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Food purchasing behaviors, dietary energy density, perceived health status, and perceived nutrition knowledge of female food stamp recipients living in Southeast Louisiana

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FOOD PURCHASING BEHAVIORS, DIETARY ENERGY DENSITY, PERCEIVED HEALTH STATUS, AND PERCEIVED NUTRITION KNOWLEDGE OF FEMALE FOOD STAMP RECIPIENTS LIVING IN SOUTHEAST LOUISIANA

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BMI	=	body mass index
BRFSS	=	Behavioral Risk Factor Surveillance System
¢	=	cents
CCHIP	=	Community Childhood Hunger Identification Project
CDC	=	United States Centers for Disease Control and Prevention
CFSM	=	United States Core Food Security Module
CNPP	=	Center for Nutrition Policy and Promotion
CSFII	=	Continuing Survey of Food Intakes by Individuals
DGA	=	Dietary Guidelines for Americans
DRI	=	Dietary Reference Intakes
EAR	=	Estimated Average Requirement
EBT	=	Electronic Benefits Transfer
ED	=	energy density
EDNP	=	energy-dense, nutrient-poor
EI	=	energy intake
FSP	=	Food Stamp Program
g	=	gram
hdi	=	healthy diet indicator
kcal	=	kilocalorie
kg	=	kilograms
kJ	=	kilojoules
lb	=	pound

LP = linear programming

LSRO = Life Sciences Research Office

m^2 = meters squared

ND = nutrient density

NHANES= National Health and Nutrition Examination Survey

NRC = National Research Council

% = percent

PRWORA = Personal Responsibility and Work Reconciliation Act

RDA = Recommended Dietary Allowance

SES = socioeconomic status

TFP = Thrifty Food Plan

UK = United Kingdom

USDA = United States Department of Agriculture

WHO = World Health Organization

ABSTRACT

Purchase and consumption of energy-dense nutrient poor [EDNP] foods by low-income individuals contributes to the lower diet quality and increased risk of chronic disease (e.g. obesity, type 2 diabetes) in this population. Food purchasing behaviors, dietary energy density [ED], perceived health status, and perceived nutrition knowledge were assessed in 22 female food stamp recipients in Southeast Louisiana. Two 24-hour recalls (at the beginning and at the end of the month) and food expenditure receipts were collected; participants also completed several questionnaires. Fifty percent [%] (n=11) of study participants were food secure, and fifty percent (n=11) were food insecure. Sixty-four % (n=14) of study participants were obese. Perceived nutrition knowledge was significantly associated with body mass index [BMI] (p=0.021) and with monthly expenditures on EDNP foods (p=0.076). A significant association of perceived eating habits with BMI was found (p=0.023). Age was significantly associated with monthly expenditures on EDNP foods (p=0.007), monthly fast food consumption (p=0.090), and perceived physical health (p=0.086). Food security status significantly influenced monthly expenditures on EDNP foods (p=0.007) and monthly fast food consumption (p=0.095), but did not significantly influence BMI or perceived physical health. Income per person in the household was also found to significantly influence perceived physical health (p=0.060). The impact of food purchasing behaviors and dietary energy density on the health of female food stamp recipients in Louisiana should be studied further.

CHAPTER 1

INTRODUCTION

Food insecurity is defined as "limited availability of nutritionally adequate and safe foods or limited ability to acquire acceptable foods in socially acceptable ways" (1). Some American households cope with food insecurity on a regular basis. National prevalence estimates from 2004 revealed four demographic groups with food insecurity rates well above the national average of 11.2 percent (%): households with children, headed by a single female (31.7%); households with incomes below poverty level (35.1%); African-American households (22.1 %); and Hispanic households (22.3%) (2). Socioeconomic predictors of food insecurity have been established; low household income and a single female head of household (with less than twelve years of education) are considered the most important predictors (3-6).

Prevalence estimates of obesity (7-9), and the chronic diseases related thereto (*e.g.* type 2 diabetes, coronary heart disease) (10-11), are remarkably higher among African-American females than their Caucasian counterparts (7-13). Females in low-income households, including those participating in the Food Stamp Program (FSP), have a higher propensity for becoming overweight/obese (7,11,14) and for self-reporting chronic diseases (6) or poorer general health (8) than females in higher income households.

Energy density (ED) is an important variable in the assessment of diets and food choices of low-income households. Diets with high ED that are high in fats and added sugars, and lack adequate nutrients, are termed energy-dense nutrient-poor (EDNP) (15-19). High ED foods are available at low cost, are associated with greater satiety, and are often consumed by low-income households in order to avoid hunger and save money (16-22). Conversely, nutrient dense (ND) foods are low in ED but high in essential nutrients; these foods are often more costly and less

satiating than ED foods (15-18). Evidence of increased consumption of EDNP foods among low-income females supports the assertion that these women have diets that may compromise their overall health (5,6,15-22).

Objectives

The objectives of this study were: 1) to correlate food security status of female FSP participants with the amount of money spent on ED foods; 2) to examine specific foods purchased by analysis of grocery receipts; 3) to categorize foods from each collected grocery receipt into EDNP or ND categories; and 4) to compare the ED of foods purchased to perceived nutritional knowledge, perceived physical health status, perceived energy intake, and actual body mass index (BMI).

Hypotheses

It was hypothesized that:

1. Food insecurity status would be inversely correlated with monthly expenditures on EDNP foods.
2. An inverse correlation would exist among subjects' perceived nutrition knowledge, perceived physical health at the present time, perceived energy intake, and monthly expenditures on EDNP foods.
3. A positive correlation would exist among monthly food stamp allotments, monthly expenditures on EDNP foods, and subjects' BMI.

Assumptions

The assumption made in the design and implementation of this study was: foods purchased by participants were representative of typical purchases in these households.

Limitations

Limitations of this study were:

1. A non-probability sample was used.
2. Return of grocery receipts relies on motivation and memory; some participants did not return all food receipts obtained during the time this study was conducted.

Justification

This exploratory study is important for several reasons. First, examination of types and amounts of EDNP foods purchased will extend the literature on the relationships among food security, FSP participation, food purchasing behaviors, and diet quality. Research on these relationships is critical for Louisiana, since rates of poverty and low education levels are higher in the state than for national estimates (23). Poorer diet quality and increased risk of chronic disease are disproportionately higher in populations with lower incomes and lower education levels; thus, women in our sample are more likely to experience poorer diets and chronic diseases than the general population. Second, categorization of foods into EDNP and ND groups will help uncover which food types are overrepresented and underrepresented in the diets of this population. Third, comparison of the energy densities of foods purchased to demographic indicators will allow for speculation regarding the influences of self-reported health status, education, and perceived nutrition knowledge on food purchasing behaviors.

More research is needed concerning the effects of FSP participation on food purchasing behaviors, diet costs, and diet quality. This exploratory research project seeks to do this. Data collected from this research will extend the literature on the diet quality of FSP participants, and will also be made available to policymakers, nutrition educators, FSP coordinators, and Food Stamp Nutrition Education program coordinators. The availability of this research will allow

more informed decisions to be made regarding FSP policies concerning the nutrition education of FSP participants.

CHAPTER 2

REVIEW OF THE LITERATURE

Food Security/Insecurity

Background

In 1990, the 101st U.S. Congress established the National Nutrition Monitoring and Related Research Act (USC PL101-445), which fostered the establishment of a research program to standardize measures of food security, food insecurity, and hunger (1). The concept of food insecurity was adopted officially in 1992 with the initiation of the Food Security Measurement Project, and was used as a framework for researching and designing policies to address poverty-related food access problems in United States households. The Life Sciences Research Office (LSRO) of the Federation of American Societies of Experimental Biology, in collaboration with the American Institute of Nutrition, developed and published conceptual definitions of food security, food insecurity, and hunger (1). Sponsorship by the United States Department of Agriculture (USDA) Food and Consumer Services and the Centers for Disease Control and Prevention (CDC), the National Center for Health Statistics allowed for these conceptual definitions to be operationalized; empirical measures of food security were subsequently developed in the Food Security Measurement Study of 1995-1997 (1).

Concepts and Definitions

Food security, as defined by the LSRO expert panel, refers to "access by all people at all times to enough food for an active, healthy life (14)." Food security must include, at a minimum, "ready availability of nutritionally adequate and safe foods, and an assured ability to acquire acceptable foods in socially acceptable ways (14, 24)." In contrast, food insecurity is

defined as “limited availability of nutritionally adequate and safe foods or limited ability to acquire acceptable foods in socially acceptable ways (24).”

The concept of food insecurity is often differentiated into both household and individual levels. At the household level, food insecurity is defined as the lack of access for all members at all times to enough food to lead active, healthy lives (25). Food insecurity at the individual level is described as the inability to meet food needs at all times in socially acceptable ways (25). “Socially acceptable way” refers to acquisition of food from conventional food sources such as: grocery stores, restaurants, and government food assistance programs, without resorting to unconventional means, such as emergency food supplies, or to unsafe means, such as stealing or scavenging (1, 14). In focus group discussions where food insecure individuals provided lists of food acquisition strategies, the majority of strategies listed were deemed socially unacceptable, suggesting that food insecure individuals must often adopt unconventional methods of obtaining food (26, 27).

Hunger is defined as “an uneasy or painful sensation caused by a lack of food (1, 14, 24-25, 28-29).” Food insecurity is often likened to hunger, but these terms are not interchangeable. Food insecurity is a conceptual definition, while hunger refers to a physical experience. Hunger represents a more severe form of food insecurity, and carries with it the emotional connotation of a “painful experience” (1, 24, 28). Hunger is evident in some food insecure households; however, it is not an automatic consequence of food insecurity (24).

Measures of Food Security/Insecurity

One of the first scales developed to measure hunger in households with at least one child under the age of twelve was the Community Childhood Hunger Identification Project (CCHIP) hunger index (30). This instrument consists of eight questions regarding an individual’s food

situations and coping mechanisms. The approach used in the CCHIP index captures the economic strategies used by household providers to stretch food budgets; the instrument also depicts whether adults deprive themselves of food before depriving their children of food (25, 30).

Another scale, the Radimer/Cornell scale, was designed to distinguish between household, adult, and child food insecurity (25). This thirteen-item instrument provides a graded scale of severity of food insecurity, ranging from mild (anxiety that food supply will run out) to severe (children deprived of food for an entire day) (25, 30). The Radimer/Cornell scale also allows for subtle distinction between insufficient resources to access sufficient desirable foods and insufficient resources to meet basic biological food needs (25).

Support of the Radimer/Cornell scale and the CCHIP index as appropriate screening tools for food security is provided by results from two studies (31-32). Results obtained from a random sample of 193 households supported the validity of the Radimer/Cornell scale as a measurement tool to distinguish varying degrees of food insecurity and hunger (31). A second study conducted one year later showed the Radimer/Cornell tool was helpful in the identification of rural households experiencing food insecurity. Review and analysis of these studies led to the conclusion that the Radimer/Cornell and CCHIP measures had good specificity and excellent sensitivity (32). These studies provide support for the CCHIP and Radimer/Cornell measures as valid screening tools in food security assessment.

Major features from the above mentioned instruments were extracted by a multi-agency panel of the U.S. government and integrated into a census instrument, which is now administered annually to a sample of the U.S. population (30). This module is known as the U.S. Government Food-Security/Hunger Core Module or Core Food Security Module (CFSM). The design of the

CFSM is intended to identify households experiencing food insecurity or hunger as a result of monetary constraints. Eighteen multiple-part questions are used in the CFSM to assess the severity of household food insecurity, and to address the incidence of food insecurity over the last twelve months. Household food security is subsequently graded on a continuum, with the lowest extreme being food secure, and the highest being food insecure with severe hunger (30).

A six-question short form of the CFSM was developed for situations where time constraints exist. However, the short form is not without limitations, including: inability to distinguish between the two most severe forms of food insecurity, a slight increase in bias when used in samples that differ from the national sample used to establish the short form, less precision in comparison to the standard form of the CFSM, and exclusion of child-focused items (25, 30). Despite its limitations, the short form of the CFSM correctly classifies food security levels in 97.7% of all households (33). Thus, the short form of the CFSM is considered a reliable and relatively accurate measure of risk of food insecurity.

Prevalence of Food Insecurity

United States

Approximately 88.8% of households in the United States were considered food secure in 2004. Of the remaining 11.2% of households, over 3.5% consisted of one or more household members experiencing hunger because of lack of affordability of an adequate supply of food. The remaining 7.7% of food insecure households resorted to various coping strategies to assure acquisition of enough food to prevent hunger (2).

National prevalence estimates from 2004 revealed four demographic groups with food insecurity rates well above the national average of 11.2%. These groups are: households with children, headed by a single female (31.7%); households with incomes below poverty level

(35.1%); African-American households (22.1%); and Hispanic households (22.3%). Among households with children, married-couple households have the lowest rate of food insecurity (10.8%); single woman households with children possess a rate more than twice that of the national average (8.7% vs. 3.5%) (2).

Louisiana

Prevalence estimates from data at the state level (years 2001-2003) were combined to allow for increased reliability of statistical analysis. Overall, the average estimate of food insecure households in Louisiana significantly exceeded the national average (12.3% vs. 11.2%). However, the number of food insecure households with hunger is significantly less than the national average (2.6% vs. 3.5%) (2).

Domestic Food Assistance Programs

Food Stamp Program

The Food Stamp Program (FSP) is the primary nutrition assistance program in the United States, accounting for over half of all food assistance expenditures in 2001 (34). The stated purpose of the FSP is to provide low-income households the ability to purchase foods needed for nutritionally adequate diets. Unlike other government-funded nutrition assistance programs (which target specific groups), the FSP is available to most households that meet income criteria (gross household income cannot exceed 130% of poverty guidelines). The FSP is an entitlement program, meaning that all individuals meeting eligibility requirements are automatically entitled to participate. Monthly benefits are provided to participants, allowing for the purchase of approved foods at approved food stores. In the past, most households participating in the FSP were given monthly allotments in the form of coupons, which were exchanged for food at approved stores. As of October 2002, all FSP participants now receive their benefits via

Electronic Benefits Transfer (EBT), where funds are linked to a card resembling a banking debit card (34). A household's monthly food stamp allotment is based on the USDA's Thrifty Food Plan (35) (described in the next section).

The Federal Government subsidizes all food stamp benefits issued through the FSP, and administrative costs are shared with corresponding states. FSP expenditures increase or decrease according to the operational costs of serving those who apply and those who are eligible to receive benefits. As a result, the FSP quickly adjusts to changing economic conditions; it expands to meet increased need during economic recession; conversely, it contracts during periods of economic growth and development (34).

Participation in the FSP

Participation in the FSP peaked in 1994 at 27.5 million persons (35, 36). Between 1994 and 2000, participation in the FSP declined by 34% to reach a record-low average of 17.1 million persons (36, 37). The decline in FSP participation was attributed to both sustained economic growth and the enactment of the Personal Responsibility and Work Reconciliation Act (PRWORA) in 1996. A steady increase in FSP participation has occurred since 2000; approximately 23.9 million individuals participated in the FSP in 2004 (38). In Louisiana, FSP participation rates have followed a similar increase, with approximately 750,000 individuals participating in 2004 (39).

Thrifty Food Plan

Background

The Thrifty Food Plan (TFP) is the basis for determination of food stamp allotments, and is also considered the cornerstone of all domestic nutrition assistance programs. The USDA describes the TFP as "providing a national standard for a nutritious diet at a minimal cost for

households on food stamp budgets." The TFP employs the term "market baskets"-- shopping lists that specify the type and quantity of foods that individuals could consume at home to achieve minimally priced, nutritionally adequate diets (35). Twelve TFP market baskets exist; each is specific to one of twelve age-gender specific groups (Table 1).

Table 1. Age-gender groups included in TFP market basket creation.

Children	Males	Females
1 year of age	12 to 14 years of age	12 to 19 years of age
2 years of age	15 to 19 years of age	20 to 50 years of age
3 to 5 years of age	20 to 50 years of age	51 years of age and greater
6 to 8 years of age	51 years of age and greater	
9 to 11 years of age		

Revision of TFP

The TFP was revised in 1999 to reflect current dietary recommendations, food consumption patterns, food composition data, and food prices, while maintaining the costs of revised market baskets at the levels of previous baskets. Two primary data sources were used in the revision of the TFP: the USDA's 1989-1991 Continuing Survey of Food Intakes by Individuals (CSFII) and the Food Price Database. The Agricultural Research Service of the USDA conducted the CSFII, and the Food Price Database was created by the USDA's Center for Nutrition Policy and Promotion (CNPP) by merging foods from the CSFII with national food price data (35).

The CSFII was administered to a nationally representative sample of households in the 48 continental states. Data from the CSFII concerning dietary intakes of low-income individuals were used for the TFP revision. "Low-income" was defined as a gross income at or below 130% of the United States' poverty threshold (i.e. the gross income limit for FSP eligibility). The CSFII sample consisted of approximately 7800 low-income individuals. Participants were asked what foods they consumed daily, both at home and away from home. The ingredients of,

nutrient content of, and amount of each food consumed are included in the data set used for TFP revision. Approximately 4800 different foods were reported; these foods were later placed into 44 TFP food categories (40).

Since the CSFII did not contain information on food prices or expenditures, the CNPP developed a method for food price estimations. The Food Price Database was created using the estimations calculated by the CNPP method (35). Food pricing data were obtained from several sources (Table 2).

Table 2. Sources used in obtaining national average food price data.

Source Name	Data Collected
A.C. Nielsen	Scantrack system data
United States Department of Labor	Income statistics
USDA Agricultural Marketing Service	Wholesale prices for fresh
National Marine Fisheries Service	Fish prices

Market Basket Revision

The Food Price Database was used, along with a mathematical optimization model, to calculate a TFP market basket for each of the pre-determined twelve age-gender groups. The model minimized deviations from average consumption patterns for the 44 food categories, and helped researchers develop new consumption patterns that would maintain constant costs and meet nutritional requirements. Each model consists of four sets of data inputs and is also subject to three constraints. The data inputs are related to each of the 44 food categories, and include: average consumption, average food category price, nutrient profile, and Food Guide Pyramid serving profile (35). The three constraints in the model are related to dietary restrictions and TFP cost. Market baskets were updated to incorporate current dietary recommendations; however, a quantitative standard was not recommended for dietary fiber or added sugars. Thus, each age-gender market basket was revised to provide no less than average consumption of

dietary fiber, and no more than average consumption of added sugars (40). Second, each age-gender market basket was constrained to equal the average real cost of its previous TFP basket. Lastly, each TFP market basket was constrained to fall within an average consumption range for each of the 44 food categories; this was done to ensure that no food category increased or decreased to an unreasonable level (35).

The 1995 Dietary Guidelines for Americans (DGA), the *Diet and Health Report* from the National Research Council (NRC), and serving recommendations from the USDA Food Guide Pyramid were all incorporated into the 1999 revisions of TFP market baskets. Recommendations for saturated fat and total fat consumption were based on the 1995 DGA, while recommendations for cholesterol and carbohydrate were based on the National Research Council's *Diet and Health Report*. According to the USDA, the revised TFP market baskets for each of the twelve age-gender groups "meets 100 percent or more of the group's Recommended Dietary Allowances (RDAs) for 15 essential nutrients—protein, vitamin A, vitamin E, vitamin C, thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, calcium, phosphorus, magnesium, iron, and zinc" (40).

Food costs were heavily considered during market basket revision; assurance that FSP participants could meet updated nutrition standards with the revised TFP at the cost of the previous TFP was critical. The mathematical optimization model employed by the USDA in the TFP revisions "solves" itself in the cost range between 96% and 125% of the TFP cost (35). However, 125% of the TFP cost would place many FSP participants into the cost category of the Low-Cost Food Plan, which is the next higher cost USDA food plan.

Menu and Recipe Creation

The market basket created for a family of four was converted into menus and recipes intended for use by FSP participants. Researchers under contract with Pennsylvania State

University developed the menus and recipes. All menus and recipes were initially evaluated by taste panelists, and then by eight four-person FSP participating households in rural Pennsylvania. Foods with acceptable scores (from lab evaluations) were included in the final menus evaluated by FSP participating households. Participating households purchased the foods listed in the menus, prepared the recipes, and evaluated sensory qualities of the foods prepared (35). Overall, the menus and recipes were "well-accepted" by the households. However, one significant limitation existed in the evaluation process: only eight families were used to conduct evaluations, and all were from rural Pennsylvania; thus, subjects and results were not representative of the national population.

Diet Quality and Food Security Status

Diets worsen as food security status declines; intakes of fruits and vegetables decrease, and consumption of total fat and added sugars increases considerably from average national intakes (41-43). Results of food consumption patterns in 153 Toronto women seeking food assistance demonstrated that individuals experiencing moderate or severe hunger consumed fewer servings of fruit, vegetables, and meat when compared to individuals without hunger (41).

Fruit and vegetable intake, as well as specific nutrient intakes were assessed in a sample of 193 women living in a rural county in New York (42). Both the food secure (n=90) and food insecure (n=103) groups consumed less than the recommended five servings of fruits and vegetables daily. Consumption of fruits and vegetables by the food insecure group was still significantly lower than that of the food secure group. Potassium, fiber, and vitamin C intakes were also significantly lower in the food insecure group (42). However, the grouping of women in this study may contribute to the significance of the results; women with varying degrees of hunger were grouped into the food insecure group, which increased its sample size.

Results from another Toronto-based study (n=145 women) demonstrated significant differences for energy, protein, vitamin A, zinc, iron, and magnesium intakes among groups defined by food security status (43). Findings from these three studies support the assertion that dietary intake is compromised as food security status declines (41-43).

Cross-sectional data from the third National Health and Nutrition Examination Survey (NHANES III) were used to assess dietary intakes of adults from food sufficient and food insufficient families; adults were grouped based on food sufficiency status and age. The terms "food sufficient" and "food insufficient" were used in this study synonymously with the terms food security and food insecurity. Younger adults from food insufficient families (n=454) had significantly lower calcium and vitamin E intakes; and older adults from food insufficient families (n=117) had significantly lower energy, vitamin B-6, iron, protein, magnesium and zinc intakes when compared to their food sufficient counterparts (n=5844 for younger adults, n=3394 for older adults; intakes analyzed after adjustment for income and other covariates). This study design was favorable for a number of reasons, including using a nationally representative sample, incorporating both genders, varying income levels, and varying age ranges. However, only one question regarding food insufficiency was included in the screening tool. Use of a single question may not provide enough information to categorize individuals properly; further, the effect of food insufficiency on diet quality and dietary intake may not be adequately quantified. Design limitations notwithstanding, results of the study suggest that adults of any age living in situations of food insufficiency are more apt to have lower intakes of particular foods and nutrients (44).

Dietary inadequacy is prevalent in the low-income, food insecure population (44-46). Recent research has addressed the role of nutritional counseling/nutritional education in

addressing dietary inadequacies of low-income individuals. A group of low-income adults was questioned regarding fruit and vegetable intake, provided nutrition education counseling for one year, then re-questioned about fruit and vegetable intake after completion of counseling. There was a control group, in which no counseling was performed. Fruit and vegetable consumption increased significantly in the group that received counseling. Increases in plasma beta-carotene concentrations, along with alpha tocopherol concentrations were observed in both groups, but a rise in plasma levels was only significant in the group that was counseled. These results suggest that nutritional counseling could foster increases in fruit and vegetable intakes of low-income individuals (45).

The Foods of our Delta study evaluated intake data from a culturally diverse population. This study was conducted in the lower Mississippi Delta region, where the poverty rate greatly exceeds the U.S. average. Comparisons were drawn between the diets of subjects and the general U.S. population based on cross-sectional data, CSFII data, and the Dietary Reference Intakes (DRI) (46). Delta subjects and the U.S. population were divided into African-Americans and Caucasians for easier comparisons with the above mentioned data sets. Energy, protein, and carbohydrate intakes did not differ significantly between the Delta and U.S. Caucasian populations. Caucasians in the Delta study also ate fewer fruits and vegetables, more meats and legumes, more discretionary fat, and more added sugar than the U.S. Caucasian population. Intakes of fiber, vitamin A, vitamin C, beta-carotene, thiamin, riboflavin, niacin, vitamin B-6, vitamin B-12, calcium, magnesium, iron, and potassium were lower in the Delta Caucasian population; cholesterol, fat, and fatty acid intakes were higher.

African-Americans from the Delta study ate less protein, fruits and vegetables, dairy, and ready-to-eat cereals than their U.S. counterparts. Thus, intakes of fiber, vitamins A and C, beta-

carotene, riboflavin, niacin, vitamins B-6 and B-12, calcium, magnesium, iron, potassium, phosphorus, zinc, and copper were lower in the Delta African-American population (46).

In comparing the Delta population to the U.S. population, inadequacies in nutrient intakes are evident. Less than twenty percent of the adult Delta population met the DRI for fiber and calcium. Fewer than 40% of the Delta population met the Estimated Average Requirement (EAR) for Vitamin A, and less than ten percent met the EAR for Vitamin E. However, as household income increased, the percentage of families that met the DRI/EAR for over 15 nutrients increased significantly (46).

Another study examined the intake patterns of preschool children, adult women, and the elderly. No significant differences were found between the intakes of food sufficient preschool children and food insufficient preschool children. However, food insufficient adult women had significantly lower intakes of energy, calcium, magnesium, and vitamins A, E, C, and B-6 when compared to food sufficient women. Food insufficient elderly also had significantly lower intakes of protein, energy, calcium, and vitamins A and B-6 than did food sufficient elderly (47).

Conclusions and associations from the above research can be applied to a sample of U.S. women, despite the fact that two of the aforementioned studies were conducted in Canada (41, 43). All studies demonstrated the lesser quality of diets in food insecure groups when compared to food sufficient/food secure counterparts, regardless of geographic location. Moreover, significantly lower intakes of specific foods and nutrients by food insecure groups were exhibited in each of the studies (41-47), thereby confirming the existence of a direct relationship between food security status and diet quality.

Food Purchasing Behaviors of Low-Income Households

The examination of dietary quality and food intake in households must include the consideration of food resource management in these households. Food resource management is described as "the handling of all foods and resources that may be used to acquire foods by an individual or family" (48). An integral component of food resource management is that of food purchasing. Food purchasing behavior (and the influences thereof) is especially critical in low-income households, where food dollars are often limited, and purchases must be carefully considered (48-51).

Two cross-sectional surveys were administered in a study of a nationally representative sample of adults (n=2,967) to determine the importance of various influences on food consumption. Demographic differences were examined for all respondents. Regardless of demographic characteristics, taste was found to be the most significant influence on food choices. Cost was stated as the second most important influence on food choice. Cost was reported as most important among younger, low-income, non-white households, thereby suggesting that food costs are an important influence of foods purchased and subsequently consumed. Convenience of foods purchased was also important to low-income households, suggesting that ease of food preparation also plays an important role in food purchasing (48).

Americans, as a group, consume fewer servings of fruits (38% of individuals) and vegetables (23% of individuals) than were recommended by the Food Guide Pyramid (49). Low-income households consume even fewer fruits and vegetables than the general American population (47). Data from a subset of the 2000 Consumer Expenditures Survey showed that in any given week, low-income households purchased significantly fewer fruits and vegetables when compared to higher income households. Moreover, in any given week, 19% of low-

income households purchased no fruits and vegetables, versus only 9% of higher-income households (49).

A report on food purchasing behaviors, based on 1998 food store purchase data, revealed that low-income households purchased more meat and poultry in combination than middle-income and higher-income households (7.6% and 6.7% more, respectively). Although low-income households purchased more meat and poultry, they spent less per pound, which suggests that low-income households reduce food costs by purchasing products of lower quality. Low-income households also purchased 3.3% less fruits and vegetables by weight than higher-income households. However, low-income households spent almost 13% less on fruits and vegetables, which suggests that these households choose less costly types of these products. Lastly, results showed that low-income households also purchased more foods at sale prices, suggesting that households generally ignored their brand preferences in order to extend their food budgets (50).

A study conducted with a nationally stratified sample of FSP participants (n=957) examined the relationship between food purchasing behaviors and diet quality in low-income households. Results showed that FSP participating households in which the primary food shopper engaged in "careful shopping practices" (i.e. use of coupons, use of a shopping list, looking for sales, comparison shopping) were significantly more likely to meet 100% of the RDAs for eight nutrients. Over half of the households included in this study (52%) did not regularly employ these "careful" practices; these households were significantly less likely to meet 100% of the RDAs for the nutrients examined. Moreover, only 25% of those households that did not regularly employ "careful shopping practices" reported having enough food at the end of the month. Results suggest that although low-income households make attempts to

economize when purchasing food, these attempts may ultimately result in inadequate nutrient intakes (51).

Dietary Energy Density

Concepts and Definitions

The World Health Organization (WHO) considers dietary energy density (ED) a principal contributor to the obesity epidemic (15, 16, 19). Energy density refers to the metabolizable energy in a given weight of food, and is generally expressed in kilocalories per gram (kcal/g) or kilojoules per gram (kJ/g)[a]. The ED of individual foods is a function of their water content; *i.e.*, foods with the highest ED contain less water per unit weight, while lower ED foods contain more water per unit weight (15-17, 19). The extremes of the ED spectrum are represented by vegetable oil (9 kcal/g) and water (0 kcal/g) (16, 52). Water has the greatest impact on ED; it contributes substantially to food weight without adding energy (16). Macronutrients also contribute to ED—fat is the most influential of contributors, due to its high energy content (16, 17). When all contributing factors are included, ED is calculated as follows:

ED = energy density in kcal/g; C_k = carbohydrate in kcal; C_g = carbohydrate in grams; P_k = protein in kcal; P_g = protein in grams; F_k = fat in kcal; F_g = fat in grams; E_k = alcohol in kcal; E_g = alcohol in grams; Fi_g = fiber in grams; and U_g = undigestible components in grams.[b]

$$ED = \frac{C_k + P_k + F_k + E_k}{C_g + P_g + F_g + E_g + Fi_g + U_g}$$

Multiple regression analyses of foods (n=171), adapted from the NHANES II food list data, were conducted to determine the relationships between macronutrients and ED. Results demonstrated that water accounted for 85% of ED variance; water and fat together (R^2 = 0.91

[a] 1 kilocalorie = 4.184 kilojoules
[b] Adapted from reference 21

and 0.87, respectively) contributed to 99% of ED variance. Carbohydrate (including sugar), protein, and fiber content of foods (R^2 = 0.17, 0.23, and 0.0053, respectively) accounted for the remaining 1% of ED variance. These results suggest the minimal involvement of carbohydrate, protein, and fiber in ED variance (16).

Measurement of Dietary Energy Density

Dietary energy density investigations are a relatively new endeavor, and there are neither standard calculation methods nor published nationally representative values for ED. The primary methodological differences in ED calculations involve inclusion of beverages. Values of ED reported in the literature have been calculated by a variety of methods and include only food or food and varying combinations of beverages, such as: all beverages, all beverages excluding water, and all energy-containing beverages (17, 18, 53, 54). Recently, efforts have been made to provide a rationale for beverage inclusion in a standardized ED calculation. Mean daily dietary ED values for 9,288 adults (19 years and older) were calculated using two 24-hour recalls from the CSFII (1994-1996). These ED values were calculated using the following categories: food; food and liquid meal replacements; food and alcohol; food and juice; food and milk; food and juice and milk; food and energy-containing beverages; and food and all beverages. Energy densities varied by calculation method, with the lowest ED measured in the food and all beverages category (0.94 kcal/g ± 0.01), and the highest ED measured in the food category (1.85 kcal/g ± 0.01). The ED of subjects' diets significantly differed with sex, age, and ethnicity. The mean ED for men was higher than that of women, the older subjects' mean ED was less than those of the younger subjects, and African-Americans had higher mean ED than other ethnic groups (54). These results support the need for inclusion of beverages in the

development of a standardized ED calculation, and demonstrate the variation in ED between diets of varying sexes, ethnicities, and age groups.

Nutrient intakes of lean (n=41) and obese (n=34) men and women in a free-living environment in England were analyzed using six variations of ED calculations. Calculations varied as follows: 1) all food and beverages; 2) all food, non-energy beverages; 3) food and milk, other non-alcoholic beverages; 4) food only, all beverages; 5) all dry matter, water; and 6) macronutrients only. Results were contradictory among analysis methods for nutrient intakes in both lean and obese individuals. No correlations were made from the results of this study; however, the authors did conclude that the methods for calculation of ED in freely selected diets must be carefully defined (53). This study supports the need for standardized methods of ED calculation in the free-living environment. Although a standardized ED calculation method does not exist, studies have been conducted to support the importance of ED in the diet.

Dietary Energy Density and Energy Intake

Energy density influences palatability and satiety. Palatability is a subjective measure of the pleasantness of a food (20). Satiety is an internal state of energy repletion after a meal that tends to inhibit the resumption of eating (17, 20). Foods that are higher in fat or sugar (more energy dense) are generally more palatable than foods that are higher in water. In order for satiation to occur with consumption of fewer calories, a food must be energy dense and high in volume. The problem seen with high-ED foods, although they are higher in calories and volume, is that they are “passively overconsumed”; leading to an increase in total calories consumed (energy intake), and weight gain (17, 19, 20). Therefore, ED is considered a key influence on total energy intake (EI).

The best evidence to support the influence of ED on EI comes from prospective, observational studies conducted in a laboratory setting. Normal-weight women (n=18), were provided meals for three test sessions, each lasting three days. Breakfast and lunch meals were required to be consumed in full, and were identical in content. In all meals changing portion sizes instead of adding or removing sugar and fat controlled for palatability. For the evening meal, subjects were allowed to choose one of three versions of the same entrée, with the only variant being the ED of the entrée (high ED, medium ED, or low ED); subjects were unaware of the variations. Interviews were conducted with the subjects after the meals, to assess hunger and fullness. Evening meals were not required to be consumed in full, and were weighed before and after eating. Significantly more energy was consumed in the condition of high ED than in the low and medium ED conditions, suggesting that ED directly affects EI independent of macronutrient content (55).

Lean (n=19) and obese (n=19) women were provided the same meal pattern in the same experimental setting. Six test sessions were conducted, each lasting three days. Three variants of the evening meal were designed with varying fat contents (25%, 35%, and 45%) and energy densities, but had similar palatabilities. Results indicated that ED significantly influenced EI across all fat contents in both lean and obese women. Hunger and fullness were not significantly affected across fat contents or ED contents (22).

The primary limitation of the above studies is that they were conducted in a laboratory setting. All external factors contributing to dietary intake were controlled for in the aforementioned studies. Very few studies have been conducted in free-living settings (where foods are freely chosen), since no standard ED calculation methods exist. One of the few studies conducted in a free-living environment examined the effects of ED on EI in 36 hospitalized

elderly subjects. The ED of all meals was manipulated (either high ED or low ED), and food volume was kept constant. A crossover design was implemented, with a 6-week period for each study condition. Energy intakes were 40% higher and body weight increased 3.4% in the high ED condition, supporting the influence of ED on EI in the free-living environment (53).

Consumption of energy-dense, nutrient-poor (EDNP) foods by Americans was examined in 15,611 subjects using data from NHANES III. The potential independent associations of EDNP food intake with intakes of energy, macronutrients, micronutrients; and serum vitamin, nutrient, and carotenoid profiles were examined using linear and logistic regression procedures. Three tertiles of EDNP food consumption were created, with first tertile consisting of individuals that consumed the least EDNP foods (9.0% ± 0.1), and the third tertile consisting of individuals that consumed the most EDNP foods (44.8% ± 0.2). Approximately 27% of total energy intake in the total sample was provided by EDNP foods. Women, non-Hispanic whites, and those aged 20-34 years consumed a higher percentage of EDNP foods relative to other age and ethnic groups. Mean energy intake and percentage of energy from fat and carbohydrate significantly increased with increasing consumption of EDNP foods. Significant inverse correlations existed for vitamins A, C, B-6, and B-12; folate; calcium; high-density lipoprotein cholesterol; and iron and consumption of EDNP foods. Percentage of energy from EDNP foods was also an independent positive predictor of serum homocysteine concentration. These data support, in a nationally representative population, that consumption of EDNP foods occurs at the expense of nutrient-dense foods. Consumption of EDNP foods may increase risk of: increased energy intake; marginal micronutrient intake; poor compliance with nutritional guidance; and low serum concentrations of vitamins and carotenoids (56).

Dietary Energy Density, Diet Costs, and Low SES

Energy-dense foods provide dietary energy at remarkably low cost (57). Added sugars and fats in processed foods are cheaper to manufacture, transport, and store than are perishable meats, dairy products, and fresh produce. The low energy cost of some manufactured foods may be linked to the low cost of added sugars and added fats. Added sugars are derived from cane, beet, or corn sources, and are much less costly than natural sugars in fruits and vegetables (58, 59). The current price of refined sugar (sucrose) at world market rates, according to USDA data, is ten cents per pound (¢/lb) (60). Thus, one dollar can purchase approximately 17,925 kcal (approximately 9 days' worth) of dietary energy (58). The global market price of most vegetable oils is 20 ¢/lb (61); however, since fat has a higher ED than carbohydrate, 17,925 kcal of dietary energy can also be obtained from vegetable oil for approximately one dollar (58, 59).

In many low-income families, obtaining sufficient dietary energy at low cost is an important concern; FSP participants cited "the most important factor in choosing and preparing foods was to ensure that no one would complain that they were still hungry" (58, 62). Therefore, choosing ED foods that are high in added sugars and fats may be an unintentionally rational decision, not a misguided one, simply because these foods are the cheapest sources of dietary energy available (57-59, 63).

Subjects from the United Kingdom (UK) Women's Cohort Study (n=15,191, ages 35-69) were mailed a detailed food frequency questionnaire and participated in a follow-up telephone interview regarding their dietary habits. Dietary habits were rated on a "healthy diet indicator" (hdi) scale, ranging from 0 (lowest) to 8 (highest), based on WHO dietary recommendations. Diet costs were calculated using prices from the 1995 National Food Survey. Fruits and vegetables were the highest cost foods in all hdi scores, and total diet cost increased significantly

between extreme scores. Although the results of this study were significant, two main limitations existed. First, the UK Women's Cohort Study was based on response to an initial questionnaire, and suggested subjects' interests in health and diet. Second, 41% of the respondents were vegetarians. Neither characteristic was likely representative of the British population (64). Regardless, results support the higher cost of healthier diets.

A cross-sectional survey conducted in Val de Marne, France provided data from randomly selected men (n=361) and women (n=476). Analyses were conducted on freely selected diets of subjects. Linear programming (LP) modeling was used to develop isoenergetic diets for each gender that incrementally decreased in cost. Constraints were applied to each model to ensure that LP diets were comparable to observed dietary patterns in the general French population. Diets higher in fats, sugars, and refined grains (in 100 g increments) were associated with both lower diet costs and lower energy costs after adjustment for energy intakes, gender, and age. In contrast, diets higher in fruits and vegetables (in 100 g increments) were associated with increased diet costs and increased energy costs. Additionally, the amounts of energy contributed to the cost constrained diets by sweets and added fats increased, while the amounts of nutrients contributed decreased, namely zinc, calcium, potassium, folate, vitamin B-6, vitamin D, vitamin C, and beta-carotene. Results of this study suggest that a cost constraint can decrease the nutrient density of the diet, while increasing its energy density. Furthermore, these studies support the assertion that the higher cost of a nutrient-dense, low ED diet may be the primary deterrent in selection of these types of diets by low SES households (65-69).

Health Disparities in Low-Income Individuals

In the United States, the incidence of obesity is higher than the national average among racial and ethnic minorities and the poor (6, 70-72). High prevalence of obesity in women is

positively correlated with lower education levels and lower incomes. A causal relationship between food insecurity and obesity has not been established; however, the association of food insecurity and obesity in women has been demonstrated repeatedly (70-72).

Four questions adapted from the U.S. Household Food Security module were used to evaluate food insecurity in an ethnically diverse sample of women. Increased risk of obesity in non-Hispanic white women was associated only with the intermediate level of food insecurity (food insecurity without hunger), and not with the more severe food insecurity with hunger. Conversely, a dose-response relationship was observed for Asian, Hispanic, and Black women, with the increased severity of food insecurity augmenting obesity risk (70).

Olson (70), using the Radimer/Cornell measure to determine degree of food insecurity in rural New York State women, demonstrated that prevalence of overweight/obesity increased with moderate food insecurity, but decreased with the severity of the condition. Townsend (71) similarly observed that women from households with mild food insecurity were 30% more likely to be overweight than women from food secure households. However, Townsend employed the USDA food sufficiency indicator instead of the Radimer/Cornell measure used by Olson. Differences in instruments used limit comparisons that can be made regarding food security status. Despite differences in the instruments used and in the populations examined, these studies confirm a relationship between intermediate levels of food security and increased overweight/obesity risk (70, 71). Similar results were found in the sample of female FSP participants used in the initial study on which this thesis is based (73).

Basiotis and Lino analyzed NHANES III data to examine further the association between food insecurity and overweight/obesity (72). Use of the NHANES III data was beneficial for two primary reasons: the data were nationally representative of the U.S. population and

measured height and weight were used. The NHANES III data set also included body mass index (BMI) calculations based on subjects' measured heights and weights. BMI is a calculation based on measured height and weight, and is calculated in kilograms of body weight per meters of height squared (kg/m^2). According to National Institutes of Health (NIH) criteria, a BMI ranging from 25 kg/m^2 to 29.9 kg/m^2 classifies an individual as overweight; a BMI greater than or equal to 30 kg/m^2 classifies an individual as obese (74). This study (74) used a BMI greater than or equal to 25 kg/m^2 to define a subject as overweight and a BMI greater than or equal to 28 kg/m^2 to define a subject as obese. A significantly higher percentage of women in food insufficient/insecure households were overweight compared with food sufficient/secure households (58% vs. 47%). No significant differences were found in percentages of food sufficient/insufficient women who were obese (72).

The studies mentioned above (70-72) reveal a paradoxical relationship between food insecurity and overweight/obesity. Findings indicated increased prevalence of overweight/obesity among less severe forms of food insecurity, and decreased prevalence among the extremes of the food insecure range. The food insecurity-obesity paradox is not well understood. A primary contributor, however, to the paradox may be the food acquisition cycle (resource cycling), which often synchronizes with the food stamp distribution cycle (70, 75). Palatable, ED foods are often abundant when food stamp benefits are first received (at the start of the month), but as benefits and food selections become limited (near the end of the month), intake is involuntarily restricted. Overeating of palatable foods will again occur when money and benefits are again replenished—this pattern may result in gradual weight gain over time, due to the increased energy content of these foods. The increased energy content of the palatable

foods results in an unintentional increase in EI, leading to positive energy balance and net weight gain (70-72, 75).

Obesity is a risk factor for chronic diseases, such as type 2 diabetes mellitus, cardiovascular disease, and certain cancers (76-78). The CDC analyzed data from the 2000 Behavioral Risk Factor Surveillance System (BRFSS) to assess the socioeconomic status of women with diabetes. The BRFSS is a state-based, random-digit-dialed telephone survey of the U.S. population (=18 years of age). Multivariate regression analyses were conducted to examine the relationships between having diabetes and living in a low-income household or not completing high school. Age, race/ethnicity, and living arrangements were controlled for in the analyses. The number of women with diabetes that had not completed high school (27.7%) was more than double that of women with diabetes that had completed high school (12.2%). Furthermore, women with diabetes were approximately twice as likely to have a household income less than $25,000/year than women without diabetes (40.4% vs. 22%) (77).

Data from the 2003 BRFSS were analyzed by the CDC to evaluate racial/ethnic and socioeconomic disparities in risk factors for heart disease in stroke. Six risk factors were examined: hypertension, hyperlipidemia, diabetes, current smoking, physical activity, and obesity. The prevalence of having multiple (defined as two or more) risk factors was highest among persons with annual incomes less than $10,000 when compared to persons with annual incomes greater than $50,000 (52.5% vs. 28.8%). Educational level also reflected risk factor prevalence, with 52.5% of those with less than a high school diploma having multiple risk factors. Overall prevalence rates were calculated for all states; thirty-eight states had multiple risk factor prevalence rates less than 40% (mean = 37.2%). Twelve states, including Louisiana, had multiple-risk factor prevalence rates well above 40% (78).

CHAPTER 3

SUBJECTS AND METHODS

Study Approval

The Institutional Review Board of Louisiana State University Agricultural Center approved this study (# H03-05) on July 10, 2003.

Description of Prior Study

This study was part of a larger study: *Food security status, nutrient intake at the beginning and end of the monthly resource cycle, and body mass index in female food stamp recipients* (73). A brief summary of the initial study design is warranted; complete details appear in the unpublished Master's thesis cited above.

Subject Overview

Seventy-two adult female food stamp recipients (19-75 years of age) were interviewed in 2003 and 2004 at their homes in Assumption, East Baton Rouge, Iberia, Iberville, Orleans, St. Mary, St. Tammany, or West Baton Rouge parishes. The majority of participants were African-American (94 %) (73).

Data Collection

Two 24-hour diet recalls were collected for nutrient analysis: an initial recall at the beginning of the month, and a follow-up recall at the end of the month. At the initial interview, subjects were asked to collect all food receipts, both grocery and restaurant, for a one-month period. Pre-addressed, postage-paid envelopes were provided for subjects to return all receipts to investigators.

An instrument was used to collect demographic and health-related data including: education level, employment status, marital status, household size, household income, perceived

health status and medical insurance status (Appendix A). Subjects were asked to report the total monthly income for their households; income included wages, monetary gifts, government assistance, and non-government assistance. Perceived physical health was determined by asking each subject the following question: "compared with other people your age, how would you rate your overall physical health at the present?" Subjects were given five answer choices, with 1=poor, 2=fair, 3=good, 4=excellent, and 5=don't know. Subjects were also asked "do you have medical insurance—yes or no?" If subjects answered yes, they were asked to state the name of their insurance carrier.

Stated height and three measurements of body weight were recorded for each participant. The average of the weight measurements was taken; BMI was calculated (74, Appendix B). Food security status was determined using a modified USDA short form (25, 30, 33, Appendix C). Food security status was classified according to the method of Nord et al. (2).

Current Study

Data from the household survey and the modified food security questionnaire were used in the current study. Education level was coded for the subjects: 0=less than high school education and 1=high school education or more than high school education. Employment status and marital status were also separately coded, with 0=unemployed (or unmarried), and 1=employed (or married). At the time of the initial study, additional questions were included as an addendum to the modified food security questionnaire to assess subjects' perceptions of their own nutrition knowledge, energy intake, eating habits, and diet quality (Appendix C). Answers to this questionnaire were based on a Likert Scale (79). Subjects rated nutrition knowledge, eating habits, and diet quality on a scale of 1 to 5, with 1 being "poor" and 5 being "excellent." Energy intake was rated on a similar continuum with 1 being "much too low" and 5 being "much

too high." Subjects were also asked a probing question: "What does a 'balanced meal' mean to you?" A correct definition of balanced meal included foods from all 5 food groups: fruits, vegetables, meats and meat substitutes, dairy, and grains. Answers were coded: 0=subject did not correctly define balanced meal; 1=subject omitted one or two food groups; 2=subject correctly defined balanced meal. Lastly, subjects were asked about their frequency of fast food intake: "on average, how often do you eat in fast food restaurants?" Answers were coded: 1=rarely or never; 2=several times per month; 3=several times per week; 4=once per day; 5=most meals. All data collected from the above listed questionnaires were entered into Excel spreadsheets for analyses. A summary of data analyzed for use in this study appears in Table 3.

Table 3. Instruments used in data collection and data analyzed.

Household Survey (Appendix A)	BMI Datasheet (Appendix B)	Food Security and Nutrition Questionnaire (Appendix C)
▪ Education ▪ Employment ▪ Marital status ▪ Household size ▪ Household income ▪ Perceived physical health at the present time ▪ Medical insurance	▪ Age ▪ Height ▪ Weight ▪ BMI	▪ Food security status ▪ Food stamp allotment/month ▪ Monies spent in excess of food stamp allotment/month ▪ Perceived energy intake ▪ Perceived nutrition knowledge ▪ Fast food intake ▪ Perception of balanced meal

To examine food purchasing behaviors and dietary energy density of low-income FSP particpants, complete sets of grocery receipts were required. Only 48 of the 72 subjects returned any grocery receipts (Figure 1). Receipts returned by one subject did not list food items; this subject was excluded from the analysis. Criteria for a "complete" set of grocery receipts included: names/types of all food items purchased, cost of each food item purchased, total of purchase, and quantity of each food item purchased. Total food expenditures were calculated for each subject based on returned receipts. Expenditures were then compared to each subject's stated monthly food income. Total monthly food income included each subject's monthly food

stamp allotment plus any additional income provided to the subject (from family or friends) for food acquisition (these amounts were self-reported). Subjects whose receipt expenditures were within ± $100 of their total monthly food income values were included in final data analysis. Twenty-two of the 72 women returned grocery receipts that met all criteria; these women were the subjects used in this study (Figure 1).

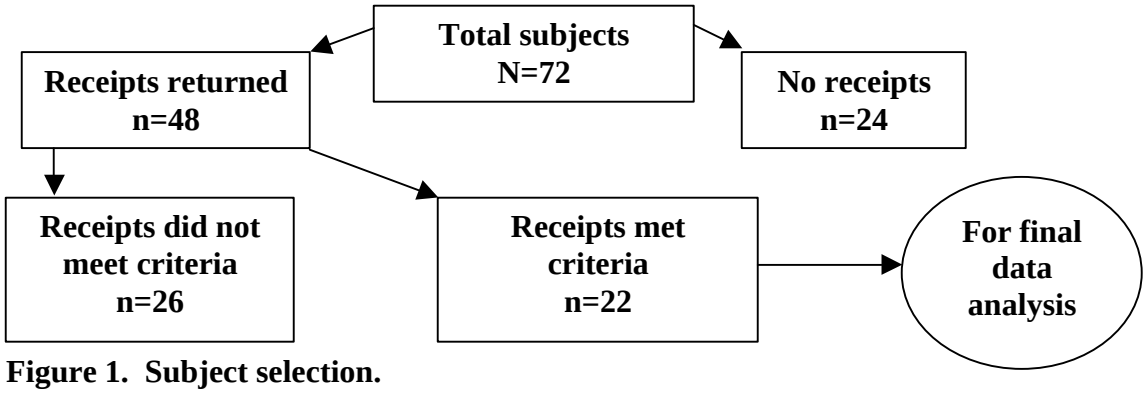

Figure 1. Subject selection.

Recording and Classification of Raw Data

All food items from receipts were classified and recorded into separate Statistical Package for the Social Sciences (SPSS) Version 14.0 (Chicago, IL) spreadsheets for each of the 22 women, and verified for accuracy. Information included: date of purchase, location of purchase, food purchased, amount purchased, brand purchased, and quantity purchased. Foods purchased were classified into one of two categories based on the methods of Kant (56): energy-dense, nutrient-poor (EDNP) or nutrient dense (ND). Foods included in the EDNP and ND categories appear below:

EDNP Foods

- Baked and dairy desserts: cakes, cookies, pies, ice cream, puddings, cheesecakes
- Sweeteners: sugar, candy, syrup, and sweetened beverages
- Salty snacks: corn, tortilla, and potato chips, pretzels
- Added fats: butter, margarine, oils, dressings, gravies

- Miscellaneous: coffee, tea, broth, spices and seasonings, condiments
- Alcohol

ND Foods

- Foods belonging to one or more of the five major food groups (dairy, fruit, vegetables, whole grains, meat and meat alternates).

Total dollars spent on EDNP foods were calculated for each subject. Total dollar amounts spent on EDNP foods were divided by total household income for each subject and multiplied by 100 to obtain the percent of total household income spent on EDNP foods. For each household income measure calculated in this study, an income per person measure was also calculated by dividing the household income measure in question by the household size reported by the subject. The following measures were calculated on a per person basis for use in this study: total household income, total household income less food stamps, food stamp allotment, and total dollars spent on EDNP foods. These values were calculated for use in statistical analyses where the effects of a dependent variable on study participants as household members were desired (instead of the variable's effects on the household as a whole).

Data Analysis and Reporting

In the initial study, each of the 22 subjects had been classified into one of three groups: food secure (FS), food insecure (FI), or food insecure with hunger (FISH). Because of its small size, the FISH group (n=3) was collapsed into the FI group for all data analyses in this study. In all linear regression analyses, a probability value of $p = 0.05$ was initially considered significant (80). The p-value was extended to $p = 0.10$ for probit analyses and ordered probit analyses performed in this study, due to the exploratory nature of these analyses (80). All descriptive statistics and single-factor analysis of variance (ANOVA) tests reported were calculated using Microsoft Excel for Windows. All regression models reported were conducted using SPSS.

Mean self-reported age and mean household size ± standard deviation (SD) were calculated for the FS and the FI groups using the descriptive statistics option in Excel. These variables were compared using the single-factor ANOVA statistical analysis tool in Excel.

BMI for each study participant was entered into an Excel spreadsheet. Mean BMI ± SD was calculated for both the FS group and the FI group, using the descriptive statistics option in Excel and compared using the single-factor ANOVA tool.

The linear regression analysis option in SPSS was used to assess the effects of food security status, age, income, food stamp allotments, and perceived nutrition knowledge on total dollars spent on ED foods. Linear regression analysis was also used to assess the effects of age, food security status, frequency of fast food visits, total expenditures on ED foods, food stamp allotment, perceived physical health, perceived nutrition knowledge, and perceived eating habits on BMI in study participants.

Probit analyses are specific types of linear regression analyses that regress a dependent variable with more than two categories on a set of independent variables (80). The probit regression analysis option in SPSS was used to determine the effects of age, food security status, education, perceived nutrition knowledge, and previous nutrition class attendance on subjects' ability to plan balanced meals. Ordered probit analyses are linear regression analyses that are employed when the dependent variable being examined is dichotomous (80). An ordered probit analysis was used to assess the effects of age, perceived nutrition knowledge, income, food security status, education, and medical insurance status on perceived physical health at present. An ordered probit analysis was also performed to assess the effects of age, income less food stamps, household size, perceived nutrition knowledge, food security status, and education level on self-reported monthly frequency of fast food visits.

CHAPTER 4

RESULTS

Table 4 shows descriptive information of participants by food security status and race. Mean BMI in kg/m^2 ± SD and mean household size in persons ± SD for both food security status groups are also shown. Mean BMI for the FS and FI groups were 33.45 ± 4.43 and 37.6 ± 4.06, respectively. No significant differences were found between mean BMI and either of the two food security status groups. Mean age of study participants was 43.63 ± 5.07 years for the FS group and 50.09 ± 3.64 years for the FI group. No significant differences were observed for mean age between the food secure and food insecure groups.

Table 4. Descriptive information of study participants on basis of food security status. Data for age (years), BMI (kg/m^2), and household size (persons) are presented as means ± SD.

Food Security Status	N	Race	Age (years)	BMI (kg/m^2)	Household Size (persons)
FS	11	10 African-American	43.63 ± 5.07	33.45 ± 4.43	3.09 ± 0.56
FI	11	11 African-American	50.09 ± 3.64	37.6 ± 4.06	2.73 ± 0.52

The majority of study participants were African-American females (n=21). Of the 22 study participants, 11 were food secure (91% African-American) and 11 were food insecure (100% black). The majority of study participants were unemployed (n=18; 81.8%). Fifty-nine percent of participants reported an education level of high school or greater (n=13). Additional demographic data, including monthly dollars spent on food, monthly food stamp allotment, percent of monthly income spent on ED foods, and monthly expenditures on ED foods per person appear in Table 5. No significant differences were found between mean values for FS and FI group data (Table 5). Additional questionnaire data including perceived current physical health, perceived nutrition knowledge, and perceived eating habits appear in Table 6. No significant differences were observed between mean values for FS and FI groups (Table 6).

Table 5. Additional demographic data of study participants, categorized by food security status (all values are monthly values). All values are reported as means ± SD.

Food Security Status	Total Spent on Food (Dollars)	Food Stamp Allotment (Dollars)	Total Income Spent on ED Foods (%)	Expenditures on ED Foods per Person (Dollars)
FS	153.47 ± 52.31	151.91 ±71.21	29.96 ± 9.43	15.18 ± 2.62
FI	159.91 ± 75.38	159.91 ±75.38	25.92 ± 9.83	22.95 ± 4.43

Table 6. Additional questionnaire data of study participants, categorized by food security status. All values are reported as means ± SD.

Food Security Status	Perceived Physical Health (Current)	Perceived Nutrition Knowledge	Perceived Eating Habits
FS	2.36 ± 0.67	2.18 ± 0.75	2.55 ±0.82
FI	1.91 ± 0.70	2.45 ±0.93	2.45 ± 1.13

There were no significant associations of age, food security status, fast food frequency, dollars spent on ED food per person, food stamps received per person, or perceived physical health with BMI (Table 7). A positive association (p=0.021) was seen between perceived nutrition knowledge and BMI. A negative association (p=0.023) was seen between perceived eating habits and BMI.

Table 7. Results of linear regression analysis of the associations of age, food security status, fast food frequency, dollars spent on ED food per person, food stamps received per person, perceived physical health, perceived nutrition knowledge, and perceived eating habits with BMI.

Independent Variable	Beta	Standard Error	t	Significance
Age	0.244	0.260	0.938	0.365
Food security status	4.093	5.395	0.759	0.462
Monthly fast food frequency	2.153	4.544	0.474	0.643
Dollars spent on ED food/person	-0.121	0.366	-0.330	0.747
Food stamps/person	0.068	0.136	0.497	0.627
Perceived physical health	-5.899	4.662	-1.265	0.228
Perceived nutrition knowledge	14.164	5.407	2.620	0.021**
Perceived eating habits	-10.699	4.167	-2.568	0.023**
Constant	23.175	24.236	0.956	0.356

* indicates significance at = 0.10; ** indicates significance at = 0.05
R^2 = 0.145; adjusted R^2 = 0.471

Table 8 shows results from the linear regression analysis of the association of age, food security status, income less food stamps per person, food stamp allotment per person, and perceived nutrition knowledge with monthly ED food expenditures. There were no significant associations of income less food stamps per person or food stamp allotment per person with monthly ED food expenditures. Age (p=0.007), food security status (p=0.007), and perceived nutrition knowledge (p=0.076) were significantly associated with monthly ED expenditures.

Table 8. Results of linear regression analysis of the associations of age, food security status, income less food stamps per person, food stamp allotment per person, and perceived nutrition knowledge with monthly ED food expenditures.

Independent Variable	Beta	Standard Error	t	Significance
Age	-1.035	6.145	-3.082	0.007**
Food security status	18.881	0.020	3.073	0.007**
Income less food stamps/person	0.026	0.130	1.329	0.203
Food stamp allotment/person	0.189	0.336	1.448	0.167
Perceived nutrition knowledge	9.817	5.183	1.894	0.076*
Constant	38.476	21.551	1.798	0.091*

* indicates significance at = 0.10; ** indicates significance at = 0.05
R^2 = 0.364; adjusted R^2 = 0.515

Four women did not provide complete answers to the questionnaire used to assess meal planning abilities. Thus, only 18 study participants were included in the balanced meal analysis. Results from the probit analysis of the association of age, food security status, education level, perceived nutrition knowledge, and previous nutrition class attendance with balanced meal planning ability appear in Table 9. There were no significant associations of any tested variables with balanced meal planning ability.

No significant associations of income less food stamps, household size, perceived nutrition knowledge, food insecurity, or education level with monthly frequency of fast food consumption were found (Table 10). Significant associations were found with age (p=0.090) and food security status (p=0.095).

Table 9. Results from probit analysis of the associations of age, food security status, education, perceived nutrition knowledge, and previous nutrition class with balanced meal planning ability.

Independent Variable	Estimate	Standard Error	Z	Significance
Age	0.035	0.029	1.210	0.226
Food security status	-1.546	1.192	-1.297	0.195
Education level	-1.204	1.158	-1.040	0.299
Perceived nutrition knowledge	-0.408	0.465	-0.877	0.380
Previous nutrition class	0.349	0.837	0.417	0.677
Intercept	-0.116	1.881	-0.061	0.951

Table 10. Results of ordered probit analysis of the associations of age, income less food stamps, household size, perceived nutritional knowledge, food security status, and education with monthly frequency of fast food consumption.

Independent Variable	Estimate	Standard Error	Significance
Age	-0.052	0.031	0.090*
Income less food stamps	0	0	0.421
Household size	0.153	0.223	0.495
Perceived nutritional knowledge	0.565	0.486	0.244
Food security status	1.227	0.734	0.095*
Education level	0.225	0.713	0.753

* indicates significance at = 0.10; ** indicates significance at = 0.05
McFadden R^2 = 0.285

No significant associations of food security status, education level, or medical insurance status were seen with perceived physical health (Table 11). However, there were significant associations of age and income per person with perceived physical health (p=0.086 and p=0.060, respectively; Table 11).

Table 11. Results of ordinal probit analysis of the associations of age, perceived nutritional knowledge, income per person, food security status, education, and medical insurance status with perceived physical health.

Independent Variable	Estimate	Standard Error	Significance
Age	- 0.045	0.026	0.086**
Perceived nutrition knowledge	0.557	0.350	0.112
Income per person	0.003	0.002	0.060**
Food security status	- 0.608	0.544	0.264
Education level	- 0.446	0.409	0.523
Medical insurance status	- 0.175	0.692	0.800

* indicates significance at = 0.10; ** indicates significance at = 0.05
McFadden R^2 = 0.195

CHAPTER 5

DISCUSSION

Perceived nutrition knowledge and perceived eating habits were significantly associated with BMI. Significant associations of age, food security status, and perceived nutrition knowledge with monthly ED expenditures were also seen. There were no significant relationships of any tested variables with balanced meal planning ability. Age and food security status were significantly associated with monthly frequency of fast food consumption. Lastly, age and income per person were significantly associated with perceived physical health.

Eleven of our study participants were food secure, and 11 were food insecure. In our study, the FSP only partially achieved its fundamental goal, "to prevent hunger among low-income Americans of all ages and household types" (27, 81, 82), since approximately half of our participants experienced some type of food insecurity. This is, however, a broad statement considering our sample size of only 22 women. The partial success of the FSP is supported, however, by results from the initial study (n=64), in which 26 women were classified as FI and 9 were classified as FISH; 55% of the original participants had some level of food insecurity. A study by Cohen *et al.* (83) exemplifies the complex relationship between FSP participation and food insecurity. This study (83) showed a worsening of food insecurity among food stamp recipients than among non-eligible participants and near-eligible individuals.

Females in low-income households, especially those participating in the Food Stamp Program (FSP), have a higher probability of being overweight/obese (7, 11, 14) and for self-reporting chronic diseases (6) or poorer general health (8) than females in higher income households. The relationship between low socioeconomic status (SES) and overweight/obesity is reported in the literature (7-9). National data examined by Ramsey and Glenn (9) showed that

significantly more rural women than suburban women were impoverished, had an increased prevalence of obesity, and reported a poorer overall health status (9). The effect of race was not examined in that study (9); however, the results characterize our subjects, all of whom were low-income, and many of whom lived in rural areas. Kahn *et al.* (7) and Jeffery and French (8) found inverse associations among weight gain, education level, and income in two economically diverse samples of women. Although Ramsey and Glenn (9), Kahn *et al.* (7), and Jeffery and French (8) did not examine the effect of food security status, the prevalence of overweight/obesity was significantly associated with lower SES in all three studies (7-9). Regardless of the effect of race, it was not surprising that our sample of female FSP participants had a greater prevalence of obesity.

Our failure to find a difference in mean BMI between the FS and FI groups does not support the relationship reported in the literature, which suggests a greater prevalence of overweight/obesity among more intermediate levels of food insecurity (69, 70). This lack of significance is probably due to our small sample size. Regardless of food security status, prevalence estimates for obesity (7-9), and related chronic diseases (10-11), are remarkably higher among African-American females than their Caucasian counterparts (7-13).

We hypothesized that level of food security status would be inversely associated with monthly expenditures on EDNP foods. Our results support this hypothesis. Food insecure subjects spent significantly more money on EDNP foods than food secure subjects, though household size and household income did not influence food security status. The impact of food security status on purchase and consumption of EDNP foods has been well documented in the previous literature (55, 56, 61-68). In a nationally representative study of 15,611 individuals conducted by Kant (68), low-income African-American women were in the highest tertile of

individuals consuming EDNP foods. Similar to Kant's study (68), our results indicated a significant increase in ED food expenditures for food insecure women. This is probably because of the low cost, high satiety, convenience, and long shelf-life associated with most EDNP foods (compared with fresh fruits, fresh vegetables, and other perishable items). Taste and cost are important factors influencing food choices, and have been cited as the two most important influences of food choices among low-income individuals (57).

Since most EDNP foods are high in added fats and sugars (58-60), they are palatable, satiating, and cheap (55, 56, 61-68). World market prices of sucrose (10 ¢/lb) and vegetable oils (20 ¢/lb) (2005) allow for lower manufacturing costs for foods including these products; these foods are sold for lower prices as a result (58, 60, 61). FSP participants cited "the most important factor in choosing and preparing foods was to ensure that no one would complain that they were still hungry" (62). Therefore, choosing ED foods that are high in added sugars and fats may be an unintentionally rational decision, since these foods are cheaper and allow families to "stretch" their food dollars.

We also hypothesized that an inverse association would exist between perceived nutrition knowledge and monthly expenditures on EDNP foods. Since this analysis was exploratory in nature, we expanded the significance of the p-value to = 0.10 (80). Our results did not support this hypothesis. Perceived nutrition knowledge significantly influenced monthly ED expenditures, but the correlation was positive. This suggests that as subjects rated their nutrition knowledge higher on the given scale, they purchased more EDNP foods. This finding has not been reported previously.

The influence of perceived nutrition knowledge on monthly ED expenditures is supported further by the positive relationship we found between perceived nutrition knowledge and BMI.

Increased purchase and consumption of EDNP foods as an influence on weight gain has been previously reported in the literature (17, 19, 20, 55, 56, 70-72). A dose-response relationship was observed between food security severity and obesity risk for Asian, Hispanic, and Black women in one study (70). Townsend (71) similarly observed that women from households with mild food insecurity were 30% more likely to be overweight than women from food secure households. Basiotis and Lino (72) analyzed NHANES III data and found that a significantly higher percentage of women in food insufficient/insecure households were overweight compared with food sufficient/secure households (58% vs. 47%).

Results from Olson (70), Townsend (71), and Basiotis and Lino (72) show a complex paradoxical relationship among food insecurity, EDNP foods, and overweight/obesity. EDNP foods are often abundant when food stamp benefits are first received. Interestingly, EDNP foods are also chosen at the end of the food stamp month, when benefits are scarce. Consumption of EDNP foods seems to occur in the low-income, food insecure population regardless of the food stamp benefit cycle. Studies show that the ED of foods is a function of their fat and water content (16, 17, 58, 59, 96). Energy dense foods have less water, and are generally higher in fat (16, 17, 96). The ED of a food has the largest influence on an individual's energy intake; the palatability of ED foods contributes to the "passive overconsumption" of these foods, leading to positive energy balance and net weight gain (70-72, 75, 96). Our participants who rated their nutrition knowledge as higher on the scale bought more EDNP foods, and had higher BMIs (and increased chronic disease risk) as a result of this behavior.

The WHO linked high consumption of EDNP foods to the global obesity epidemic (15, 85). In addition to an increased risk of chronic diseases associated with obesity, low-income individuals are also at increased risk of vitamin and mineral deficiencies, due to their lower

intakes of most vitamins and minerals (ENDP foods are usually low in these key micronutrients) (47, 86-90). A cross-sectional survey compared food intake data of 1751 adults in the Lower Mississippi Delta region with national survey data (47). As a group, Delta African-Americans had lower intakes of fiber, vitamins A and C, beta-carotene, riboflavin, niacin, vitamins B-6 and B-12, calcium, magnesium, iron, potassium, phosphorus, zinc, and copper when compared to Delta Caucasians and the general U.S. population (47). Although the Delta study did not evaluate diet based on food security status, its adult participants were demographically similar to ours (i.e., high chronic disease risk, low-income, low education level, Southern area). The Delta study revealed a population at risk for poor nutritional status and chronic diseases.

Findings from our initial study (73) also support low-income individuals' increased risks of chronic disease and micronutrient deficiencies. Mean intakes of all participants in the initial study failed to meet established DRIs (91-94) for potassium, folate, dietary fiber, calcium, and vitamins A, C, D, and E. Mean energy intakes from fat and protein and mean intakes of saturated fat, cholesterol, and vitamin B_{12} were significantly higher at the beginning of the food stamp month for the FI group. Mean energy intake from carbohydrate was significantly higher for the FI group at the end of the food stamp month, suggesting the replacement of protein and fat with carbohydrates. The replacement of fat and protein with carbohydrate may have reflected the increased consumption and purchase of EDNP foods that often occurs when resources and food are scarce. Initial study participants' carbohydrate intakes consisted of mostly simple sugars thought to contribute to obesity (15-17, 20); 24-hour recall data from showed minimal consumption of complex carbohydrates (e.g. fruits, vegetables, whole grains). Moreover, dietary fiber intakes of all participants were low, which further confirms the minimal consumption of fruits, vegetables, and whole grains. Overall, the diet quality of participants in the initial study

was poor, with diets emphasizing fatty meats and processed snack foods (73). These conclusions regarding diet quality can also be applied to our sample, since it was a sub-sample from the initial study. There is an urgent need for further nutrition education in this population, in order to prevent the increased risk of obesity-related chronic disease and vitamin or mineral deficiencies.

Our last hypothesis was that a positive association would exist between monthly food stamp allotment and monthly expenditures on EDNP foods. Our results do not support this hypothesis. No significant relationships were seen between monthly food stamp allotments and monthly expenditures on EDNP foods. Our lack of significance was probably due in part to small sample size. Previously reported results (56, 89) support the positive association between monthly food stamp allotment and overall food expenditures, but do not address the purchase of EDNP foods. It is reasonable to conclude that purchase and consumption of EDNP foods may be related to participation in the FSP; this relationship has been well documented in the previous literature (51, 88-90).

Since this was an exploratory study, we performed several other statistical analyses for which no formal hypotheses were stated. The positive relationship between perceived nutrition knowledge and BMI can be explained, in part, by participants' apparent lack of appropriate nutrition knowledge. Participants may believe that the nutrition knowledge they possess is well-founded; however, the nutrition knowledge they are putting into practice is incorrect, and leads to poor food choices. The purchase and consumption of EDNP foods, a contributing factor to overweight/obesity in low-income individuals, is one of these poor dietary practices (17,19,20,55,56). However, a negative relationship was found between perceived eating habits and BMI, suggesting that as participants rated their eating habits lower on the scale, their BMIs

increased. This could indicate that participants were aware of the poor quality of their eating behaviors and food choices. This could also indicate that participants were consuming foods that fit their food stamp budgets and personal preferences (i.e. EDNP foods), and were not consuming foods to promote good overall health (fruits, vegetables).

Results from a nationally representative sample of FSP participants and eligible non-participants examined by Gleason *et al.* (89) suggest that dietary knowledge in the low-income population is relatively low, but does not translate into complacency with current dietary practices. Over 60% of respondents from both groups believed that dietary intake could make a difference in their chances of developing a chronic disease (89). However, when asked if they believed that their diets were compliant with healthful dietary practices, FSP participants were more likely to say "no". Fifty percent of FSP participants believed their diets were too high in fat, 47% believed their diets were too low in fiber, and approximately 32% believed that their diets were too low in vitamins and too high in sugars and calories (89). However, the Gleason *et al.* study (89) did not assess whether the respondents possessed the knowledge to change their dietary habits for the better. Our results suggest that although participants were aware that their eating habits were seemingly poor, they did not possess the necessary nutrition knowledge, desire, or ability to change these eating habits. One potential explanation for this finding is that there is a true difference in dietary attitudes between FSP participants and eligible non-participants. Overall, these results demonstrate the need for both additional nutrition education and additional restrictions on food stamp purchases in this population.

Age, food security status, education level, perceived nutrition knowledge, and previous nutrition class attendance were not significantly associated with participants' abilities to plan balanced meals. These results are supported by results from the initial study (95). In the initial

study, self-rated nutrition knowledge did not influence balanced meal planning ability, nor did participation in nutrition education classes (95). As reported by Gleason *et al*. (89), dietary knowledge and attitudes of FSP participants support their inability to plan balanced meals. Low-income FSP participants do not know specific facts related to what types of dietary practices are healthful, such as what foods they should eat to maintain a healthy diet (89). In general, low-income adults are 20% less likely to be able to recall specific dietary information when compared to higher-income adults (89). Low-income adults also know less than 50% of the USDA's Food Guide Pyramid recommendations for food consumption, and are particularly unlikely to know they should consume a minimum of six servings of grains and five to nine servings of fruits and vegetables daily (89). It can be inferred that, although the subjects of the Gleason *et al.* study believed they were eating poorly, they did not possess the nutrition knowledge to change their dietary habits. Limited nutritional knowledge of FSP participants seems a likely contributor to their inability to plan balanced meals, but is probably only one of many factors; other factors include social and cultural factors, which were not examined in the Gleason *et al.* study (89) or in our study. The influence of social and cultural factors on the nutritional knowledge and balanced meal planning ability of FSP participants deserves further study.

Age and food security status were significantly associated with monthly frequency of fast food consumption. At some fast food outlets, the average ED of the entire menu is 2.63 kcal/g, which is more than twice the ED of recommended healthy diets (1.25 kcal/g). Fast foods are high in saturated fats, sodium, and fiber, and portion sizes are excessive (96). Items available at fast food restaurants are estimated to be 2 to 5 times larger than 2 decades ago (96-98). Our younger participants and food secure participants ate more fast food than older participants and

food insecure participants. This is of concern considering the information on fast food cited above. These participants may be at increased risk for overweight/obesity and related chronic diseases beginning earlier ages. Further, if participants experience health-related problems as a result of overconsumption of EDNP foods (including fast foods), their household incomes may decrease due to inability to work (as a result of health problems). These burdens will leave less money available for food, which will lead to further purchase and consumption of EDNP foods, and allow "passive overconsumption" of these foods to continue.

Age and income were significantly associated with perceived physical health. Younger participants and participants with a higher household income per person were more likely to rate their physical health higher on the given scale. The CDC, as part of a minority health surveillance study (84), asked black women in Orleans Parish to rate their physical health on a scale of 1 to 4, with 1=poor and 4=excellent. In that study, 23.4% of black women reported their physical health as 'poor' or 'fair' (84). Our study used the same scale as the CDC study; however, our participants were from 9 parishes and our sample was small. In our study, 81.8% of FI participants reported their physical health as 'poor' or 'fair', while 54.6% of FS participants reported their health as 'poor' or 'fair'. The difference seen between our results and those of the CDC (percentages of our subjects reporting 'poor' or 'fair' health were up to 4-fold higher than those of the CDC) probably reflect differences in sample size and location. Income stratification and other demography associated with sample selection may have been widely distributed across the CDC study sample (since the sample was not limited to FSP participants), whereas it was limited in our study. Interestingly, none of our participants rated their physical health as 'excellent.' This component of our study deserves further examination.

Conclusion

Perceived nutrition knowledge and perceived eating habits were significantly associated with BMI. These results can be partially explained by the low cost and high satiety associated with EDNP foods, and the passive overconsumption that often occurs when these foods are consumed. Age, food security status, and perceived nutrition knowledge were significantly associated with monthly ED expenditures. There were no significant associations of any tested variables with balanced meal planning ability. Age and food security status were significantly associated with monthly frequency of fast food consumption. Lastly, age and income per person were significantly associated with perceived physical health. Our study participants were unable to plan balanced meals, and purchased (and consumed) EDNP foods that were high in fat, sugar, and sodium (73).

We conclude from these results that participants' nutrition knowledge and eating habits were generally poor, and that their weight status was reflective of this. Our results suggest that the FSP would benefit from some modifications i.e. mandatory nutrition education classes, more frequent food stamp benefits over the food stamp month, development of an 'exclusion list' to prevent FSP participants from using benefits to purchase EDNP foods, meal planning classes with a registered dietitian if diet quality and health status of its participants is expected to improve. However, cost is a limiting factor in some of these modifications; adjustments to the FSP budget (or donations of time and services) may be required.

Future Directions

Future studies similar to ours should be conducted on a larger scale to increase statistical power and allow for greater detection of differences between samples. Additional monetary compensation could be offered after each complete set of receipts is returned, to better assure

compliance with returning receipts. If returned receipts are not complete, the subject could be contacted and encouraged to provide complete receipts in order to receive compensation. Also, additional ethnic groups should be included in future studies to allow for determination of differences on the basis of ethnicity/race. Female FSP participants of low SES from various ethnic groups should be studied and the data compared with higher income, educated women from the same racial/ethnic groups in Louisiana. It would also be of great interest to study a larger sample of FSP participants and compare collected data to a demographically similar group of eligible non-participants. A study of this type would provide additional information on the complex relationship among FSP participation, food insecurity, and obesity.

Our results regarding perceived nutrition knowledge, perceived eating habits, and monthly ED expenditures suggest that attempts should be made in future studies to further examine the relationships between nutrition knowledge and food purchasing and consumption. Nutrient-to-cost comparisons and meal planning exercises could be used to assess these variables in FSP participants. Lastly, the research on the relationship between FSP participation, perceived nutrition knowledge, and energy density is limited in the literature and deserves further study.

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APPENDIX A

HOUSEHOLD SURVEY

Household Survey – SRDC 2003—04

Name: _____ Interview Date: _____
Social Security #: _____

Address: _____
Street City State Zip

Home phone: _____ Work phone: _____
Relative/ Other phone: _____

1. **Education level**: (*Check all that apply*.)
a. ____ High school diploma b. ____ GED c. ____ Some college
d. ____ College degree (record highest degree) e. ____ Trade or technical college
f. ____ FIND Work / STEP g. ____ Project Independence h.____ Nutrition classes (i.e. EFNEP, FNP) (list): _____ i. ____ Other training programs: (list)
_____

2. Are you currently attending any school or training programs? ____ Yes ____ No
2a. What? _____
2b. How many hours? _____

3. Are you currently working? ____ Yes ____ No
3a. Where/ What type of job? _____
3b. How many hours per week? _____
3c. What is your hourly wage? Or weekly salary? _____
3d. What benefits are available at your job? _____
_____

4. **Marital status**:
a. ____ Married b. ____ Single, living with parents/ relatives _____
c. ____ Single, living alone d. ____ Single, living with man
e. ____ Divorced, living alone f. ____ Divorced, living with man
g. ____Widowed

5. **How many children do you have?** _____
a. Ages of children: _____

6. **Persons living in the household**: (how many)
a. ____ own children b. ____ other children c. ____ Mother
d. ____ Father e. ____ siblings f. ____ Other relative(s)
g. ____ Female friend h. ____ Male friend i. ____ Other

Medical Insurance and Care:

7. Do you have medical insurance? ___ Yes ____ No
    a. Government provided: Medicaid? ___ Yes ____ No Medicare?___Yes ___No
    b. Is medical insurance available through your employer? ____ Yes ____ No
    c. Does your employer pay all, a portion of, or none of your medical insurance?
    d. How much do you pay for medical coverage? _____

8. Do your children have medical insurance? ___ Yes ___ No
    a. Government provided: LaChip ____ Yes ____ No
    b. Is medical insurance available through your employer for your children? __ Yes __ No
    c. Does your employer pay all, a portion of, or none of your children's health insurance?

9. Are you able to get the medical care that you need? ___ Yes ___ No
    a. If not, why not? _____

10. Are your children able to get the medical care they need? ___ Yes ____ No
    a. If not, why not? _____

11. Compared with other people your age, how would you rate your overall physical health at the present (circle one)

poor	fair	good	excellent	don't know
(1)	(2)	(3)	(4)	(5)

12. Compared with other people your age, how would you rate your overall physical health over the past five years (circle one)

poor	fair	good	excellent	don't know
(1)	(2)	(3)	(4)	(5)

13. Compared with other people your age, how would you rate your overall mental health at the present (circle one)

poor	fair	good	excellent	don't know
(1)	(2)	(3)	(4)	(5)

14. Compared with other people your age, how would you rate your overall mental health over the past five years (circle one)

poor	fair	good	excellent	don't know
(1)	(2)	(3)	(4)	(5)

15. When was the last time you visited a physician? _____
    a. Did you go to the physician's office or to the emergency room? _____

16. When was the last time you visited a dentist? _____
    a. Was it a routine visit or did you go in on an emergency basis? _____

17. Have you ever had a PAP smear? _____ a. Do you have them regularly? _____ b. When was your last PAP smear? _____ c. Results? _____ d. How did you pay for the PAP smear? _____

18. Have you ever had a mammogram? _____ a. Do you have them regularly? _____ b. When was your last mammogram? _____ c. Results? _____ d. How did you pay for the mammogram? _____

19. Has a doctor ever told you that you have:
    a) Heart disease _____
    b) High cholesterol _____
    c) High blood pressure _____
    d) Diabetes _____
    e) Fluid Retention _____
    f) A problem weighing too much _____
    g) Anemia _____
    h) Cancer _____
    i) Arthritis _____
    j) Osteoporosis _____
    k) Depression _____

20. Are you taking any kind of medicines?

    List:_____

21. **Sources of Income**: (*record amount and frequency*
    a. Wages and salaries (self) _____
    b. Wages and salaries (other household members) _____
    c. Tips, commission, overtime _____
    d. Odd jobs (doing nails, hair, babysitting, transportation, etc.) _____
    e. Social Security _____
    f. SSI _____
    g. Child support _____
    h. Unemployment Compensation _____
    i. Workmen's Compensation _____
    j. Veteran's benefits _____
    k. Regular gifts from family or friends to assist with bills or expenses _____
    l. Other income sources _____

22. **Government Benefits as Sources of Income**
    a. TANF _____
    b. EITC (Earned Income Tax Credit) _____
    c. Child care assistance _____

d. Housing assistance _____
e. Energy/Fuel Assistance _____
f. Transportation Assistance _____
g. Educational grants or loans _____
h. Other _____

23. **Expenses**
a. Rent or house payment _____
b. Electric/ Gas _____
c. Sewer/ Water/ Trash collection _____
d. Cable _____
e. Telephone _____
f. Cell phone/ pager _____
g. Credit card payments _____
h. Loan payments _____
i. Rent-to-own payments _____
j. Life or burial insurance _____

24. Does anyone help you pay your monthly expenses? _____ Yes _____ No
a. Who helps? _____
b. How often? _____
c. How much? _____
d. What do they help pay for? _____

25. To what extent is your income sufficient to live on?
_____
_____

26. If you do not have enough money to pay your bills, what are some things that you will do without?_____
What do you do to stretch your money? _____
_____

27. **Transportation**:
a. Do you have a valid driver's license? ____ Yes ____ No
b. Do you own a car? ____ Yes ____ No
c. If not, do you have reliable transportation? ____ Yes ____ No

28. **Feelings about Employment:** (If applicable)
a. Are you satisfied with your current job? ____ Yes ____ No

b. What do you like most about your job? _____

_____

_____

c. Is there a job that you would rather be doing? What? _____

_____

_____

d. Is there something that makes it difficult for you to keep your job? If so, what? _____

_____

_____

APPENDIX B

BMI DATASHEET

Name: _____ Date: _____

Machine settings:

Height (stated): _____

Age (stated): _____

Weight & BMI: _____

Weight & BMI: _____

Weight & BMI: _____

Waist Circumference: _____

Waist Circumference: _____

Waist Circumference: _____

Comments:

APPENDIX C

FOOD SECURITY AND NUTRITION QUESTIONNAIRE

SRDC 2003—04 USDA Food Security Module (modified)

[Administer these items in a fairly standard manner. Upon completion of these items, go on to the height, weight, and waist circumference measures, then the 24-hour food recall]

The next questions are about the food eaten in your household in the last 30 days and whether you were able to afford the food you need.

1. "The food that I bought just didn't last, and I didn't have money to get more." Was that often, sometimes, or never true for you in the last 30 days?

2. "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 30 days?

   (1) Often true (2) Sometimes true (3) Never true

   Probe: What does "balanced meal" mean to you?

3. In the last 30 days, did you ever cut the size of your meals or skip meals because there wasn't enough money for food?

   (1) Yes _____ (2) No _____

4. In the last 30 days, did you ever eat less than you felt you should because there wasn't enough money to buy food?

   (1) Yes _____ (2) No _____

5. In the last 30 days, were you ever hungry but didn't eat because you couldn't afford enough food?

   (1) Yes _____ (2) No _____

6. In the last 30 days, have you not eaten in order to have enough food for your children?

   (1) Yes _____ (2) No _____

7. Which of these statements best described the food eaten in your household in the last 30 days? (Check only one)

   (1) We always have enough to eat and the kinds of food we want

(2) We have enough food to eat but NOT always the KINDS of food we want
(3) SOMETIMES we don't have ENOUGH to eat
(4) OFTEN we don't have ENOUGH to eat

8. Who does the majority of the grocery shopping in your household? (circle one)

a) Self
b) Spouse/significant other
c) Parent(s)
d) Child(ren)
e) Friends/roommate
f) Other (describe): _____

9. Who does the majority of cooking for your household? (circle one)
a) Self
b) Spouse/significant other
c) Parent(s)
d) Child(ren)
e) Friends/roommate
f) Other (describe): _____

10. Where do you do the majority of your food shopping?

11. Where else do you shop for food?

12. What amount of food stamps do you receive each month? _____

13. How much money do you spend for food above the amount of food stamps that you receive each month? _____

14. If you need to, how do you stretch your food stamps to reach the end of the month?
_____

15. On the average, how much does your household spend per week on food?

$0-25	$26-75	$ 76-125	$126-200	$201-300	$301-500
(1)	(2)	(3)	(4)	(5)	(6)

16. How many persons does this feed per week? (fill in a number in each of the spaces below; fill in zero if applicable)

a. _____ number of adults
b. _____ number of teenagers
c. _____ number of children
d. _____ number of infants

17. Do you receive WIC? ____ Yes ____ No

18. How would you rate your eating habits? (circle one)

Poor	Fair	Good	Excellent
(1)	(2)	(3)	(4)

19. How would you rate the nutritional quality of your diet? (circle one)

Poor	Fair	Good	Excellent
(1)	(2)	(3)	(4)

20. About how many calories do you think you eat a day? (circle one)

Much Too Low	Somewhat Low	Just About Right	Somewhat High	Much Too High
(1)	(2)	(3)	(4)	(5)

21. How would you rate your knowledge of nutrition? (circle one)

Poor	Fair	Good	Excellent
(1)	(2)	(3)	(4)

22. On average, how often do you eat in fast-food restaurants? (circle one)

Rarely Or Never	Several Times Per Month	Several Times Per Week	Once a Day	Most Meals
(1)	(2)	(3)	(4)	(5)

23. Which fast-food restaurants do you eat in most often?

24. What do you typically order in these fast-food restaurants?

25. On average, how often do you eat in other types of restaurants?

Rarely Or Never (1)	Several Times Per Month (2)	Several Times Per Week (3)	Once a Day (4)	Most Meals (5)

26. Which restaurants do you eat in most often?

27. What do you typically order in these restaurants?

28. Use the silhouettes above to answer the following questions about yourself (for each item, fill in the number of the corresponding silhouette).

a. Which figure is closest to your size? _____
b. Which figure is closest to the figure you desire? _____
c. Which figure represents you as a child? _____
d. Which figure represents you as a teenager? _____
e. Which figure is closest to your highest adult body weight? _____
f. Which figure is closest to your lowest adult body weight? _____

29. Do you think you were overweight as a child or teenager? (If yes, proceed with the Perception of Teasing Scale - POTS.)

VITA

Carrie Marie Elks was born in Baton Rouge, Louisiana, on November 28, 1978. Carrie attended Runnels High School in Baton Rouge, and graduated as valedictorian of her class in May 1996. She began her collegiate work at Louisiana State University in August 1996, and graduated with Upper Division Honors Distinction from the University in May 2001. Immediately following her college graduation, she relocated to New Orleans to complete her dietetic internship at Touro Infirmary. Carrie sat for and passed the board registration examination for dietitians in September 2002, and has been working as a Registered Dietitian since that time. Her current goal is to continue her graduate education in hopes of attaining a doctoral degree from LSU.