualities. In general, the more recent study found lower income responses than the earlier one. Food away from home retained its very high response to income, but the response of food at home dropped sharply. The income responsiveness of meat, poultry, fish and eggs declined by 50 percent, while the income responsiveness of eggs became negative, consistent with other studies. Fresh fruit became more responsive to higher income, while butter’s response declined sharply. This evidence supports the notion that responses to income change over time as consumers reevaluate foods’ characteristics. These changes are consistent with a shift toward healthier diets, although changes in relative prices and other factors cannot be ruled out by examining just these two independent cross-sectional studies.

Two recent studies have explored the effect of information by examining national consumption and price data for cholesterol and the fats and oils complex. (Brown and Schrader, 1990; Yen et. al., 1996) Brown and Schrader found that the increase in information about cholesterol decreased per capita egg consumption 16 percent over the 1955-1987 period. Yen et. al. found that information changed demand for fats and oils; in particular, resulting in reduced consumption of butter and lard, but not necessarily all fats and oil. Thus, it is not inevitable that affordable food will defeat nutrition information in determining diets.

In summary, evidence is somewhat mixed on the impact of rising income on the demand for individual foods with particular nutrient profiles has increased or decreased. In sharp contrast to the above, there is no debate that food away from home is becoming ever more popular and that income and economic forces are the major determinants. The reasons are well-known: higher incomes, convenience, more women in the labor force, and smaller households. The frequency

of dining out increased by more than two-thirds over the past two decades rising from 16 percent of all eating occasions in 1977 to 27 percent in 1995 (Lin, Frazao, and Guthrie, forthcoming). Consequently, a greater proportion of nutrient intakes have been obtained from away-from-home food sources. For example, food away from home provided 34 percent of total caloric intake in 1995, nearly double the 19 percent in 1977. Similarly, away-from-home foods provided 38 percent of total fat intake, 29 percent of total calcium intake, and 27 percent of total iron intake in 1995, compared with 18, 17, and 16 percent, respectively, in 1977.

Rising consumption of food away from home may make it more difficult for consumers to make informed choices regarding the nutritional content of meals. Many people, including many dietitians, have a very difficult time measuring the nutritional quality of a meal or a mixture of foods. In fact, 203 dietitians were asked to guess the amount of fat and calories in 5 prepared meals (Center for Science in the Public Interest; New York Times, 1998). They were generally way off the mark. For example, a hamburger and onion rings, with 1,550 calories and 101 grams of fat, were surmised to have only 863 calories and 44 grams of fat. This has become an increasingly important problem in our society as dining out, fast foods, home delivery, and prepackage meals become an ever growing part of our culture. People may be aware of the nutrient content of a particular food but the situation becomes more complex when foods and ingredients are combined in unknown portions with unknown preparation methods.

A recent study has also shown that between 1977-1995, smaller nutritional improvements occurred in foods prepared away from home than in home foods, and, in 1995, away-from-home foods typically contained more of the nutrients over consumed and less of the nutrients under consumed by Americans than home foods (Lin, Frazao, and Guthrie, forthcoming). For example, fat provided 41 percent of calories for both home and away meals in 1977. By 1995, the fat content of home foods had declined steadily to 32 percent of calories but only to 38 percent for foods away from home. A similar story holds for saturated fat.

Interestingly, since food away from home contains more fat and cholesterol and less fiber, its higher income response could counter improved knowledge and attitude effects that may come with higher income. This question is addressed later.

Perceptions Often Do Not Match Reality.

Nutrition advice is often given, with some notable exceptions, in terms of eating less of this nutrient or more of another. This advice rests on the assumption that people know not only what nutrients are in the food they eat, but also the quantities -- especially difficult information to obtain when dining at the local cafeteria or steakhouse. Herein then lies the dilemma: What if actual intakes vary significantly from perceived intakes? All the dietary advice in the world will fall on deaf ears if people *believe* their diets are meeting dietary recommendations. Unless someone is gaining unwanted weight or experiencing some health problem they are likely to reach the reasonable conclusion that nutrient supply equals nutrient demand. That is, change is not necessary. The evidence is not encouraging. Approximately 30-percent of Americans believe their diets contain about the right amount of fat for a healthy diet and another 46 percent believe their diets contain too much fat (Bishow, Blaylock, and Variyam, 1998). The fact is that both groups obtain 37 percent of their calories from fat sources. Both of the groups present challenges for nutrition educators. The optimists may not respond to nutrition advice since they

believe their diets conform already to dietary guidelines and the realists simply may not see a need for change.

Time Preferences and Constraints

Today's nutritional issues are driven by the discovery of strong links between nutrition and chronic diseases, such as coronary heart disease, cancer, and stroke. Nutritional concerns now focus on excessive consumption of fats, saturated fats, and sodium and the under consumption of some nutrients and food components, such as calcium, dietary fiber, and iron. Whether the problem is over-or-under consumption, the common denominator is that the associated health outcomes are often slow to manifest themselves and in many cases may never appear. This uncertainty and delayed impact effects consumer behavior. There is simply no guarantee to a consumer that a lifetime of healthy eating will result in reduced morbidity outcomes or increased longevity. Perhaps all that is required is to begin practicing good nutrition at some point in life or substitute medical inputs for that low-fat, high fiber diet. Economists simplify these behavioral phenomena into a factor often referred to as time preferences.

In the long-run, taste considerations may simply prevail; habits and other forces may be too difficult to overcome. Similarly, the uncertain future benefits of better nutrition -- you have to die of something -- may outweigh the perceived potential benefits of healthy eating. Put differently, for many people healthy eating is just not worth the effort and sacrifice. The latter may be a particularly difficult phenomena to overcome since Americas seem to discount the future heavily. We need to look only at the nation's extraordinary low savings rates or the high credit card balances for evidence. Convincing people of the long-run benefits of good nutrition is clearly made more difficult if immediate gratification is given a higher priority.

Time constraints are another important consideration. Time is required to obtain nutrition information and to purchase and prepare nutritious food competes with time that could be used in labor markets, for leisure, or at the shopping mall.

Time constraints also affect the gathering of nutrition information. A consumer seeking nutrition information can use a variety of sources, each with a time and monetary cost and a perceived contribution to their well-being. Advertisers' information will have the lowest cost, but not necessarily the highest perceived contribution. Generally, consumers obtain information from sources low in search costs, but value information from other sources more highly. In one poll, respondents cited print media and TV as the most common sources of nutrition information, but cited doctors, books, and dietitians as the most useful. Family and friends fell in between. This apparent discrepancy between use and usefulness is consistent with the costs of information sources; information from medical professionals is both expensive (in time and money) and rarely used. Gleaning information from books takes time and is rarely sought. Virtually free information through the mass media is widely used, even if given marginal value.

Food is the second most advertised product category (Gallo, 1996). With a bewildering array of food items from which to choose, research indicates that the average consumer takes only 12 seconds to make a brand selection with nearly half choosing in one second (Moorman, 1996). That is not much time to compare prices or check a nutrition label. Of course, Madison Avenue

with sixteen billion advertising dollars seeks to help us here. Not surprisingly, most of these advertising dollars promote prepared and convenience foods, snacks, and alcoholic beverages. As a reference point, the Federal government spends about \$326 million annually promoting the Food Guide Pyramid and other healthy eating practices (USDA Report to Congress, 1995) .

Time constraints were cited as an obstacle to better nutrition by 21 percent of consumers (ADA, 1995). Mothersbaugh et al. (1993) found that time constraints had a negative effect on an individual's adherence to recommended dietary practices. However, increased nutrition knowledge, such as better meal planning and preparation skills, offset the negative effects of time constraints. Confusion about dietary advice is also a form of time constraint. About 21 percent of consumers agreed that there are so many conflicting studies they don't know what to believe (ADA Nutrition Trends Survey). This makes it very time intensive, or impossible, to sort through the masses of information. The development of the *Dietary Guidelines for Americans*, which give a clear and consistent message to consumers about what they should eat to be healthy, is one approach to solving this problem. Continued promotion of the Dietary Guidelines as a source of consistent, reliable advice may help overcome this barrier (Sutton et al., 1995).

Nutrition Knowledge, Attitudes, and Awareness

Most paradigms assume that when the consumer is provided with knowledge -- nutrient content of foods, for example--attitudes toward diet will change, resulting in changed dietary behavior. However, knowledge by itself will not affect behavior; motivation must be provided. The motivational knowledge could be that healthy eating will produce better health and reduce risks of chronic diseases. Of course, the costs of acquiring and processing information are important constraints.

One convenient way of characterizing nutrition is the Rogers system, which identifies three types of knowledge: awareness, knowledge of principles, and awareness of diet and health relationships (Rogers, 1983). To this list, we would suggest adding attitudes and barriers to change.

Awareness of Diet and Disease Relationships

Awareness of a relationship between diet and health is assumed to be the first step in motivating interest for acquiring knowledge about healthy eating choices. Americans show fairly high levels of awareness of relationships between diets and chronic disease, such as heart disease and cancer (Levy and Heimback, 1989; Ippolito and Mathos, 1995, 1996). In general, consumers are aware of health problems associated with many nutrients. For example, 71 percent of consumers are aware of health problems associated with how much fat a person eats; 59 percent are aware of the health/saturated fat intake, but only 48 percent are aware of the association between health and iron intake (Variyam, Blaylock, and Smallwood, 1997).

Furthermore, consumers are becoming more aware of diet/health relationships. Less than 20 percent of consumers were aware of a linkage between fats and heart disease in 1982, but more than 25 percent now know of the link between cholesterol and heart disease (Guthrie, Derby, and Levy, 1998). By 1995, 60-percent of consumers know of the fat/heart disease association, far out pacing cholesterol in the public's eye as the key dietary risk factor for heart disease.

Interestingly, saturated fat has not penetrated the public consciousness. Only about 5 percent of consumers thought the relationship between saturated fat consumption and heart disease was an important risk factor, unchanged for 13 years.

Awareness of links between diet and cancer has also increased but is below levels for heart disease. In particular, more than 30 percent of consumers mention fruits and vegetable consumption as associated with cancer, up from about 15 percent in 1984 (Levy and Derby 1995, 1996).

However, awareness of health problems associated with diets is not a panacea. Awareness of the link between weight and health is virtually universal, but obesity is a widespread problem (Kuczmarski, et al., 1994). The same is true for calcium. Despite widespread knowledge of calcium and health relationships, consumption is still below recommendations for women over age 20 (Tippett, et al. 1995; Food Surveys Research Group, 1996). Other factors are clearly intervening.

Knowledge of Nutrition

Knowledge of nutrition can take two general forms: knowledge of principles (e.g., advice about the percent of calories that should come from fat) and knowledge of the specific nutrient content of a food. The extent of consumer knowledge in these areas is mixed (Levy, Fein, and Stephenson, 1993). Only 33 percent of consumers know that saturated fat is more likely to be a solid while 39 percent are aware that cholesterol is found only in animal products (Variyam, et al. 1997). In terms of knowledge of the nutrient content of foods, consumers do better. For example, almost 90 percent of consumers know that regular hamburger contains more fat than ground round; butter contains more cholesterol than margarine; and white bread has less fiber than wheat bread (Variyam, et al. 1996, 1997).

Knowledge of nutrition principles, like awareness, is not a panacea. Despite high levels of knowledge, fiber consumption is low and fat consumption is high, suggesting intervening factors, such as the demand for convenience, dining out, and taste considerations are having a significant influence.

Attitudes About Attributes

Nutrition knowledge arms the consumer with tools for instituting change but the consumer's attitude determines whether the motivation exists for making the change (Axelson and Brinberg, 1989). Attitudes are subjective and involve the tradeoff between one attribute of a food, meal, or diet against another. If consumers do not value the nutritional qualities of foods more than taste, convenience, or price then they may not choose nutritious foods, regardless of knowledge levels.

Surveys by the Food Marketing Institute indicate that more than 75 percent of consumers place a high value on nutrition, but almost 90 percent value taste and 64 percent think price is very important (Food Marketing Institute, 1989, 1995-97). Evidence from USDA surveys indicate that 67-percent of consumers believe choosing a diet with plenty of fruits and vegetables is important; 61 percent a low-fat diet; and 37 think people should eat at least two servings of dairy products daily (Guthrie, Derby, and Levy, 1998). Seventy-five percent thought it very important

to maintain a healthy weight (Guthrie, Derby, and Levy, 1998). Positive attitudes about nutrition may motivate change; negative attitudes present a barrier. A American Dietetic Association survey indicates that 38 percent of consumers believe that to improve their diets requires giving up favorite foods (ADA, 1995).

ERS Studies of Nutrition Information

Economic Research Service (ERS) has been conducting recent studies using data on individuals to explore the influence of nutrition knowledge, attitudes, awareness of diet/health links, income, education, and personal and household characteristics on diet quality and nutrient intakes. ERS has published detailed analyses of consumer intakes of fat, cholesterol, fiber, and as well overall diet quality (Variyam et al, 1997, Variyam et al, 1995, Variyam, et al., 1998). Recent work has focused on examining the influence of a mother's nutrition information on the diets of her children. These studies use two surveys of the same population: the Continuing Survey of Food Intakes by Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS) of USDA. The CSFII is an interview and diary record of food ingestion for a three-day period. The DHKS is a follow-up telephone survey with the "food managers" of the responding households, and contains questions on knowledge and attitudes about nutrition.

The ERS work is unique in several ways. First, direct measures of nutrition knowledge are used. Previously, only Kenkel in the health area has used direct measures of information to examine the demand for physician services and the role of schooling in the choice of healthier habits (Kenkel, 1991). Prior studies have used proxies for nutrition knowledge, such as years of education or income that may account for information differences among people. The problem with this approach is that such variables have a direct effect on health input choice, besides their indirect effect on input choice through information. These direct and indirect effects cannot be separated without explicitly modeling information separately from diet quality or nutrient intake, that is, treating information as an endogenous factor. This has the important implication that key diet quality determinants, such as education and income, as well as other personal and household characteristics may influence both quality and nutrition information levels simultaneously. For example, this approach allows the separation of income effects into a direct effect on quality because of purchasing power or time constraints and an indirect effect through nutrition knowledge. Consequently, it may be the case that income increases fat intakes because it increases the demand for fatty meats but at the same time, since income and nutrition information levels are related, it may have a dampening impact on fat intakes. Heretofore, these types of impacts could not be separated. Lastly, the ERS approach assumes that nutrition information cannot be directly observed (a latent variable) but can only be indirectly measured via various indicators. For example, questions probing diet-health awareness were combined to form a single underlying measure of diet/nutrition knowledge (see Table 1 for examples). Similarly, questions on nutrient content knowledge were used to form a specific measure of content knowledge.

Research Findings from One ERS Study

A recent ERS study examined the influence of maternal nutrition knowledge and other maternal characteristics on the diet quality of children between 2 and 17 years of age. Diet quality is

assessed using the Healthy Eating Index, U.S. Department of Agriculture's instrument for measuring overall diet quality incorporating 10 recommended nutritional guidelines (USDA, 1995). Much of the existing research on a maternal role in children's health and nutrition is in the economic development literature (Barrera, 1990; Behrman, 1995; Behrman and Wolfe, 1987; Haughton and Haughton, 1997; Kassouf and Senauer, 1996; Senauer and Garcia, 1991; Thomas and Strauss, 1992), and only a few studies have provided direct evidence on the role of information (Thomas, Strauss, and Henriques, 1991). Relatively little is known in the U.S. context about the relationship between a child's diet and the nutritional literacy of the person responsible for meal planning or preparation--often the mother. The existing U.S. evidence linking parental nutrition knowledge and children's intake of nutrients is mixed (Colavito et. al., 1996; Klesges et. al., 1991). Lack of controls for measurement errors and endogeneity of parental nutrition knowledge may have contributed to these inconclusive results.

Presented in Table 1 is a sample of the types of indicators used to develop the measures for nutrient content knowledge and awareness of diet-disease relationships. While nutrition knowledge may be increasing for the population as a whole, levels vary widely among different population groups. For example, income and education have similar effects: the more you have the more you're aware of diet-disease relationships and the more nutrient content questions you can answer correctly. Whites answered more nutrient content questions correctly and were more aware of diet-disease relationships than nonwhites. Ability to answer nutrient questions also varied by ethnicity. Knowledge differences varied little by mothers' age.

Maternal Knowledge and Childrens' Diet Quality

The ERS study found significant evidence that greater maternal health and nutrition knowledge leads to better diet quality for preschoolers but not necessarily for school-age children after accounting for the influence of maternal background characteristics, health habits, and household characteristics. *Nutrition information makes a difference.* These results lead to the conclusion that health and nutrition education may be more effective if targeted toward mothers with young children and school-age children.

ERS research suggests that both maternal education and household income have positive effects on maternal nutrition knowledge, consistent with the hypothesis about their role in increasing access to and use of information (Ippolito and Mathios, 1990). Like Thomas, Strauss, and Henriques (1991), ERS finds that after the knowledge-enhancing role of maternal education is taken into account, its direct effect on child diet quality is negative. Conditional on nutrition knowledge, education may be increasing the demand for convenience foods and food-away-from home, both have been found to be of lower dietary quality (Lin, Guthrie, and Blaylock, 1996; Lin and Guthrie, 1996).

Mothers' age may capture the effects of learning and experience that remain after controlling for her schooling. Height is a key variable used in many previous studies to control for maternal background effects (Behrman, 1995). Consistent with previous results, ERS finds that maternal age and height are significantly related to higher childrens' diet quality (Barrera, 1990; Haughton and Haughton, 1997; Thomas and Strauss, 1992). However, neither maternal height nor age has information-related effects, suggesting that they capture maternal background and endowment effects that do not influence information acquisition. For example, older mothers

may have developed “rules of thumb” about food selection and preparation techniques that translate into healthier diets, holding nutrition knowledge levels constant.

Excepting Haughton and Haughton (1997) in a developing country context, few have studied maternal weight as an explanatory variable. While they found a positive relationship between child nutrition and maternal weight, ERS finds that maternal weight has an inverse relationship with childrens’ diet quality through its influence on maternal nutrition knowledge. One explanation is that obesity may be discouraging mothers from investing further in information acquisition and processing. This conclusion is supported by the fact that the adverse influence is greater at higher weight levels. These opposite findings are clearly related to the fact that in developing countries, weight is a positive indicator of health since under consumption of foods and nutrients related to weight is the major problem. In the U.S. and other industrialized countries, overweight or obesity is a negative indicator of health. Therefore, both results confirm the underlying relationship that maternal health endowment is positively related to children’s nutritional outcomes.

One key variable overlooked in the children’s health and nutrition literature is maternal time preference. Several studies have emphasized that health habits as well as other human capital choices may be affected by an individual’s time preference (Farrell and Fuchs, 1982; Grossman and Kaestner, 1995). An individual who places a higher value on current enjoyment may place less value on healthy habits, education, and information acquisition activities compared to those who place a higher value on future enjoyment. In the mother-child context, this means a positive effect of maternal education or maternal health knowledge on child nutrition may be due to a mother’s lower time preference which places a higher value on both her and her child’s future health. To estimate the ‘true’ education or information acquisition effect, it is necessary to have a control for maternal time preference. In the ERS study, mothers’ smoking status is used as such an indicator (Evans and Montgomery, 1994). Results indicate that maternal smoking has a substantial negative effect on children’s diet quality. The sizable effect of maternal smoking status is also not related to information. This poses a challenge to nutrition educators since standard nutrition information programs are not likely to lower the dietary risk of children with smoking mothers. This result also has important policy implications given that earlier studies have found that smoker’s own diets are substantially worse than of nonsmokers (McPhillips, Eaton, and Gans, 1994). An earlier study of the diet quality of household main meal planners found that smokers have significantly lower Healthy Eating Index (HEI) scores than nonsmokers (Variyam, Blaylock, Smallwood, and Basiotis, 1998). The present results show that this negative effect is transmitted to children with essentially a similar, if not a higher, magnitude. Therefore, nutrition education programs need to target smokers, particularly those who are the main meal planners of their household, and alert them to the possible negative influence of their health habits on their children’s diets.

In previous studies, children’s age and sex have been included to capture possible gender and age discrimination in the allocation of household resources. To the extent that children’s diets are under parental control, gender or age differences were not expected in the ERS study and none is found. Among household characteristics, there is a large positive effect for children from households where at least one member is on a vegetarian diet. As the *Dietary Guidelines for Americans* notes, vegetarian diets are consistent with its recommendations and can meet

Recommended Dietary Allowances for nutrients. This result and the result for smoking show how strong intra-family effects are generated by the health habits of individual members of the household.

Other household characteristics are generally insignificant, except race, in explaining variation in children's HEI scores. HEI scores for black children are lower than those of other races. Given the potential effect of such higher dietary risk for preschoolers on their future health and schooling, this is a clear indication that nutrition education programs should target black households for special attention.

The effects of nutrition information sources are as expected. Time spent watching television is inversely related to knowledge, possibly because it curtails more information-intensive activities like reading. The effects of receiving dieting advice from a physician or a dietician, and the education level of the male head have positive effects on children's HEI, working through increased knowledge.

Summary

Overall, it appears that the forces of rising incomes, time constraints, time preferences, and moderate food prices are outweighing nutrition and health information. Between 1970 and 1994, the calories available in the food supply rose 15 percent (Putnam and Allshouse, 1997). In 1998, the American Heart Association declared obesity a risk factor for heart disease while citing increased levels of obesity in the United States, from 25 percent in 1976-1980 to 36 percent in 1997. The increase in obese Americans accompanied a decline in the percent of calories from fat: from 40 percent of the diet in 1965 to 34 percent in 1991. Obesity is probably due to greater caloric intake and inactivity (American Heart Association, 1998).

These trends may not be inevitable. Economic studies reveal that consumers' response to changes in income can change in a direction consistent with nutrition information. But even after these changes, increased incomes continued to lead to higher food intakes. A population which is putting itself at risk through eating calls for information strategies that can balance economic forces.

Other evidence reveals improved knowledge over time. On balance, Americans appear to be acting on nutrition information, but offsetting the cumulative effect on their total diets with increased calories and added fats and oils. These two trends reflect both economic forces--income and a desire to save time--and possibly less recognized calories and fat in processed foods. The economic forces will continue to operate but there is hope that the information effects of increased incomes and schooling will eventually offset their more direct effects. Additionally, time preferences may change. A substantial improvement in overall diet quality could arise, if Americans become convinced that longer term gains in health can become a reality through short-term modifications in eating habits.

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Table 1 -- Sample of Nutrition Knowledge Questions and Mothers responses

Question	Percent of Correct Responses
Which has more fiber?	
<u>Fruit</u> or meat	81.8
<u>Whole-wheat bread</u> or white bread	92.9
<u>Kidney beans</u> or lettuce	53.6
Which has more cholesterol?	
<u>Butter</u> or margarine	83.8
Egg whites or <u>yolks</u>	79.2
Skim milk or <u>whole milk</u>	95.5
Which has more fat?	
<u>Regular hamburger</u> or ground round	86.7
<u>Hot dogs</u> or ham	66.6
<u>Peanuts</u> or popcorn	89.6
Yogurt or <u>sour cream</u>	87.3
<u>Porterhouse steak</u> or round steak	52.3
Which kind of fat (saturated, <u>polyunsaturated</u>) is more likely to be a liquid rather than a solid? Or are they equally likely to be liquids?	26.9
Is cholesterol found in vegetables and vegetable oils, <u>animal products</u> , or all foods containing fat or oil?	35.1

Source: 1989-90 Diet Health Knowledge Survey.

Note: Correct answers are underlined.

**Table 1 cont. --Diet-health knowledge questions and percent responses
Children's Nutrient Intakes Study**

Question	Percent of "Yes" Responses	
	Age 2-5	Age 6-17
Have you heard about any health problems that might be related to how much:		
Fat a person eats?	70.8	74.0
Saturated fat a person eats?	57.5	61.9
Fiber a person eats?	47.1	51.3
Salt a person eats?	81.5	88.8
Calcium a person eats?	63.6	63.9
Cholesterol a person eats?	85.7	85.9
Sugar a person eats?	80.5	80.9
Iron a person eats?	54.9	52.0
Being overweight?	87.0	90.9
N	308	538

Source: 1989-90 Diet Health Knowledge Survey.