Food security status, nutrient intake at the beginning and end of the monthly resource cycle, and body mass index in female food stamp recipients

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FOOD SECURITY STATUS, NUTRIENT INTAKE AT THE BEGINNING AND END OF THE MONTHLY RESOURCE CYCLE, AND BODY MASS INDEX IN FEMALE FOOD STAMP RECIPIENTS

A Thesis
Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Master of Science in

The School of Human Ecology

by
Caroline C. Burke
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LIST OF ACRONYMS

FSP=Food Stamp Program
USDA=United States Department of Agriculture
BMI=Body Mass Index
DRI=Dietary Reference Intake
RDA=Recommended Dietary Allowance
LMD=Lower Mississippi Delta
AIN=American Institute of Nutrition
CCHIP=Community Childhood Hunger Identification Project
CFSM=Core Food Security Module
NHANES=National Health and Nutrition Examination Survey
WIC=Women, Infants, and Children
EBT=Electronic Benefits Transfer
CSFII=Continuing Survey of Food Intake by Individuals
CEX=Consumer Expenditure Diary Survey
EFNEP=Expanded Food and Nutrition Education Program
FSNEP=Food Stamp Nutrition Education Program
HNIS=Human Nutrition Information Service
TEE=Total Energy Expenditure
FIS=Food Insecure
FS=Food Secure
FIF=Food-Insufficient Families
FSF=Food-Sufficient Families
FISH=Food Insecure with Hunger

%=percent

SFA=Saturated Fatty Acids

MUFA=Monounsaturated Fatty Acids

PUFA=Polyunsaturated Fatty Acids

wt=weight

lbs=pounds

kcals=kilocalories

PRO=Protein

CHO=Carbohydrate

DGA=Dietary Guidelines for Americans

ATP=Adult Treatment Panel

HDL=high-density lipoprotein

LDL=low-density lipoprotein

LI=lactose intolerant

LT=lactose tolerant

EDNP=energy dense nutrient poor

CHD=Coronary Heart Disease

mg=milligram

µg=microgram

g=gram

µg/d=micrograms/day

mg/d=milligrams/day
Diets are typically poorer and risk of chronic disease (e.g. obesity) is greatest in low-income populations. Food security status, nutrient intake, and Body Mass Index were assessed in 64 female food stamp recipients in Southeast Louisiana. One 24-hour dietary recall was collected at the beginning of the month (Day 1) and one at the end of the month (Day 2). Food security status was: 29 food secure (FS), 26 food insecure (FIS), and nine food insecure with hunger (FISH). Sixty-two % (n=39) of our study participants were obese. Mean % energy from protein (p=0.03); total fat (p=0.029), % saturated fatty acids [SFA] (p=0.027), % monounsaturated fatty acids [MUFA] (p=0.012), % polyunsaturated fatty acids [PUFA] (p=0.047); and vitamins B_{12} (p=0.045), E (p=0.011) and A (p=0.033), respectively, for Day 1 were higher than Day 2 in the FIS group. Mean % energy from carbohydrate for Day 2 was significantly greater (p=0.002) than Day 1 in the FIS group. In FISH subjects, cholesterol intake was higher (p=0.0352) on Day 1 than on Day 2. In the FS group, mean calcium (p=0.047) and iron (p=0.039) intakes were significantly greater on Day 2 when compared to Day 1. Mean cholesterol intake was different (p=0.031) among the three food security status groups.

Regardless of food security status, % SFA, cholesterol, and sodium exceeded current Adult Treatment Panel (ATP) III recommendations with the exception of mean cholesterol intake on Day 2. Mean % MUFA and % PUFA intakes were approximately 50% below ATP III recommendations. Mean intakes of all food security status groups failed to meet the established Dietary Reference Intakes (DRIs) for potassium; folate; vitamins D, E, and A; calcium; and dietary fiber. Few study participants met the DRI for calcium; potassium; dietary fiber; and vitamins A, E, or D. Diets of all participants were poor and risk of nutrient deficiencies was
high. The relationship between diet, weight, and food security in food stamp participants
deserves further study.
CHAPTER 1
INTRODUCTION

Introduction

Food insecurity, that is the uncertainty or inability associated with obtaining food for all household members due to money or resource shortage, is a reality for some Americans (1). National estimates in 2002 showed the following four groups had food insecurity rates that exceeded the national average of 11.1 percent (%): households with incomes below the poverty level (38.1 %); households with children, headed by a single woman (32.0%); Hispanic households (21.7%); and black households (22.0%) (1, 2). A female head of household (3, 4) and low income are the most important predictors of food insecurity (3-7).

Low-income females are more likely than middle- or higher-income females to be overweight/obese (8-10) and to report having poorer overall health (11) or a chronic disease (7). Regardless of income level, prevalence estimates for obesity (12-19) and related chronic conditions (20-22) are notably higher among black than white women. The prototypical food insecure individual is a low income, black female head of household who is probably overweight/obese or has a related chronic disease.

In general, low-income women have diets that may compromise their health (4-6, 23-28). Low levels of food intake along with poor food choices, specifically in food insufficient/food insecure women with hunger, increases likelihood of vitamin and mineral deficiencies, thereby compromising nutritional status (4-6, 23-25, 28).

Food stamp program (FSP) participation adds an additional level of complexity to the link between diet and food insecurity. Food insecure women who participate in the food stamp program have episodic eating patterns (29-31). Studies suggest that participants overeat when
food stamps are first received, but limit their food intake at the end of the resource cycle when food is scarce (29-32).

In our study, the measurement tool used to assess dietary intake was the multiple-pass 24-hour dietary recall. Underreporting is an acknowledged limitation of methods that rely on self-reported intake (e.g. 24-hour dietary recalls), especially when compared with the doubly labeled water method, (33-35), which is the gold standard for measuring energy expenditure (36). Despite its recognition as the gold standard, the doubly labeled water technique requires costly stable isotopes and sophisticated instruments (37). As such, it is often replaced by less difficult and inexpensive methods, e.g. 24-hour dietary recall (38). Telephone-administered 24-hour dietary recalls appear to be as effective as the in-person 24-hour recalls in estimating dietary intake (35, 39-41).

**Objectives**

Objectives of this study were to: 1) determine the food security status of female food stamp recipients using a modified version of the United States Department of Agriculture (USDA) short form; 2) calculate Body Mass Indices (BMI)s of participants and compare these calculations to energy and nutrient intake; and 3) calculate and compare energy and nutrient intake at the beginning and end of the resource cycle using in-person and telephone 24-hour recalls.

**Hypotheses**

It was hypothesized that:

1. The majority of study participants are food insecure.
2. The majority of study participants are overweight and have diets that increase their risk of both nutrient deficiencies and chronic disease.
3. The majority of study participants are more likely to meet the recommendations for the Dietary Reference Intakes (DRIs) and Recommended Dietary Allowances (RDAs) when food stamp benefits are first received as opposed to the end of the resource cycle.

**Assumptions**

Assumptions that were made in the design and implementation of this study were:

1. The sample size was adequate (n=64) to describe nutrient intake.
2. The modified version of the USDA short form was a valid instrument for measuring food security.
3. The 24-hour recall was an acceptable method of obtaining dietary data for an aggregate sample.
4. The 24-hour recall was appropriate to account for possible fluctuations in typical eating patterns.
5. Interviewers developed rapport with participants that encouraged honest responses to questions.

**Limitations**

Limitations in this study were:

1. A non-probability sample was used.
2. The 24-hour recall relies on memory.
3. Underreporting of dietary intake is a common cause of recall bias, and may have been influenced by a number of factors in this study (e.g. overweight/obese, low education level, comfort level among interviewers).
4. The interviewers were not indigenous to the population sampled and may have biased the participant’s responses.
**Justification**

This study is important for three major reasons. First, calculation and comparison of energy and nutrient intake at the beginning and end of the resource cycle will extend the literature on the relationship between food security status and diet. Prevalence rates of poverty and low education in the Lower Mississippi Delta (LMD) region of Arkansas, Louisiana, and Mississippi have been shown to be higher than U.S. national estimates (11). Diets are typically poorer and risk of chronic disease (e.g. obesity) is greatest in populations where low-income and low education levels are widespread. Second, diet analysis will help to describe mean energy and nutrient excesses or deficiencies in our sample. Third, weight analysis will allow speculation about the influence of energy and nutrient intake on BMI.

The relationship between diet and food security status/food sufficiency in a generalized low-income population have been described in the literature (4, 23-25, 28); however, more research is desired to discuss FSP participation effects on food security status and diet. Our research seeks to accomplish this task. Data collected from this research not only will extend the literature on FSP participation effects, but also will be made available to policymakers and nutrition educators to make informed decisions.
CHAPTER 2
REVIEW OF THE LITERATURE

Food Insecurity

Background and Definitions

In the early 1990s, the concept of food security was espoused as a framework for describing, researching, and designing policies to address food access problems stemming from poverty at the household level in the U.S (42). In 1990, the Life Sciences Research Office of the Federation of American Societies of Experimental Biology in partnership with the American Institute of Nutrition (AIN) derived and published conceptual definitions for the U.S. context of food security, food insecurity, and hunger. Through the backing of the USDA Food and Consumer Services and Centers for Disease Control and Prevention National Center for Health Statistics, empirical measures of food security were developed in the Food Security Measurement Study of 1995-1997 (42).

The AIN Expert panel defined food security broadly as “access by all people at all times to enough food for an active, healthy lifestyle” (43). At a minimum, food security must meet two criteria: “1) the ready availability of nutritionally adequate and safe foods, and 2) the assured ability to acquire acceptable foods in socially acceptable ways” (44).

Food security concepts were further differentiated by household and individual levels. At the household level, food insecurity is described as the lack of access for all members at all times to enough food to lead active, healthy lives (45). Food insecurity, at the individual level, is defined as the inability to meet food needs at all times in socially acceptable ways (45). The term “socially acceptable way” refers to conventional food sources such as grocery stores, restaurants, and government food assistance programs, without having to resort to
unconventional means such as emergency food supplies, scavenging, stealing, or other coping strategies (43, 44). Focus group discussions explored coping strategies in limited resource (food-insecure) individuals. Participants in those studies provided comprehensive lists of coping strategies, many of which were deemed socially unacceptable, suggesting that the food insecure must often explore and adopt unconventional methods of food acquisition (29, 46).

Food insecurity, although likened to the definition of hunger, is not interchangeable with hunger (44). Hunger is defined as an uneasy or painful sensation caused by a lack of food (42-44, 47, 48). Even though food insecurity does not carry the emotional connotation of a “painful experience,” hunger may be a potential consequence of food insecurity (42-44).

**Measurement Methods**

The Community Childhood Hunger Identification Project (CCHIP) is an eight question-screening instrument developed to determine an individual’s food intake and coping strategies (45). This instrument depicts the approaches taken by household providers to stretch money for food and denotes whether adults deprive themselves before they deprive their children (45). The instrument was designed specifically for families with children younger than 12 years old (48).

The Radimer/Cornell scale was intended to differentiate among household, adult, and child food insecurity (45). The instrument provides a graded scale of the degree of food insecurity ranging from mild (anxiety that food will not last) to severe (children deprived of food for a whole day), and also indirectly distinguishes between insufficient resources to acquire sufficient desirable foods and insufficient resources to meet basic food needs (45).

In a random sample of 193 households comprised of women and children, results supported the validity of Radimer/Cornell measures in distinguishing among groups of households experiencing progressively severe food insecurity and hunger (49). Another study
conducted in the following year concluded that the Radimer/Cornell measures were useful in identifying households in rural populations experiencing food insecurity (28). Moreover, the measures in that study provided information about the food supply and the dietary intake problems experienced by food insecure households and persons (28). Using data collected from the sample of the 193 households aforementioned, it was concluded that the CCHIP and Radimer/Cornell measures had good specificity (namely, the percent of truly food secure correctly classified) and excellent sensitivity (the percent of truly food insecure correctly classified) (50). Overall, these three studies (28, 49, 50) have provided support for the CCHIP and Radimer/Cornell measures as appropriate screening tools in assessing food insecurity and hunger.

The important points from the CCHIP and the Radimer/Cornell instruments were integrated into a census instrument that is administered annually to a sample of the U.S. population (45). This census instrument is called the U.S. Government Food-Security/Hunger Core Module or Core Food Security Module (CFSM), and was developed to identify those households suffering from food insecurity or hunger due to money shortages at any time during the previous 12 months (45). The module is a series of 18 questions, which cover a wide range of severity of food insecurity. Each household’s food security status lies along a continuum, with extreme categories at opposing ends (food secure vs. severe hunger) (47).

At the least severe levels of food insecurity, the questions ask whether subjects worried that their food would run out before they got money to buy more and whether they could afford to eat balanced meals (51, 52). Questions at the midrange ask about reductions in food intake, such as whether adults in the household cut the size of meals or skipped meals because there was not enough money for food. At the more severe levels of food insecurity, questions ask whether
children skipped meals because there was not enough money for food, and whether adults did not eat for a whole day because there was not enough money for food (51, 52). Based on the households’ responses to all items, interviewed households are grouped into one of three categories: food secure (those affirming less than three items), food insecure without hunger (those affirming three or more items), food insecure with hunger (those affirming eight or more items) (47, 51, 52).

The short form of the CFSM is a 6-item scale that uses a subset of the standard 18 items, and is the preferred survey method when time constraints are an issue (53). However, the short form is not without its limitations. These include: an inability to distinguish between the two most severe levels of hunger, exclusion of child-focused items, less precision in comparison with the 18-item measure, and inappropriateness for use in elderly populations who typically have a high prevalence of physical disabilities or transportation difficulties (53, 54). Despite its limitations, a study that used the short form correctly classified the level of food security for 97.7% of all households, including 95.6% of all households with children and 99.0% of all households without children (54). Moreover, the prevalence of overall food insecurity and food insecurity with hunger were underestimated by only 0.3 percentage point with the short form (54).

**Prevalence Estimates of Food Insecurity**

Food insecurity and food insecurity with hunger prevalence rates vary from state to state (2). The data from 2000-2002 were combined for the purpose of providing more reliable statistics at the state level. Louisiana’s average prevalence estimates for food insecurity (with or without hunger) exceeded the national average prevalence rates for food insecurity (with or without hunger) at 13.1% vs. 11.1%, respectively. However, Louisiana’s average did not exceed
prevalence rates of households experiencing food insecurity with hunger at the national level, 2.9% vs. 3.5%, respectively (2).

Throughout 2002, approximately 89% of American households were food secure (1). Food insecure households comprised the remaining 11.1%. Nearly one-third of food-insecure households (3.5%) were food insecure to such a degree that one or more household members were hungry because they could not afford food at least some time during the year. The remaining two-thirds of food-insecure households (7.6%) relied on a variety of coping strategies to obtain enough food to avoid hunger (1).

National estimates in 2002 showed the following four groups had food insecurity rates that exceeded the national average of 11.1%: 1) households with incomes below the poverty level (38.1%), 2) households with children, headed by a single woman (32.0%), 3) Hispanic households (21.7%), and 4) black households (22.0%) (1). Households with children had more than twice the rate of food insecurity as those without children (16.5 vs. 8.1%). Married-couple families showed the lowest rate of food insecurity (10.4%) among households with children (1).

In central cities (14.4%) and non-metro areas (11.6%), prevalence of food insecurity exceeded that of households in suburbs and other metropolitan areas outside central cities (8.8%) (1). Food insecurity rates, regionally, were above the national rate in the South and West (12.4 and 12.1%, respectively), and below the national rate in the Midwest and Northeast (9.6 and 9.2%, respectively) (1).

**Food Insecurity and Obesity**

The 1999–2000 National Health and Nutrition Examination Survey (NHANES) estimated 64% of U.S. adults aged ≥ 20 years were overweight or obese (55, 56). Body mass index is the
index used to express the ratio of weight-to-height. Individuals with a BMI of 25 to 29.9 are overweight, whereas those with a BMI of greater than or equal to 30 are obese (57).

In the U.S., obesity rates are high among those with limited-resources, racial-ethnic minorities (13-19, 55), and the poor (7-10, 55). High obesity rates in women tend to be linked with low incomes (7-10, 55) and low education levels (55).

Although a causal relationship between food insecurity and obesity has not been established, the link between food insecurity and obesity has been documented repeatedly (58). Recently, three studies (31, 58, 59) confirmed that, in women, food insecurity increases the risk of obesity. In each of these studies, the intermediate level of food insecurity (food insecure without hunger) was positively associated with risk for obesity or overweight (31, 58, 59).

Unlike the study populations of Olson (59) and Townsend (31), Adams’ study population (58) included greater ethnic diversity with regard to the relationship between food insecurity and obesity. In the Adams’ study (58), four questions adapted from the U.S. Household Food Security Module were used to evaluate food insecurity. After adjustment for characteristics expected to be related to obesity status, increased risk of obesity in non-Hispanic white women was associated only with food insecurity without hunger, and not with the more severe food insecurity with hunger. In contrast, there was a dose-response relationship observed for women of other races/ethnicities (Asians, Blacks, and Hispanics), with the risk for obesity augmented by an increase in the severity of food insecurity (58).

Using the Radimer/Cornell measure to categorize household food insecurity in rural New York State women, Olson (59) demonstrated that mean BMI and prevalence of overweight/obesity increased with moderate food insecurity, but decreased as the condition became more severe. Similarly, Townsend observed that women from households with mild
food insecurity were 30% more likely than food secure women to be overweight, but that risk at 
the more severe levels of food insecurity did not differ significantly from that of food secure 
women (31). Unlike the Radimer/Cornell measure employed by Olson (59), Townsend (31) 
used the USDA food sufficiency indicator. The differing instruments used in the studies limit 
comparisons that can be drawn about food security status. Despite differences in food 
insecurity/insufficiency tools, criteria used to determine obesity, and the populations examined, 
these studies (31, 58, 59) confirmed a relationship, with food insecurity, specifically intermediate 
levels, and increasing risk of overweight/obesity (31, 58, 59).

Moreover, those studies (31, 58, 59) confirmed an emerging paradox, with prevalence of 
overweight/obesity being less among the two extremes of food security status. The idea of a 
paradox describes the milder or moderate levels of food insecurity, with an individual being both 
overweight and food insecure (31). This paradox is not unique to U.S. populations. Finnish men 
and women completed the Edmonton Food Policy Council’s survey, which included five 
separate questions about fears and experiences of food insecurity during the past 12 months (60). 
Data in that study (60) suggested that the thinnest group was most likely to be hungry and report 
food insecurity in all five separate items, usually followed by the obese. Thus, both thinness and 
obesity were linked with food insecurity, but the more severe degree of hunger was observed 
only among the thin group, suggesting a curvilinear relationship between food insecurity and 
BMI (60).

**Food Stamp Program Participation and Food Insecurity**

Ninety-four percent of USDA’s total expenditures for food assistance come from five 
food assistance programs: the FSP, the National School Lunch Program, the Special 
Supplemental Nutrition Program for Women, Infants, and Children (WIC), the School Breakfast
Program, and the Child and Adult Food Care Program (61). The largest of the food assistance programs in 2003 was the FSP, and it accounted for 57% of all food assistance spending in 2003. This was a continuation of a longer term trend—since August of fiscal 2000, FSP participation increased in 33 of the last 38 months due to both increases in participation and increases in the average amount of benefits per person (61).

The aim of the FSP is to prevent hunger among low-income Americans of all ages and household types (61, 62). The FSP helps eligible participants to attain a more nutritious diet by providing monthly benefits for food purchases at authorized food stores (61, 62). Food Stamp eligibility depends on three criteria (63-65). First, households without an elderly or disabled member must have gross incomes at or less than 130% of the federal poverty level. Second, net incomes (gross income minus certain deductions) for a household must be below the poverty level. Third, most households must not exceed asset limits of $2,000, or $3,000 for households with a member over age 60 (63-65). The USDA’s Thrifty Food Plan, a low-cost model food plan that upholds nutrition guidelines and is updated annually to reflect the changing cost of food, determines the maximum food stamp benefit (63, 64).

Welfare reform authorized the implementation of Electronic Benefit Transfer (EBT) systems to issue food stamp benefits (66). Before October of 2002, monthly benefits were either in the form of coupons or EBT payments. Now, with the EBT system, food stamp benefits are posted monthly to a participant’s EBT account. Upon purchase of food with this ATM-like card, funds are transferred to the retailer’s account (66). Following purchases of all foods in authorized stores, the federal government reimburses these authorized stores for the value of the food (63).
The relationship between FSP participation and food insecurity has shown conflicting results (3, 67, 68). Using a national data sample taken from the 1989-91 Continuing Survey of Food Intake by Individuals (CSFII) and the 1992 Survey of Income and Program Participation, a study was conducted examining the effects of different economic and demographic variables on food insufficiency (67). Food insufficiency in that study decreased with rising income, food stamp benefits, education, and with home ownership (67). However, Cohen (68) showed that food insecurity was worse among food stamp recipients than among eligible nonparticipants and near-eligible individuals, both of which had higher average incomes (68). Further, approximately half of all food stamp recipients encountered some form of food insecurity (68).

The link between FSP participation and food insecurity is both inconsistent and complex. The omission of food insecurity from models of obesity may exaggerate the relationship between food stamp participation and obesity (30, 69). Consistent with the results of Townsend’s study (31), Gibson found a positive significant association between FSP participation and weight for women (30). Compared to no program participation, FSP participation in Gibson’s study in each of the previous five years was linked with an approximate 20.5% increase in predicted probability of current obesity (30). Although Gibson’s study (30) attempted to overcome limitations observed in Townsend’s study (31) through the use of longitudinal data, Gibson did not control for food insecurity (30). Hence, the omission of food insecurity indicators may have confounded the interpretation of FSP variables in Gibson’s study (30).

Mechanisms offered for the relationship between FSP participation and obesity include: 1) FSP participation leads to increased intake of inexpensive high energy foods likely to result in obesity; and 2) over-consumption of heavy fattening foods during the first three weeks of the food stamp benefit cycle may explain the positive relationship between FSP and being
overweight for women (30, 31). In households, food stamp benefits are expected monthly, and Townsend reasoned that binge-eating behavior occurs when food stamp benefits first arrive, followed by periods of shortage when benefits are near depletion, causing weight gain (31).

Using nationally representative data taken from the Consumer Expenditure Diary Survey (CEX) for 1988-92 and the CSFII for 1989-91, a study was conducted (70) supporting Townsend’s assertion (31) concerning monthly food stamp cycling, although the results did not demonstrate extreme levels of energy consumption (70). A large spike in mean food spending by food stamp households was observed immediately (within the first three days) after benefits were received (70). Moreover, food energy intake patterns differed for households participating in the FSP depending on whether they shopped for food frequently (more than one major shopping trip per month) or infrequently (one major shopping trip per month). Mean food energy intake fell significantly by the fourth week of the month for those who shopped infrequently (42% of all food stamp households), whereas intake remained stable over the course of the month among the remaining households (70).

Kempson (71) supported Townsend’s (31) assertion concerning the monthly food stamp cycle. Expanded Food and Nutrition Education Program (EFNEP) and Food Stamp and Nutrition Education Program (FSNEP) nutrition educators identified several food management practices used by people with limited resources to ensure food sufficiency (71). Food management practices such as overeating when food was available and cycling monthly eating patterns were confirmed. In summary, cycling monthly eating patterns consisted of: eating fresh foods before canned and pre-packed products, limiting variety at the end of the month, increased restaurant dining at the beginning of the month, and reliance upon emergency food supplies at the end of the month (71).
24-Hour Dietary Recall

The 24-hour dietary recall is a method of obtaining dietary information, requiring the participant to recall exact intake from the 24-hour period of the previous day (72). To limit the degree of underreporting with self-reported food intake, the USDA – Human Nutrition Information Service (HNIS) developed the multiple-pass 24-hour recall method (38). The multiple-pass 24-hour recall, unlike the traditional method, uses three distinct passes to obtain information about a participant’s food intake during the previous 24 hours (38). The rationale behind such repetition is to increase retrieval of the requested information by providing additional memory cues (73).

The first pass has been categorized as the quick list, in which the subject is asked to recall everything he or she consumed the previous day (38). The second pass is named the detailed description, and the purpose of this pass is clarification of foods mentioned in the quick list. Lastly, the third pass is termed the review. In this pass the interviewer reviews the list of foods revealed, probes for additional eating occasions, and clarifies food portion sizes. Major advantages of the multiple-pass approach apart from its rationale include: quickness (roughly 20-25 minutes per interview), low respondent burden when compared with methods such as weighed dietary records, and its cost-effectiveness (38).

When compared with the doubly labeled water method, the limitation of underreporting typically associated with methods that rely on self-reported intake (e.g. 24-hour dietary recalls) is even more evident (33-35). The doubly labeled water method uses stable isotopes to measure total energy expenditure (TEE) accurately in free-living people (35). Because this technique requires costly stable isotopes and sophisticated instruments, it is often replaced by less difficult and inexpensive methods, e.g., 24-hour dietary recall (37).
Although the limitations of cost and difficulty render the 24-hour dietary recall the obvious choice for many researchers who are restricted by budget, the underreporting typically associated with 24-hour dietary recalls was glaring in most (33-35), but not all studies (38) that used the doubly labeled water method as a biomarker of TEE. Mean reported energy intake by means of two 24-hour recalls and 14 consecutive days of food records in a sample of 44 women showed that food intake was underreported by 21.1% when compared against measured TEE by the doubly labeled water method (33).

In a sample of 35 low-income women, four multiple-pass 24-hour recalls were collected over a 14-day period (34). Mean energy intake was significantly lower (p=0.001) than mean TEE (2,197±607 vs. 2,644±503 kcal), suggesting that the multiple-pass 24-hour recall did not generate an accurate group measure of energy intake (34). The findings of this study of 35 low-income women (34) paralleled the results of another study (35) also conducted in a sample of 35 women (35). Results showed that mean energy intake in both two in-person and two telephone multiple pass 24-hour recalls was significantly lower (p=0.006 and 0.001, respectively) than TEE in which doubly labeled water measurements were used for validation (35).

In contrast, no significant difference was found between the three-day mean energy intake as measured by three multiple-pass 24-hour dietary recalls and TEE for the group as measured by the doubly labeled water method in a sample of 24 young children, aged four-seven years (38). The instruments (24-hour recalls and food records) in the three aforementioned studies (33-35) were found not-valid when compared to TEE, whereas the study conducted in the sample of young children (38) showed that the multiple pass 24-hour recalls were sufficient to make valid group estimates of energy intake. Overall, these four studies (33-35, 38) suggest that underreporting, though typically a drawback of self-reported intake, may be influenced more by
certain demographic characteristics and not by limitations inherent to the method itself. Thus, the population sampled can largely affect the degree of validity/non-validity of the 24-hour recall when compared with TEE using the doubly labeled water method (33-35, 38).

Research on 24-hour dietary recalls suggests that the profile of those most likely to underreport includes women (33-35, 41, 74), who are older (33, 34, 41, 74) and overweight (34, 35, 41, 74). This profile is not limited to the 24-hour dietary recall method. Seven-day estimated food records were used to obtain dietary intake in a study conducted in a sample of 22 normal-weight and obese women (75). Mean energy intake was underreported to a greater degree by obese women when compared to normal-weight women (-19.4% vs. – 9.7%) (75). Thus, regardless of the method of self-reported intake, underreporting ensued a specific prototype.

In contrast, another study in a sample of 78 men and women showed that underreporting does not always ensue a specific prototype, especially if the generalizations being made pertain to gender (73). Although women underestimated energy intake to a larger degree than men during the self-selected diet period (13% and 11%, respectively), men underestimated and women overestimated during the controlled period (13% and 1.3%, respectively). Thus, the type of recording period (self-selected vs. controlled) influenced the accuracy of recalled energy intake in women to a larger degree than men (73).

**Telephone Interviewing**

Telephone interviewing, in general, has several advantages. The major advantage is that it is less expensive than face-to-face interviewing, with direct costs involving as little as one-fourth the cost of face-to-face surveys (35, 72, 76). Other advantages of telephone interviewing versus face-to-face interviewing include: less time consuming and the removal of psychosocial
variables (35). The removal of psychosocial variables often improves the extent of openness and honesty on the part of the individual being interviewed (35).

The research conducted on telephone interviewing, particularly as it concerns telephone 24-hour dietary recalls, suggests that in-person and telephone 24-hour recalls are interchangeable. The results of a study that involved collection of four multiple-pass 24-hour recalls (two in-person, two by telephone) in a sample of women revealed no significant differences in mean energy intake between the telephone and in-person interviews (2,253±688 kcal and 2,173±656 kcal, respectively) (35). The results of a second study conducted in a sample of older, black females, showed no significant difference between two in-person 24-hour dietary recalls using the multiple pass approach and one telephone 24-hour dietary recall using the multiple pass approach for any nutrient (41). Moreover, no statistically significant differences were found among methods based on employment, education, or income, which suggests that demographics do not negatively impact the efficacy of telephone interviewing, specifically as it affects telephone 24-hour dietary recalls (41).

Seven-hundred telephone-administered 24-hour dietary recalls collected from women aged 20 to 49 years were compared to 540 in-person 24-hour dietary recalls taken from women, 20 to 49 years, who participated in the 1994-1996 CSFII survey (40). No significant differences were observed between the telephone survey and the 1996 CSFII results. This study not only provided support for the telephone recall as a valid data collection tool, but also evidenced the appropriateness of the telephone recall as an acceptable method of data collection in national food consumption surveys (40).

In a sample of rural low-income participants from the Delta region of Arkansas, Louisiana, and Mississippi, no significant differences for mean energy or protein intake were
detected between multiple pass telephone and in-person 24-hour dietary recalls (39). Findings persisted in spite of adjustments for age, gender and BMI. Not only have those findings provided support for the use of telephone surveys as an appropriate method to obtain dietary data, but also the results are particularly meaningful for study participants in a rural, low-income area at risk of or experiencing food insecurity (39).

**Diet and Low Income**

**Food Purchasing Behavior and Low Income**

Regardless of income status, Americans (as a group) eat fewer servings of fruits and vegetables than are currently recommended by the Food Guide Pyramid (77). However, the lack of fruits and vegetables purchased and subsequently consumed appears to be greatest among individuals who have a low-income (77, 78). A study that used a data set taken from a subset of observations from 1991 and 2000 CEX showed that low-income households spent significantly less on fruits and vegetables when compared to higher income households (77). In fact, about 19% of low-income households bought no fruits and vegetables in any given week versus approximately 10% of higher income households (77).

Using a 1998 sample of food store purchase data, it was found in a report on food purchasing behavior that low-income households purchased 7.6% more meat and poultry (combined) than middle-income households and 6.7% more than higher-income households (78). Although low-income households purchased more meat in that report, they spent less per pound for both meat and poultry, which suggests that those with a low socioeconomic status reduce their spending by purchasing lower quality products. Moreover, low-income households purchased 3.3% fewer fruits and vegetables (by weight) per person than high-income households and spent 13% less, which suggests that low-income households are selecting fruits and
vegetables that cost less (78). Although the scope of this thesis does not address food-spending behavior directly by evaluating grocery receipts, these two studies (77, 78) deserve mentioning because dietary data collected from 24-hour dietary recalls reflects both food purchased and consumed.

**Diet and Food Security Status**

With a worsening of food security status, diets have been shown to be noticeably poorer (4, 23-25, 28). Among those with no hunger evident, moderate hunger, and severe hunger, the results of food consumption patterns in 153 women seeking charitable food assistance in Toronto showed that those with severe or moderate hunger reported significantly lower consumption of fruit and vegetables, as well as meat, when compared to those in households with no hunger evident (4). Thus, food security status was shown to have an effect on consumption of servings from fruits and vegetables as well as meat, with household food insecurity being linked with lower servings from these two major food groups (4).

Unlike the aforementioned study (4), which evaluated diets using food groups, nutrient intakes were assessed in a sample of 193 women living in a rural New York State county (28). Neither the food insecure (FIS) nor the food secure (FS) groups in that study (28) consumed the recommended number of servings from the five foods groups. Potassium and fiber, in addition to fruit consumption, were significantly less in the FIS group when compared to the FS group. Among those who were FIS, a significantly greater percentage of respondents consumed less than the RDA for vitamin C and fewer than five fruits and vegetables per day when compared to FS participants (28). In that study (28), FIS was shown to be associated with lower consumption of fruit and vegetables, as well as those variables in the nutrient analysis (e.g. potassium, fiber) thought to represent fruit and vegetable consumption. Hunger groups were collapsed into the
FIS group, increasing the number of individuals who were categorized as FIS. The increase in sample size for the FIS group may explain the degree of significance detected among FS and FIS groups for study parameters.

In a sample of 145 Canadian women, significant differences were detected among groups defined by food security status (no hunger evident, FIS with moderate hunger, and FIS with severe hunger) for energy, protein, vitamin A, iron, magnesium, and zinc as food security status worsened (25). These findings suggested that dietary intakes were compromised in this population of Canadian women with worsening of food security (25).

Dietary intakes in adults from food-insufficient families (FIF) and adults from food-sufficient families (FSF) were examined using cross-sectional data from NHANES III (24). Younger adults from FIF had significantly lower intakes of calcium, and older adults from FIF had significantly lower intakes of energy, vitamin B-6, magnesium, iron and zinc when compared to their food-sufficient counterparts after adjustment for family income and other covariates (24). Results from this study suggested that adults who live in families without enough food to eat were more likely to have lower intakes of certain nutrients and food (24). The design of this study was exceptional for a variety of reasons. These were incorporation of: both genders, different age ranges, different income levels, and a national sample. However, the assessment tool used in this study could be considered a limitation, since food insufficiency uses only one question versus multiple questions used to determine food insecurity. A single question may not be adequate to categorize individuals, and the effect of FIF on diet may be blunted.

Although the methods used and selected micronutrients that were lacking differed, a similar study was conducted quantifying the risk of low intakes of energy and 14 other nutrients in preschoolers, adult women, and the elderly (23). Results showed that food insufficiency
among adult women was significantly associated with lower intakes of energy, magnesium, and vitamins A, E, C, and B-6 when compared to those who were food sufficient (23).

Although two (4, 25) of these studies were conducted in a sample of Canadian women, limiting associations that can be drawn among a U.S. sample, all five studies (4, 23-25, 28) showed that diets in FIS/FIF groups were poorer than FS/FSF counterparts. Moreover, there were significant differences among groups for specific food groups or nutrients in each of the studies (4, 23-25, 28), which confirmed a definite relationship between food security status and its influence on diet quality.
CHAPTER 3
SUBJECTS AND METHODS

Subject Overview

Seventy-two adult female food stamp recipients, predominantly black women, aged 19 to 75 years, were contacted and interviewed at their homes or another place of their choice. Subjects were collected from eight Louisiana parishes: East Baton Rouge, West Baton Rouge, Iberville, St. Mary, Assumption, Iberia, Orleans, and St. Tammany. Although information was collected from individuals living in both metropolitan and rural areas, the overwhelming majority of the participants lived in rural areas.

Subject Recruitment

Initially, 25 participants were selected randomly from separate lists of food stamp recipients living in each of the following parishes, East Baton Rouge, Iberville, and Assumption, for a total of 75 participants. Although telephone calls were made to each of the 75 selected study participants, only nine agreed to participate (six from East Baton Rouge and three from Iberville).

Due to the lack of recruitment success, we expanded the research design to include non-probability sampling. Successful recruiting outlets were:

1. EFNEP trainers and extension agents in East Baton Rouge, Iberville, Assumption, and Orleans Parishes recruited EFNEP participants
2. Word of mouth promotion–participants encouraged their friends or family members to participate
3. Flier postings in the Office of Family Support in St. Mary Parish–yielded interested volunteers, who in turn recruited acquaintances from St. Mary and Iberia Parishes
4. One participant was recruited from St. Tammany Parish by one of the interviewers.

Data Collection

Each interview was conducted in the participant’s home during the time frame when food stamp benefits were first received. Interviewer(s) verbally described the intent of the study (Appendix A). It was explained that participants would receive a $40.00 incentive after completion of the study. Interviewer(s) also informed participants that they could refuse to answer questions that made them uncomfortable and could withdraw from the interview anytime without prejudice. It was also explained to participants that the interview would be audiotaped, and that the information collected would remain confidential. Written informed consent was obtained from the participants (Appendix A).

Interviewers used several research instruments to collect data:

1. Demographic variables such as age, education, nutrition training, employment, marital status, household income, and health status (Appendix B)

2. Modified version of the USDA Food Security Module Short Form (Appendix C), which uses a subset of the standard 18 items, and is the preferred survey method when time constraints are an issue (53)

3. Questionnaire assessing eating habits, nutritional quality of diet, energy intake, nutrition knowledge, and fast food intake based on a ranking continuum (Appendix C)

4. Three Tanita scale (model number: Body Composition Analyzer BF-350; vendor: Tanita Corp of America; city and state of vendor: Arlington Heights, Illinois) measurements of weight (Appendix D)

5. In-person 24-hour dietary recall was conducted using the multiple pass approach (34, 35, 38, 39, 41, 73) during the time frame when food stamp benefits were first received. The
food, brand name, and amount were documented. Food models, measuring tools, and a handout with pictures of portion sizes and measurements that was left with each of the participants were used to provide thorough estimates of actual intake.

6. Approximately 3 ½ weeks after the initial interview, a telephone administered 24-hour dietary recall, using the multiple pass approach was conducted to assess food intake at the end of the resource cycle. Food, brand name, and amount were documented. The handouts containing the pictures of portion sizes and measurements were used to aid both the graduate student and participant in better estimating portion sizes.

Figure 1 – Data Collection
Data Analysis and Reporting

Food security status was determined using a modified version of the USDA short form (Appendix C). The short form is a six-item scale and is the preferred survey method when time constraints are an issue (53). The short form asks about food security status over the past 12 months for all six questions; however, we modified this version to inquire about food security over the past 30 days only. As such, question four of the short form was omitted because it asked, “How often did this happen-some months but not in every month, or in only one or two months?” In addition, another question was added to the short form for a total of six questions, which asked, “In the last 30 days, have you not eaten in order to have enough food for your children.”

Items 1 and 2 were scored as affirmative if response was (1) often true or (2) sometimes true; items were scored as negative if response was (3) never true (53). Items 3, 4, 5 & 6 were scored as affirmative if response was (1) yes and negative if response was (2) no. Those households affirming zero or one item were classified as FS. Households affirming 2, 3, or 4 items were classified as FIS; households affirming 5 or 6 items were classified as food insecure with hunger (FISH) (53).

Mean self-reported age ± standard deviation was calculated for the three food security status groups. Mean age for each group of study participants were compared using ANOVA.

Three measurements of weight were recorded, and then the average weight in pounds for each study participant was calculated and entered into an Excel file. BMI for each study participant was calculated using the formula weight in kilograms divided by the square of height in meters (kg/m²) (12). Individuals with a BMI < 18.5 are underweight, those with a BMI within the range of 18.5-24.9 are normal, those with a BMI within the range of 25-29.9 are overweight,
and those with a BMI \( \geq 30 \) are obese (79). Obese individuals were then further subdivided into 3 classes: Class I, II, and III and their BMI ranges 30-34.9, 35-39.9, and \( \geq 40 \), respectively (79). Using Excel Descriptive Statistics, mean weight in pounds (lbs) ± standard deviation and mean BMI (kg/m\(^2\)) ± standard deviation were calculated for the three food security status groups. Mean weight and BMI for each group of study participants were compared using ANOVA.

Diet data were also analyzed using Excel. Day 1 consisted of food intake consumed at the beginning of the food stamp month when benefits were first received. Day 2 consisted of food intake consumed at the end of the food stamp month. Paired two-sample t-tests (two-tailed) compared mean energy and nutrient intakes between Days 1 and 2 for the total population; FS and FIS collapsed groups (when the FISH group data was collapsed into the FIS group); and breakdown by food security status (FS, FIS, and FISH). However, only comparisons that were made for the three food security status groups were elaborated upon more fully in this thesis, since results were similar when the data were analyzed as a total population as well as when the FISH group was collapsed into the FIS group.

Food intake for Days 1 and 2 were entered as separate days in Nutritionist Pro (Single Version 2.2, San Bruno, CA) to determine individual intake of energy, % energy from macronutrients, % saturated fatty acid (SFA), % monounsaturated fatty acid (MUFA), % polyunsaturated fatty acid (PUFA), and intakes of cholesterol, sodium, potassium, vitamin C, folate, dietary fiber, vitamins B\(_{12}\), D, E, and A, beta-carotene, calcium, iron, and zinc for each day. Nutritionist Pro did not have comparable units of measurement for serving sizes of some foods. Thus, we purchased these foods at Albertson’s and weighed them on a scale so that we
could estimate serving sizes in measurement units accepted by the program. All Nutritionist Pro data were checked and entered into an Excel file.

Paired two-sample t-tests (two-tailed) compared the mean intakes of energy, % energy from macronutrients, % SFA, % MUFA, % PUFA, cholesterol, sodium, potassium, folate, dietary fiber, vitamins C, B\textsubscript{12}, D, E, and A, beta-carotene, calcium, iron, and zinc ± standard deviation between Days 1 and 2 for FS, FIS, and FISH groups. A p-value less than or equal to 0.05 was considered to be significant. Mean values for Days 1 and 2 were compared to recommended levels (80-85).

ANOVA was used to determine if the differences between Days 1 and 2 calculated for each study participant among the three food security status groups was significant for any of the aforementioned diet parameters. Differences between the days for each study participant were compared among the three food security status groups.

The number and percentage of individuals meeting (100%) or exceeding the DRI values (80-83) for protein, carbohydrate, fat, potassium, folate, dietary fiber, vitamins C, B\textsubscript{12}, D, E, and A, calcium, iron, and zinc were also determined. Comparisons between mean intakes of the aforementioned diet parameters for Days 1 and 2 were made against the number and percentage of individuals who met or exceeded the recommendations.

**Study Approval**

This study was approved by the Institutional Review Board by Louisiana State University Agricultural Center. This study was conditionally approved on July 10, 2003 and was given approval number H03-05.
CHAPTER 4

RESULTS

Seventy-two female food stamp recipients were selected through non-probability sampling methods. Of the participants interviewed, eight were excluded from these analyses: five were pregnant, two were older than 70 years, and one reported an energy intake of greater than 13,000 kcals. Thus, a total of 64 study participants were included in the diet analysis. One woman was excluded from the weight calculations only since she could not balance on the scale for an accurate measurement. Consequently, only 63 study participants were included in the weight analysis.

The majority of study participants were black females (n=60). Of the 64 study participants, 29 were food secure (93% black), 26 were food insecure (92% black), and nine were food insecure with hunger (100% black). Mean ages of study participants were: 42.59 ± 13.65 years for the FS group, 40.65 ± 13.65 years for the FIS group, and 37.67 ± 14.41 years for the FISH group. No significant differences were observed for mean age among the three food security status groups. Breakdown of study participants by parish is displayed in a chart below.

Table 1: Number of individuals from selected parishes

<table>
<thead>
<tr>
<th>Parish</th>
<th>Number of Study Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Baton Rouge</td>
<td>13</td>
</tr>
<tr>
<td>Iberville</td>
<td>16</td>
</tr>
<tr>
<td>Orleans</td>
<td>3</td>
</tr>
<tr>
<td>Assumption</td>
<td>10</td>
</tr>
<tr>
<td>West Baton Rouge</td>
<td>1</td>
</tr>
<tr>
<td>St. Mary</td>
<td>15</td>
</tr>
<tr>
<td>Iberia</td>
<td>5</td>
</tr>
<tr>
<td>St. Tammany</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 2: Study Demographics: number of study participants on basis of food security status and race. Data for weight (wt) in pounds (lbs) and BMI in (kg/m$^2$) are presented as mean ± standard deviation

<table>
<thead>
<tr>
<th>Food Security Status</th>
<th>N</th>
<th>Race</th>
<th>Wt (pounds)</th>
<th>BMI (kg/m$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>28*</td>
<td>26 black</td>
<td>205.01 ± 71.73</td>
<td>34.51 ± 11.92</td>
</tr>
<tr>
<td>FIS</td>
<td>26</td>
<td>24 black</td>
<td>211.03 ± 70.96</td>
<td>36.35 ± 12.89</td>
</tr>
<tr>
<td>FISH</td>
<td>9</td>
<td>9 black</td>
<td>207.27 ± 72.85</td>
<td>34.66 ± 10.44</td>
</tr>
</tbody>
</table>

*woman excluded from weight calculations

Table 2 shows the number of study participants on the basis of food security status along with race. Mean weight (wt) in pounds (lbs) and the mean BMI in kg/m$^2$ ± standard deviation for the three food security status groups are also shown. The mean BMI for the FS and FISH groups were both class I obesity. The mean BMI for the FIS group was class II obesity. There were no significant differences found among weights or BMIs among the three food security status groups.

Table 3: Breakdown of weight status, using National Institutes of Health criteria, by food security status

<table>
<thead>
<tr>
<th></th>
<th>Underweight</th>
<th>Normal 18.5-24.9</th>
<th>Overweight 25-29.9</th>
<th>Obese I 30-34.9</th>
<th>Obese II 35-39.9</th>
<th>Obese III &gt;40</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>2 (6.9%)</td>
<td>4 (13.8%)</td>
<td>5 (17.2%)</td>
<td>6 (20.7%)</td>
<td>3 (10.3%)</td>
<td>8 (27.6%)</td>
</tr>
<tr>
<td>FIS</td>
<td>1 (3.8%)</td>
<td>4 (15.4%)</td>
<td>5 (19.2%)</td>
<td>6 (23.1%)</td>
<td>2 (7.7%)</td>
<td>8 (30.8%)</td>
</tr>
<tr>
<td>FISH</td>
<td>-</td>
<td>-</td>
<td>3 (33.3%)</td>
<td>4 (44.4%)</td>
<td>-</td>
<td>2 (22.2%)</td>
</tr>
</tbody>
</table>

Table 3 shows the breakdown of weight status by food security status using the National Institutes of Health criteria. Of the 39 study participants who were categorized into one of the obese classes, 18 of them had a BMI greater than 40.

Table 4 shows the mean energy intake in kilocalories (kcals), mean percent (%) of energy from protein (PRO), mean % of energy from carbohydrate (CHO), and mean % of energy from total fat for Days 1 and 2 for the three food security status groups. Based on the mean intake of % energy from the different macronutrients, none of the three food security status groups
Table 4: Mean energy intake in kilocalories (kcals) ± standard deviation, and percent energy from macronutrients Protein (PRO), Carbohydrate (CHO), and Total Fat for Days 1 and 2 for study participants who were Food Secure, Food Insecure, and Food Insecure with Hunger

<table>
<thead>
<tr>
<th></th>
<th>Intake (kcals) Day 1</th>
<th>Intake (kcals) Day 2</th>
<th>Day 1 % Energy from PRO</th>
<th>Day 2 % Energy from PRO</th>
<th>Day 1 % Energy from CHO</th>
<th>Day 2 % Energy from CHO</th>
<th>Day 1 % Energy from Total Fat</th>
<th>Day 2 % Energy from Total Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>1905.10 ± 1105.60</td>
<td>1720.32 ± 992.40</td>
<td>15.75 ± 4.67</td>
<td>17.16 ± 5.63</td>
<td>50.29 ± 11.44</td>
<td>51.03 ± 9.45</td>
<td>33.12 ± 13.16</td>
<td>31.80 ± 8.73</td>
</tr>
<tr>
<td>FIS</td>
<td>1994.27 ± 1372.40</td>
<td>1920.60 ± 904.64</td>
<td>17.44 ± 5.00a</td>
<td>15.03 ± 4.31a</td>
<td>48.89 ± 11.42b</td>
<td>55.30 ± 9.51b</td>
<td>33.66 ± 9.73c</td>
<td>29.67 ± 8.97c</td>
</tr>
<tr>
<td>FISH</td>
<td>2027.74 ± 761.99</td>
<td>1311.02 ± 914.4</td>
<td>20.33 ± 12.55</td>
<td>20.80 ± 14.83</td>
<td>47.11 ± 18.99</td>
<td>50.42 ± 21.36</td>
<td>32.58 ± 15.32</td>
<td>28.79 ± 10.52</td>
</tr>
</tbody>
</table>

aFIS % Energy from PRO p=0.03 Day 1 Day 2; bFIS % Energy from CHO p=0.002 Day 1 Day 2; cFIS % Energy from Total Fat p=0.029 Day 1 Day 2

Table 5: Number and % of study participants who were FS, FIS, and FISH meeting the Dietary Reference Intakes (DRI)s for Protein (PRO), Carbohydrate (CHO), and Fat (FAT) for Days 1 and 2

<table>
<thead>
<tr>
<th></th>
<th>Day 1 PRO</th>
<th>Day 2 PRO</th>
<th>Day 1 CHO</th>
<th>Day 2 CHO</th>
<th>Day 1 Fat</th>
<th>Day 2 Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>21 (72)</td>
<td>18 (62)</td>
<td>25 (86)</td>
<td>20 (69)</td>
<td>28 (97)</td>
<td>27 (93)</td>
</tr>
<tr>
<td>FIS</td>
<td>20 (77)</td>
<td>19 (73)</td>
<td>19 (73)</td>
<td>22 (85)</td>
<td>24 (92)</td>
<td>25 (96)</td>
</tr>
<tr>
<td>FISH</td>
<td>8 (89)</td>
<td>4 (44)</td>
<td>8 (89)</td>
<td>4 (44)</td>
<td>6 (67)</td>
<td>6 (67)</td>
</tr>
</tbody>
</table>
exceeded the recommendations for % of energy from PRO, CHO, and total fat, respectively, for Days 1 and 2.

No significant differences were found between the days for mean energy intake, mean % of energy from PRO, mean % of energy from CHO, and mean % of energy from total fat for the FS and FISH groups. Significant differences were observed between the days for mean % of energy from PRO (p=0.03), mean % of energy from CHO (p=0.002), and mean % of energy from total fat (p=0.029) for the FIS group, with Day 1 being significantly greater for mean % of energy from PRO and total fat only. No significant differences were observed between the days for mean energy intake in the FIS group. ANOVA showed no significant differences for the difference between Days 1 and 2 among the three food security status groups for energy intake and % of energy from PRO, CHO, and total fat.

Table 5 presents the number and % of study participants meeting or exceeding the DRI for PRO, CHO, and fat for Days 1 and 2. A greater percentage of the study participants tended to meet or exceed the DRI for the different macronutrients in the FS and FIS groups on both days when compared to the FISH group. Approximately 89% of study participants in the FISH group on Day 1 met or exceeded the DRI recommendations for both protein and carbohydrate versus 44% for both macronutrients in FISH study participants on Day 2.

Table 6 shows the mean intakes for % SFA, % MUFA, % PUFA, cholesterol (mg), and sodium (mg) for Days 1 and 2 for the three food security status groups. Mean intakes of % SFA, cholesterol (mg), and sodium (mg) exceeded the Dietary Guideline for American (DGA) recommendations in the FS group on both days. Mean intakes of % SFA, cholesterol (mg), and sodium (mg) greatly exceeded the DGA recommendations on both days in the FIS group, with the exception of % SFA for Day 2. Mean intakes of % SFA, cholesterol (mg), and sodium (mg)
Table 6: Intake of saturated fatty acid (SFA) % energy, monounsaturated fatty acid (MUFA) % energy, polyunsaturated fatty acid % (PUFA) % energy, cholesterol (mg), and sodium (mg) on Days 1 and 2 for Food Secure, Food Insecure, and Food Insecure with Hunger; data presented as mean ± standard deviation

<table>
<thead>
<tr>
<th></th>
<th>Day 1 % SFA</th>
<th>Day 2 % SFA</th>
<th>Day 1 % MUFA</th>
<th>Day 2 % MUFA</th>
<th>Day 1 % PUFA</th>
<th>Day 2 % PUFA</th>
<th>Day 1 Cholesterol (mg)*</th>
<th>Day 2 Cholesterol (mg)*</th>
<th>Day 1 Sodium (mg)</th>
<th>Day 2 Sodium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>11.10 ± 5.46</td>
<td>10.88 ± 3.69</td>
<td>10.27 ± 6.12</td>
<td>9.78 ± 4.51</td>
<td>4.98 ± 3.22</td>
<td>4.58 ± 2.69</td>
<td>340.98 ± 339.83</td>
<td>352.83 ± 285.64</td>
<td>3227.14 ± 3278.25</td>
<td>3352.46 ± 2553.89</td>
</tr>
<tr>
<td>FIS</td>
<td>11.28 ± 4.44a</td>
<td>9.39 ± 3.78a</td>
<td>10.97 ± 5.04b</td>
<td>7.99 ± 4.66b</td>
<td>5.89 ± 3.70c</td>
<td>4.10 ± 2.18c</td>
<td>410.58 ± 577.63</td>
<td>329.19 ± 234.11</td>
<td>4042.73 ± 2960.44</td>
<td>3571.20 ± 1888.13</td>
</tr>
<tr>
<td>FISH</td>
<td>10.60 ± 6.31</td>
<td>9.89 ± 3.64</td>
<td>8.90 ± 8.31</td>
<td>9.10 ± 4.67</td>
<td>3.85 ± 2.84</td>
<td>4.60 ± 2.57</td>
<td>656.86 ± 578.39d</td>
<td>157.88 ± 95.69d</td>
<td>3666.92 ± 3144.63</td>
<td>2803.4 ± 2994.32</td>
</tr>
</tbody>
</table>

*FIS % SFA p=0.027 Day 1 Day 2; aFIS % MUFA p=0.012 Day 1 Day 2; bFIS % PUFA p=0.047 Day 1 Day 2; cFISH Cholesterol p=0.0352 Day 1 Day 2 *Differences between the days among the 3 groups for Cholesterol p=0.031
exceeded DGA recommendations on both days in the FISH group, with the exception % SFA intake and cholesterol (mg) on Day 2.

No significant differences were found between the days for mean intakes of % SFA, % MUFA, % PUFA, cholesterol (mg), and sodium (mg) for the FS group. There were significant differences observed between the days for mean % SFA intake (p=0.027), mean % MUFA intake (p=0.012), and mean % PUFA intake (p=0.047) for the FIS group, though no significant differences were found between the days for mean intakes of cholesterol (mg) and sodium (mg) in the FIS group. For the FISH group, a significant difference was found between the days for mean cholesterol (mg) intake (p=0.0352), though no significant differences were found between the days for mean intakes of % SFA, % MUFA, % PUFA, and sodium (mg). ANOVA showed that the differences between the days among the three groups were significant only for cholesterol (mg) intake (p=0.031); differences between the days among the three groups were not significant for % SFA, % MUFA, % PUFA and sodium (mg) intake.

Table 7 shows the mean intakes of potassium (mg), vitamin C (mg), folate (µg), and dietary fiber (g) for Days 1 and 2 for the three food security status groups. Mean intakes of potassium, vitamin C, folate, and dietary fiber on both days were below the established DRI values in FS, FIS, and FISH groups, with the exception of mean vitamin C intake on Day 1 in all food security status groups. No significant differences between the days were observed for mean intakes of potassium (mg), vitamin C (mg), folate (µg), and dietary fiber (g) in the FS group, although the difference between the days for vitamin C approached statistical significance (p=0.065). No significant differences were observed between the days for mean intakes of potassium (mg), vitamin C (mg), folate (µg), and dietary fiber (g) in the FIS group. Also, no
Table 7: Intake of Potassium, Vitamin C, Folate, and Dietary Fiber for Food Secure, Food Insecure, and Food Insecure with Hunger over their resource cycle; data are presented as mean ± standard deviation

<table>
<thead>
<tr>
<th></th>
<th>Day 1 Potassium (mg)</th>
<th>Day 2 Potassium (mg)</th>
<th>Day 1 Vitamin C (mg)</th>
<th>Day 2 Vitamin C (mg)</th>
<th>Day 1 Folate (µg)</th>
<th>Day 2 Folate (µg)</th>
<th>Day 1 Dietary Fiber (g)</th>
<th>Day 2 Dietary Fiber (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>1870.45 ± 1274.71</td>
<td>1726.06 ± 1187.37</td>
<td>77.40 ± 73.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>52.28 ± 49.52&lt;sup&gt;a&lt;/sup&gt;</td>
<td>315.15 ± 280.46</td>
<td>347.85 ± 353.23</td>
<td>11.20 ± 6.98</td>
<td>12.98 ± 10.39</td>
</tr>
<tr>
<td>FIS</td>
<td>2101.95 ± 1595.7</td>
<td>1752.12 ± 1030.3</td>
<td>76.78 ± 77.81</td>
<td>71.09 ± 64.72</td>
<td>334.34 ± 369.78</td>
<td>212 ± 274.28</td>
<td>15.80 ± 14.90</td>
<td>15.66 ± 10.96</td>
</tr>
<tr>
<td>FISH</td>
<td>1914.85 ± 1409.163</td>
<td>1262.91 ± 943.59</td>
<td>80.22 ± 68.48</td>
<td>49.92 ± 70.23</td>
<td>192.27 ± 121.30</td>
<td>216.16 ± 196.15</td>
<td>8.18 ± 7.70</td>
<td>12.34 ± 13.66</td>
</tr>
</tbody>
</table>

<sup>a</sup>For FS the difference in Vitamin C intake from Day 1 Day 2 approached statistical significance p=0.065

Table 8: Number and % of study participants who were FS, FIS, and FISH meeting the DRI for Potassium, Vitamin C, Folate, and Dietary Fiber for Days 1 and 2

<table>
<thead>
<tr>
<th></th>
<th>Day 1 Potassium</th>
<th>Day 2 Potassium</th>
<th>Day 1 Vitamin C</th>
<th>Day 2 Vitamin C</th>
<th>Day 1 Folate</th>
<th>Day 2 Folate</th>
<th>Day 1 Dietary Fiber</th>
<th>Day 2 Dietary Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>2 (7)</td>
<td>1 (3)</td>
<td>13 (45)</td>
<td>7 (24)</td>
<td>6 (21)</td>
<td>8 (28)</td>
<td>2 (7)</td>
<td>4 (14)</td>
</tr>
<tr>
<td>FIS</td>
<td>2 (8)</td>
<td>0 (0)</td>
<td>12 (46)</td>
<td>10 (38)</td>
<td>6 (23)</td>
<td>3 (12)</td>
<td>4 (15)</td>
<td>4 (15)</td>
</tr>
<tr>
<td>FISH</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>5 (56)</td>
<td>3 (33)</td>
<td>0 (0)</td>
<td>2 (22)</td>
<td>1 (11)</td>
<td>2 (22)</td>
</tr>
</tbody>
</table>
significant differences were observed between the days for mean intakes of potassium (mg), vitamin C (mg), folate (µg), and dietary fiber (g) in the FISH group. ANOVA showed no significant differences between the days among the three food security status groups for potassium (mg), vitamin C (mg), folate (µg), and dietary fiber (g).

Table 8 presents the number and % of study participants who met or exceeded the DRI for potassium, vitamin C, folate, and dietary fiber. Few participants met the DRI for potassium regardless of food security status breakdown. Of the total population, four individuals met the DRI for potassium on Day 1 and only one individual on Day 2. None of the individuals met the DRI for potassium in the FISH group on either day.

For vitamin C, less than 50% of the total population met the DRI for Day 1. Only 31% of the total population met the DRI for vitamin C on Day 2. Nineteen and 20% of the total population for Days 1 and 2, respectively, met or exceeded the DRI for folate. Of the total population, only seven individuals met the DRI for dietary fiber on Day 1 and ten individuals on Day 2.

Table 9 shows the mean intakes of vitamin B\textsubscript{12} (µg/d), vitamin D (µg/d), vitamin E (mg/d), vitamin A (µg/d), and beta-carotene for the three food security status groups. All groups failed to meet the DRIs on both days for mean intakes of vitamins D (µg/d), E (mg/d), and A (µg/d). The mean intake for vitamin B\textsubscript{12} (µg/d), however, exceeded current DRI recommendations for both days, with Day 1 vitamin B\textsubscript{12} (µg/d) intake surpassing the recommendation (2.4 µg/d).

No significant differences were detected in the FS and FISH groups between the days for mean intakes of vitamin B\textsubscript{12} (µg/d), vitamin D (µg/d), vitamin E (mg/d), vitamin A (µg/d), and
Table 9: Intake of Vitamin B\textsubscript{12} (µg/d), Vitamin D (µg/d), Vitamin E (mg/d), Vitamin A (µg/d), and Beta-Carotene for Food Secure, Food Insecure, and Food Insecure with Hunger over their resource cycle; data are presented as mean ± standard deviation

<table>
<thead>
<tr>
<th></th>
<th>Day 1 Vitamin B\textsubscript{12} (µg/d)</th>
<th>Day 2 Vitamin B\textsubscript{12} (µg/d)</th>
<th>Day 1 Vitamin D (µg/d)</th>
<th>Day 2 Vitamin D (µg/d)</th>
<th>Day 1 Vitamin E (mg/d)</th>
<th>Day 2 Vitamin E (mg/d)</th>
<th>Day 1 Vitamin A (µg/d)</th>
<th>Day 2 Vitamin A (µg/d)</th>
<th>Day 1 Beta-Carotene</th>
<th>Day 2 Beta-Carotene</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>6.57 ± 12.60</td>
<td>3.65 ± 5.96</td>
<td>2.07 ± 2.74</td>
<td>2.23 ± 2.38</td>
<td>5.95 ± 10.28</td>
<td>2.87 ± 2.01</td>
<td>244.72 ± 236.69</td>
<td>204.52 ± 162.78</td>
<td>480.46 ± 1450.03</td>
<td>260.29 ± 451.90</td>
</tr>
<tr>
<td>FIS</td>
<td>6.30 ± 10.82\textsuperscript{a}</td>
<td>2.68 ± 3.00\textsuperscript{a}</td>
<td>1.96 ± 2.87</td>
<td>2.03 ± 2.00</td>
<td>4.41 ± 3.36\textsuperscript{b}</td>
<td>2.73 ± 1.97\textsuperscript{b}</td>
<td>354.57 ± 345.41\textsuperscript{c}</td>
<td>200.98 ± 191.41\textsuperscript{c}</td>
<td>548.70 ± 1295.05</td>
<td>421.55 ± 623.38</td>
</tr>
<tr>
<td>FISH</td>
<td>8.21 ± 14.11</td>
<td>2.46 ± 1.73</td>
<td>0.93 ± 1.40</td>
<td>1.54 ± 2.54</td>
<td>2.07 ± 2.03</td>
<td>3.46 ± 5.84</td>
<td>273.14 ± 277.42</td>
<td>145.47 ± 138.52</td>
<td>778.85 ± 1851.86</td>
<td>29.81 ± 27.89</td>
</tr>
</tbody>
</table>

\textsuperscript{a}FIS Vitamin B\textsubscript{12} p=0.045 Day 1 Day 2; \textsuperscript{b}FIS Vitamin E p=0.011 Day 1 Day 2; \textsuperscript{c}FIS Vitamin A p=0.033 Day 1 Day 2

Table 10: Number and % of study participants who were FS, FIS, and FISH meeting the DRI for Vitamin B\textsubscript{12}, Vitamin D, Vitamin E, and Vitamin A for Days 1 and 2

<table>
<thead>
<tr>
<th></th>
<th>Day 1 Vitamin B\textsubscript{12}</th>
<th>Day 1 Vitamin B\textsubscript{12}</th>
<th>Day 1 Vitamin D</th>
<th>Day 2 Vitamin D</th>
<th>Day 1 Vitamin E</th>
<th>Day 2 Vitamin E</th>
<th>Day 1 Vitamin A</th>
<th>Day 2 Vitamin A</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>17 (59)</td>
<td>13 (45)</td>
<td>2 (7)</td>
<td>2 (7)</td>
<td>3 (10)</td>
<td>0 (0)</td>
<td>2 (7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>FIS</td>
<td>15 (58)</td>
<td>11 (42)</td>
<td>3 (12)</td>
<td>1 (4)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>3 (12)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>FISH</td>
<td>4 (44)</td>
<td>3 (33)</td>
<td>0 (0)</td>
<td>1 (11)</td>
<td>0 (0)</td>
<td>1 (11)</td>
<td>2 (22)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>
beta-carotene. Significant differences between the days were seen in the FIS group for mean intakes of vitamins B₁₂ (µg/d) (p=0.045), E (mg/d) (p=0.011), and A (µg/d) (p=0.033) with intakes being significantly greater on Day 1 when compared to Day 2. No significant differences between the days were shown in the FIS group for mean intakes of vitamin D (µg/d) and beta-carotene. ANOVA showed no significant differences among food security status groups for any of the study parameters analyzed in Table 9.

Table 10 presents the number and % of study participants who met or exceeded the DRI for vitamin B₁₂, vitamin D, vitamin E, and vitamin A for Days 1 and 2. No one in the population, regardless of food security status breakdown, met the DRI for vitamin A on Day 2. Moreover, only 11% of the total population met the DRI for vitamin A on Day 1.

Only three individuals, all of whom were categorized as FS, met or exceeded the DRI for vitamin E on Day 1. In both the FIS and FISH, none of the individuals met the DRI for vitamin E on Day 1. From the total population, only one individual (FISH) met the DRI for vitamin E on Day 2. Vitamin D intake also was of concern. A total of five individuals on Day 1 and four individuals on Day 2 met the DRI for vitamin D. Even vitamin B₁₂ intake was poor. Only 56% of the total population on Day 1 and 42% on Day 2 met the DRI for vitamin B₁₂.

Table 11 shows the mean intakes of calcium (mg), iron (mg), and zinc (mg) for Days 1 and 2 for the three food security status groups. Mean calcium intakes of all food security status groups were below the established DRI for calcium on both days. All food security status groups exceeded the DRI for iron (mg) on Days 1 and 2, with the exception of Day 1 in the FS group. Mean zinc intakes exceeded the DRI for zinc on both days in the FS group and on Day 1 in the FIS and FISH groups; mean zinc intake on Day 2 was below the DRI value in the FIS and FISH groups.
Table 11: Intake of Calcium (mg), Iron (mg), and Zinc (mg) for Food Secure, Food Insecure, and Food Insecure with Hunger over their resource cycle; data presented as mean ± standard deviation

<table>
<thead>
<tr>
<th></th>
<th>Day 1 Calcium (mg)</th>
<th>Day 2 Calcium (mg)</th>
<th>Day 1 Iron (mg)</th>
<th>Day 2 Iron (mg)</th>
<th>Day 1 Zinc (mg)</th>
<th>Day 2 Zinc (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>487.13 ± 352.54^a</td>
<td>617.04 ± 436.43^a</td>
<td>14.19 ± 15.47^b</td>
<td>20.23 ± 23.34^b</td>
<td>8.84 ± 7.02</td>
<td>8.25 ± 6.31</td>
</tr>
<tr>
<td>FIS</td>
<td>665.96 ± 535.37</td>
<td>625.93 ± 372.51</td>
<td>21.02 ± 22.83</td>
<td>28.41 ± 27.29</td>
<td>10.75 ± 10.13</td>
<td>7.19 ± 4.74</td>
</tr>
<tr>
<td>FISH</td>
<td>594.01 ± 419.11</td>
<td>484.65 ± 533.26</td>
<td>18.85 ± 20.71</td>
<td>19.20 ± 36.19</td>
<td>8.24 ± 6.54</td>
<td>5.48 ± 3.75</td>
</tr>
</tbody>
</table>

^aFS Ca p=0.047 for Day 1 Day 2; ^bFS Fe p=0.039 for Day 1 Day 2

Table 12: Number and % of study participants who met the DRI for Calcium, Iron, and Zinc for Days 1 and 2

<table>
<thead>
<tr>
<th></th>
<th>Day 1 Calcium</th>
<th>Day 2 Calcium</th>
<th>Day 1 Iron</th>
<th>Day 2 Iron</th>
<th>Day 1 Zinc</th>
<th>Day 2 Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>2 (7)</td>
<td>5 (17)</td>
<td>7 (24)</td>
<td>13 (45)</td>
<td>12 (41)</td>
<td>13 (45)</td>
</tr>
<tr>
<td>FIS</td>
<td>5 (19)</td>
<td>4 (15)</td>
<td>9 (35)</td>
<td>13 (50)</td>
<td>10 (38)</td>
<td>9 (35)</td>
</tr>
<tr>
<td>FISH</td>
<td>1 (11)</td>
<td>1 (11)</td>
<td>3 (33)</td>
<td>1 (11)</td>
<td>3 (33)</td>
<td>2 (22)</td>
</tr>
</tbody>
</table>
Significant differences were detected between the days in the FS group for both mean calcium (mg) (p=0.047) and iron (mg) (p=0.039) intakes. In the FIS and FISH groups, no significant differences were shown between the days for mean intakes of calcium (mg), iron (mg), and zinc (mg). ANOVA showed no significant differences among the three food security status groups for calcium (mg), iron (mg), and zinc (mg).

Table 12 presents the number and % of study participants who met or exceeded the DRIs for calcium, iron, and zinc for Days 1 and 2. Regardless of breakdown, all groups showed that only a small percentage of the study participants met the DRI on both days for calcium. Fewer than 43% of the total population met the DRIs on Days 1 and 2 for both iron and zinc.
Discussion

The majority of the study participants had poor diets. Significant differences between the days for nutrients analyzed were observed more frequently for the FIS group than the FS and FISH groups. Mean % energy from fat and protein and mean intakes of % SFA, % MUFA, % PUFA, vitamin B₁₂, vitamin E, and vitamin A for Day 1 were significantly greater than Day 2 in the FIS group. Mean % energy from carbohydrate for Day 2 was significantly greater than Day 1 in the FIS group. Mean cholesterol intake was the only significant difference found between the days in the FISH group, with Day 1 being significantly greater than Day 2. In the FS group, only mean calcium and iron intakes were significantly greater on Day 2 when compared to Day 1. Mean cholesterol intake was the only variable that was significantly different among the three food security status groups.

Regardless of food security status breakdown, mean intakes of % SFA, cholesterol, and sodium exceeded current Adult Treatment Panel (ATP) III recommendations (85) with the exception of mean cholesterol intake on Day 2 in the FISH group (85). Mean % MUFA and % PUFA intakes were approximately 50% below ATP III recommendations (85) regardless of food security status breakdown or day. Mean intakes of all groups failed to meet the established DRIs (80-83) for potassium, folate, dietary fiber, vitamins C, D, E, and A, and calcium on both days with the exception of Day 1 vitamin C intake. Few study participants met the DRIs on either day for calcium, potassium, dietary fiber, vitamin A, vitamin E, and vitamin D (80-83).
Mean BMIs of all food security status groups fell within the obese range. Thirty-nine of our study participants were categorized into one of the obese classes, and 18 of the 39 obese study participants had BMIs greater than 40.

Food security status in study participants was determined using a modified version of the USDA short form. Although not without its limitation, the short form is the preferred survey method when time constraints are an issue (53). In a study investigating the effectiveness of the short form, it was shown that 97.7% of households were classified correctly, and that prevalence of overall FIS and FISH were underestimated by only 0.3 percentage point (54). The findings of that study (54) confirmed the effectiveness of the short form, providing support for its robust capacity in classifying food security status of households (54).

Twenty-nine of our study participants were food secure. When the data from the FISH (n=9) group were collapsed into the FIS group (n=26), a total of 35 women were then categorized as being food insecure. These results suggest that there was not much difference numerically between individuals who were FS and those who were FIS. Thus, it could be argued in our study that the FSP failed, when applying the goal of the FSP “to prevent hunger among low-income Americans of all ages and household types” (61, 62). FSP participation adds an additional level of complexity to the link between diet and food insecurity (3, 67, 68). Food insufficiency decreased with rising income, food stamp benefits, education, and with home ownership in one study (67), whereas another study (68) showed a worsening of food insecurity status among food stamp recipients than among eligible non-participants and near-eligible individuals, both of which had higher average incomes. Similar to the results of our study, approximately half of all food stamp recipients in that study (the one showing a worsening of food security status) encountered some form of food insecurity (68).
Of the 64 study participants in our study, 60 were black females. Our sample of white females (n=4) was too small to analyze statistically. Regardless of income level, prevalence estimates for obesity (12-19) and related chronic conditions (20-22) were notably higher among black than white women. In our study, approximately 62% (n=39) of our study participants were obese, the overwhelming majority of whom were black.

Low-income women in particular were more likely to be overweight/obese (8-10) and to report having a chronic disease (7). In a study (10) using data from a national survey, it was shown that significantly more rural women than suburban or urban women were impoverished, reported a poorer health status, and had an increased prevalence of obesity (10). Although the effect of race was not investigated in that study, the results are highly characteristic of our women, the majority of whom lived in rural areas.

A study of 514 black and 2,770 white women showed that women at the greatest risk of weight gain were those with a low education level (below college level), those who became married during the 10-year interval, and those with very low socioeconomic status (8). Similar to the results of the aforementioned study (8), increased BMI and rate of weight gain were inversely associated with income in an economically diverse sample of 998 women (9). Although the three aforementioned studies (8-10) did not investigate the effect of food security status, weight gain/obesity prevalence was found to be associated with a lower socioeconomic status in all three studies (8-10). Regardless of the effect of race, it was not surprising that our population of female food stamp participants, all of whom by nature of FSP participation were low income, had a greater prevalence of obesity.

Mean BMI for the FIS group in our study was not significantly greater than the mean BMIs of both FS and FISH groups. Consequently, our lack of significance for mean BMI among
the food security status groups does not support the relationship in the literature, which suggests that prevalence of overweight/obesity is greatest among more intermediate levels of food insecurity (31, 58, 59). Regardless of food security breakdown, 39 of our study participants were categorized as obese. Eighteen (46%) of the 39 obese study participants had BMIs greater than 40, which was surprising considering the 1999-2002 prevalence estimate of extreme obesity (13.5%) among non-Hispanic black women (12). Our prevalence of extreme obesity (46%) was approximately three times the 1999-2002 prevalence estimate (13.5%) (12). Our estimates most likely reflect our small sample of predominantly black, Southeast Louisiana women, unlike 1999-2002 prevalence estimates, which encompassed a representative sample of the U.S. non-institutionalized civilian population (12).

In our study, two 24-hour dietary recalls were used to obtain dietary information. Methods, i.e. 24-hour dietary recalls, that rely on self-reported intake carry with them the added limitation of underreporting (33-35), despite the development of the multiple-pass method 24-hour recall designed to increase retrieval of the requested information (73). In addition to the limitation of self-reported intake, our study participants were highly characteristic of those most likely to underreport, which includes women (33-35, 41, 74), who are older (33, 34, 41, 74) and overweight (34, 35, 41, 74). It was probable that the degree of underreporting in our study was comparable among all food security status groups, since study participants shared similar demographic characteristics. Unfortunately, if energy intake was underestimated in our population, then the probability of other nutrients being underestimated was also increased (36). Underestimation in our population could have led to overestimation of the proportion of the population at risk of or having nutrient deficiencies (36). Despite its flaws, the 24-hour dietary
recall was used in our study, since it was easy to administer, was useful for assessing intakes of a large population, and could be telephone-administered (40).

The lack of significance observed between the days for mean energy intake in any of our food security status groups was likely to reflect the sample size. Moreover, it was probable that a greater percentage of our sample of women may have shopped more frequently than once per month, which may have eliminated significant food energy intake dips between the first and fourth weeks of the food stamp month. Frequency of major grocery shopping trips may be the result of one or a combination of factors, i.e. available transportation, adequate supply of food stamp benefits, food shortage in the household. The “food intake cycle” has been found to depend upon the frequency of major grocery shopping trips (70). Using nationally representative data, the results of one study showed that mean food energy intake dropped significantly by the fourth week in the month for those (42% of all food stamp households) who conducted major grocery shopping trips only once per month (70). Our results did not support the findings of this study (70) showing a lack of significance between the days for mean energy intake.

In our study, the variables of mean % energy from fat and protein and mean intakes of % SFA, % MUFA, % PUFA, vitamin B₁₂, vitamin E, and vitamin A that were significantly greater on Day 1 versus Day 2 in our FIS group may have reflected resource cycle trends, despite a lack of significance in energy intake. When food stamps were supplied at the beginning of the month, our FIS study participants ate more protein and fats. Twenty-four hour dietary recalls showed that study participants often consumed fatty meats that were prepared using unhealthy techniques, in addition to a number of fatty snack food items. It was not surprising that intakes of certain vitamins in the FIS group were elevated on Day 1 when compared to Day 2 considering their food intake patterns. It is common knowledge that vitamins A and B₁₂, are rich
in a number of animal foods and vitamin E is rich in vegetable oils. Also, if diets of FIS groups were also greater in %SFA, % MUFA, %PUFA on Day 1, then the majority of study participants’ diets were most likely full of fatty meats rich in SFA and the fats used to prepare them.

Mean % energy from carbohydrate for Day 2 was significantly greater than Day 1 in our FIS group. Percent energy from protein and fat were both significantly lower on Day 2 in the FIS group, which suggests that protein and fat were most likely replaced with carbohydrate. Replacement of fat and protein with carbohydrates may have reflected end of the month food purchasing behavior and consumption patterns when food is scarce. Although % energy from carbohydrate on Day 2 in our FIS group was within the ATP recommendation range (50-60%) (85), our study participants consumed carbohydrates containing simple sugars thought to contribute to obesity because our 24-hour dietary recall data showed that complex carbohydrate consumption (e.g. fruits, vegetables, whole grains) was minimal.

Although significant differences were observed between the days more frequently for nutrients in our FIS group, no significant differences in energy or nutrient intake were observed among the food security status groups with the exception of mean cholesterol intake. This suggests that the diets of our FS study participants were not that much better than the diets of FIS and FISH study participants. Thus, FSP participation in our study did not appear to improve the diets of study participants, even those who were classified as FS.

Even more surprising was that the results of our study population (n=64), specifically that of mean energy intake, were different than the findings of a previous study (86) conducted in both food stamp and non-food stamp participants (86). The findings of that study (86) encouraged us to further our research to include a larger sample size and food stamp recipients.
only (86). Despite having a total study population less than half our size (n=30), a significant
difference was found in that study between the percent energy requirement met on Days 1 and 2
among food stamp participants (n=21) (86). Moreover, significant differences between food
stamp participants (n=21) and non-food stamp participants (n=9) were observed between mean
differences of Days 1 and 2 for energy, SFA, and MUFA intakes (86). In that study (86), 20
study participants were classified as FS. Of the ten study participants who were FIS, seven were
food stamp recipients and three were non-food stamp recipients (86).

Similar to the findings in our study (with the exception of mean cholesterol intake), no
significant differences were found between the days for energy and nutrient intakes among FS
and FIS groups (86). This suggests that overall diet quality of our food stamp recipients were
equally as poor as the diet quality of food stamp and non-food stamp recipients in that study (86).
Larger studies need to be conducted in the future before it can be inferred that the lack of
significance for variables among food security status groups in our study (with the exception of
mean cholesterol intake) and that study (86) was due to failure of the FSP.

In order to reduce the risk of coronary heart disease, ATP III has developed several
essential recommendations, including reduced intake of saturated fats (<7% of total calories), up
to 10% of total calories from PUFA, up to 20% of total calories from MUFA, 25-35% of total
calories from total fat, <200 mg/day of cholesterol, and < 2400 mg/day of sodium (85). These
are slightly different for the DGA recommending: <10% of calories from SFA, fat intakes
between 20-35% calories, <300 mg/day of cholesterol, and <2300 mg of sodium per day (84).

Regardless of food security status or Day (1 or 2), mean sodium intakes were above the
recommendation of <2300 mg (84). Because salt sensitivity determines an individual’s blood
pressure response to changes in sodium intake, the relationship between a high sodium intake
and increased blood pressure cannot be generalized unless other nutrients (i.e. potassium) are also lacking (87). In our study, mean intakes of potassium on both days in all groups were poor. Recent studies (88, 89) supported the benefit of a low sodium diet, in the context of a high potassium diet, for decreasing blood pressure. In a randomized crossover study in 85% normotensive and 15% hypertensive subjects, it was shown that the low sodium intake and not the sodium supplementation phase in those consuming a self-selected high potassium diet significantly reduced home systolic blood pressure (88).

Although the effect of potassium showed a beneficial effect on blood pressure reduction (88), adequate consumption of all essential nutrients rather than the modification of any single nutrient has been shown to produce far greater improvements in blood pressure (87, 90). The effects of dietary patterns on blood pressure were assessed in 459 adults who were randomly assigned to a control diet, a diet rich in fruits and vegetables, or a “combination” diet rich in fruits, vegetables, and low-fat dairy products and with reduced saturated and total fat (90). Systolic and diastolic blood pressure were significantly reduced by 5.5 and 3.0 mm Hg more, respectively, than the control diet in both hypertensive and normotensive subjects. Systolic blood pressure was significantly reduced by 2.8 mm Hg more in the fruit and vegetable diet than the control diet, though diastolic blood pressure in the fruit and vegetable diet was not significantly reduced. Overall, the findings in that study suggested that a DASH-type diet (in that study the “combination diet”) and a fruit and vegetable diet both lowered blood pressure, but that additional components (i.e. low-fat dairy) in a DASH-type diet lowered blood pressure substantially more (90). In our study, sodium intakes were high and nutrients rich in fruits, vegetables, and dairy were lacking. Consequently, our population is at an increased risk of
hypertension due to mineral deficiency, which most likely exacerbates much of the sensitivity to sodium (87).

Mean % SFA exceeded ATP III recommendations (85) on both days regardless of food security status. Both mean % MUFA and % PUFA intakes were roughly below 50% of the ATP recommendations. Provided saturated fats and trans fatty acids are kept low, a higher intake of unsaturated fat can help to reduce triglycerides and raise high-density lipoprotein (HDL) cholesterol (85). In our population, intakes of unsaturated fats were low and probably increased the levels of certain lipid indices (e.g. triglycerides and HDL). A single-blind, randomized, controlled, crossover feeding study showed that a pecan-enriched diet rich in MUFA improved the blood lipid profile beyond that observed for the Step 1 diet (91). With the exception of Day 2 in the FISH group, mean cholesterol intakes of all groups exceeded DGA (84) and ATP III (85) recommendations. Increased cholesterol intakes along with SFA intake are both damaging to cardiovascular health in that they increase low-density lipoprotein (LDL) cholesterol (85).

The majority of our study participants failed to meet DRI values for selected micronutrients, regardless of food security status, but mean % energy intake from fat in all groups matched the upper range of current dietary guidelines (84) and ATP III recommendations (85) of up to 35%, especially on Day 1. This suggests that in our study, energy dense nutrient poor foods were consumed instead of more nutrient-dense food options.

Mean intakes on both Days 1 and 2 were dramatically below DRI values for vitamin A (82). Moreover, no individuals met the DRI for vitamin A on Day 2 (82). Despite low vitamin A intakes, it is impossible to speculate about the possibility of a vitamin A deficiency based on two days of food intake. Even serum concentrations of the vitamin are not always sensitive because of homeostatic control (92). As a fat-soluble vitamin, vitamin A is stored in the liver
and adipose tissue, and is released as needed from the liver to maintain serum concentrations (93).

Vitamin A is required for a number of functions in the body, which include vision, bone growth, reproduction, cell division and differentiation, and immune response (94). A deficiency of vitamin A can have serious consequences. Physiologic disturbances associated with vitamin A deficiency include: decreased mobilization of iron, disturbed cellular differentiation, poor immune response, increased infectious morbidity and mortality, growth retardation, anemia, and xerophthalmia (night blindness) (95).

Although vitamin A deficiency has gained attention as a problem in developing countries, inadequate vitamin A status has been a problem for certain segments of the U.S. population (93). Nonwhite women were at a significantly greater risk of having suboptimal serum retinol concentrations than were white women (93). Although our study did not evaluate serum retinol concentration, our diet analysis did show that intakes of animal foods, known to contain vitamin A, as well as fruits and vegetables, were minimal in our population of low-income black women. Though unlikely in most of our study participants, an inadequate intake of protein, calories, and zinc, needed to make retinol-binding protein, may have interfered with mobilization of vitamin A from the liver and its transport into the general circulation, causing vitamin A deficiency (94).

Despite having intakes of fat that were identical with or exceeded dietary recommendations, mean intakes of vitamin E on both days as well as the percentage of individuals who met DRI values were low (82). Vegetables oils, such as corn oil, soy oil, and peanut oil, are the best sources of vitamin E, whereas animal fats, such as butter and lard, contain lower levels of this vitamin (96). With the exception of frozen spinach and dried apricots, the majority of fruits and vegetables are poor dietary sources of vitamin E (97). Nuts and seeds, like
vegetable oils, are rich sources of the vitamin (97). In our population, nut intake was minimal and fatty meats full of animal fats (cooked in butter or lard) instead were eaten, which may explain the lack of vitamin E in study participants’ diets.

Vitamin E plays a role in the body as an antioxidant by protecting cells against the effects of free radicals. Large-scale clinical trials of vitamin E and its role in preventing atherosclerosis by protecting against lipid peroxidation and carcinogenesis by inducing apoptosis have produced inconsistent results, although a large body of cellular, animal, and epidemiological studies have demonstrated vitamin E’s effectiveness (97, 98).

Of the three mineral intakes, the number of individuals who met the calcium DRI on either day was low regardless of food security status breakdown (83). Moreover, mean intakes of calcium in all food security status groups were below the established DRI for calcium on both days (83). Calcium plays several major roles in the body, which include: blood clotting, muscle contraction, nerve transmission, and bone and tooth formation (83). Inadequate consumption of calcium containing foods is of great concern in a population of women, since low calcium intakes have been linked with increased risk of osteoporosis, hypertension, colon cancer, (99) and possibly obesity (100).

Among blacks, prevalence estimates suggest that lactose intolerance is greatest among this particular ethnic group (100, 101). However, there have been studies conducted (102, 103) which suggest that lactose intolerance is over-reported. In our population, it is probable that some of our participants were lactose intolerant and that gastrointestinal discomfort may have discouraged them from consuming dairy foods.

A study was conducted in 26 lactose intolerant (LI) and 24 lactose tolerant (LT) black women (100). Although neither group reached the DRI for calcium, average intake of calcium in
LI women was significantly lower when compared to the LT women. In the LT women, milk and dairy products (45%) and mixed foods containing calcium from non-dairy sources (30%) were the main sources of dietary calcium, unlike the LI women whose calcium intake was 46% from mixed foods and only 12% from dairy products. In that study, LI women also had significantly higher BMIs than LT women; calcium intake was also negatively linked with BMI. Thus, these results suggest an inverse relationship between low calcium intakes, typical of LI women, and increased BMIs, which suggest a potential role for calcium in weight regulation (100). In our population, prevalence of obesity was widespread and it is probable that low calcium intakes exacerbated the problem of obesity.

Lactase deficiency, whether diagnosed or self-reported, is one rationale for the apparent lack of calcium consumption in our population, though another study conducted (104) showed that in a sample of three ethnic groups, non-Hispanic black women had the lowest mean calcium intake from all dietary sources of calcium and not just from milk products (104). That study suggested that milk products were not the only sources of calcium rejected by black women, but calcium rich vegetables were as well (104).

Another likely reason for the low calcium intake in our population is lack of nutrition knowledge. Our study participants may not be knowledgeable about dairy foods (i.e. yogurt, cheese) that are low in lactose and instead choose to avoid all dairy foods. Ninety women were recruited outside of local grocery stores in low-income areas to determine calcium intake as well as the factors that affect calcium intake (99). Results showed that 80% of the subjects had calcium intakes below 75% of the RDA; protein and sodium intakes were above recommended amounts. Seventy-four percent of the women identified the relationship between calcium and osteoporosis, but few could link a lack of calcium with high blood pressure (24%) and intestinal
cancer (11%). Three major barriers to dairy calcium consumption identified were perceived adequate intake, perceived negative taste, and gastrointestinal problems due to lactose intolerance. These barriers, specifically a perceived adequate intake, show that knowledge about the role of calcium and disease is not the only factor influencing calcium intake. Thus, these women may not have perceived themselves at risk of disease because they thought their calcium intake was adequate (99).

There are several similarities that can be drawn between our study and this one (99), although our questionnaires did not ask about potential barriers to dairy consumption. Like our study, black women were recruited in Southern Louisiana, a 24-hour recall was used to obtain dietary information, and it was shown that black women had a mean calcium intake below the recommended level (99).

Mean intakes of vitamin D intake were below DRI values on both days (82). As such, it was not surprising that few individuals met the DRI for vitamin D in any of the groups regardless of food security status breakdown. Diet analysis did not take into account vitamin D from casual sunlight exposure; however, our results suggest that the majority of the study participants did not satisfy their requirements through diet (105). Natural food sources of vitamin D include cod liver oil and oily fish; fortified vitamin D food sources include milk, orange juice, and some cereals and breads (82, 105, 106).

Vitamin D not only regulates calcium absorption, but also maintains serum calcium and phosphorus concentrations (82, 107). Vitamin D deficiency reduces calcium absorption to no more than 10-15% of dietary calcium versus 30% in a person with vitamin D sufficiency (105). In our population, mean calcium intakes were abysmal. Mean vitamin D intakes from diet were also poor, which means that calcium absorption may have been reduced.
Vitamin D deficiency causes secondary hyperparathyroidism in adults. This, in turn, results in osteomalacia or non-mineralization of the collagen matrix, which increases fracture risk (105). In addition to its role in bone health, vitamin D also has several other potential physiologic actions. These include: regulation of cell growth in cancer prevention, regulation of immune function with subsequent decreased risk of autoimmune diseases, and regulation of blood pressure and of insulin production (105).

Race and ethnicity have been shown to have an effect on serum 25 (OH) D levels. Ten times as many black versus white women were vitamin D deficient (106). Vitamin D deficiency among blacks in that study was independently associated with milk consumption or breakfast cereal <3 times/wk, no use of vitamin D supplements, season, urban residence, low body mass index, and no use of oral contraceptives. BMI was not significantly associated with vitamin D deficiency in blacks, although a significant association was observed for the white women (106). White obese subjects in another study were shown to have reduced bioavailability of vitamin D from cutaneous and dietary sources due to a tendency of vitamin D to deposit in adipose tissue (108). Although these findings concerning a reduced bioavailability cannot be generalized to include blacks, it does show that obesity has been linked with vitamin D deficiency.

The number of individuals meeting or exceeding the DRI for iron was greatest on Day 2 for the FS and FIS groups, 13 and 13 individuals, respectively (83). Only one individual met the DRI for iron on Day 2 in the FISH group, which suggests that inadequate iron intake was greatest among the most severe level of food insecurity. On average, the diets of the study participants, as a whole, often exceeded the requirement for servings of meat and poultry at the expense of fruits and vegetables. This could partially explain why a greater number of individuals were able to fulfill the iron requirement in the FS and FIS groups on Day 2 when
compared to Day 1, despite a lack of fruit, vegetable and even grain consumption. In the FISH group, a lack of not only non-heme, but also heme iron sources may be the cause of the problem (83). Thus, the lack of iron intake in the FISH group may be partially explained by an overall energy deficit that reflects end of the month resource cycle trends observed and described in the literature (29-32) when food is scarce. Also, the lack of iron intake could reflect the problem of underreporting, an acknowledged limitation of the 24-hour dietary recall.

Inadequate iron consumption can result in iron deficiency, which can eventually progress to iron deficiency anemia. This type of anemia causes diminished aerobic capacity, reduced activity, and lower productivity. Using a nationally representative sample of U.S. women, the prevalence of postpartum iron deficiency in relation to reproductive status and income was estimated (109). Approximately 10% of the U.S. women in this sample 0-6 month postpartum were found to be anemic, and this estimate reached 22% in those who were low-income (109). Risk of iron deficiency among low-income women who were 0-6, 7-12, and 13-24 months postpartum was 4.1, 3.1, and 2.0 times as great as women who were never pregnant with a poverty index ratio > 130%. Women at the greatest risk of iron deficiency anemia had or were a low socioeconomic status (109). These results are particularly applicable to the low-income women in our study because most of the women were of childbearing age.

The number and percentage of individuals meeting the DRI for zinc on both days were greatest among the FS group and were least among the FISH group (83). Mean zinc intakes on Day 2 were below the DRI value in the FIS and FISH groups, which could be explained by end of the month resource cycle trends observed and described in the literature (29-32) when food is scarce. Foods rich in zinc include fortified cereals, red meats, and certain seafood (83). Based on 24-hour recall data, it was probable that seafood and meat food purchasing behavior and
consumption were greatest in the beginning of the food stamp month, and that a drop in meat intake was seen in those with a worsening of food security status. However, the lack of significance for mean zinc intake among the food security status groups suggests that zinc intake in the FS group was not much different from the FIS and FISH group, limiting the degree of speculation that can be made about mean zinc intake.

With the exception of Day 1 vitamin C intake, mean intakes of all food security status groups failed to meet the established DRIs on both days for potassium, vitamin C, folate, and dietary fiber. A lack of these nutrients, as markers of consumption, suggests that fruit and vegetable intake among the study participants was minimal. Overall diet quality of study participants was poor, with diets emphasizing fatty meats and processed snack food items.

Mean potassium intakes on both days were below DRI values; few individuals met the DRI for potassium on either day regardless of their food security status (81). This suggests a low intake of fruits, vegetables, and dairy products. We know that dairy products were not consumed as a result of the low mean intakes of calcium and vitamin D. Potassium is a very important electrolyte that exerts several protective functions by: 1) maintaining fluid volume inside and outside of cells, 2) reducing elevations in blood pressure caused by excessive sodium intake, and 3) decreasing markers of bone turnover and reappearance of kidney stones (81).

The number and % of individuals meeting the DRI for vitamin C was greater than that of vitamins A, D, and E; however, the number and percentage were still low. Low intakes of vitamin C were due to an apparent lack of fruits and vegetables. Vitamin C is found in a variety of fruits and vegetables, and is required in the synthesis of collagen, norepinephrine, and carnitine, acts as a cofactor for reactions requiring reduced copper or iron metalloenzyme, and plays a role as a protective antioxidant (82, 110). Vitamin C’s protective effects as an
antioxidant were observed in a study whereby initiation of HDL lipid oxidation was delayed in the presence of vitamin C compared to absence of the vitamin (111). Thus, vitamin C preserved the cardioprotective effects of HDL to inhibit atherogenic modification of LDL, adding to the body of literature supporting vitamin C as a protective antioxidant (111).

Failure of the majority of study participants to meet DRI folate requirements was of particular concern, since many women were of childbearing age. Folic acid, in pregnant mothers, serves to protect against neural tube defects (112). Through mechanisms of DNA instability, folate deficiency has been implicated in the etiology of certain cancers as well as colorectal incidence (113). Folate is a coenzyme in nucleic acid and amino acid metabolism (82). Moreover, folate prevents megaloblastic anemia (82). Without adequate folic acid, homocysteine accumulates and plasma homocysteine concentrations increase. Plasma homocysteine has been identified as a strong independent marker for cardiovascular disease (114). In a four-week dietary controlled, parallel intervention study, it was shown that a 500g fruit and vegetable ("high") diet significantly increased plasma carotenoids, vitamin C, folate and decreased homocysteine when compared to a 100g fruit and vegetable ("low") diet (115). That study (115) confirmed the effectiveness of a diet rich in fruits and vegetables with moderate folate content in reducing risk factors for cardiovascular disease (115).

Dietary fiber intakes of study participants were low on both days, which confirms that fruit, vegetable, and whole grain consumption were minimal. The associations between intakes of dietary fiber and whole- or refined-grain products and weight gain over time were examined in a 12-year prospective cohort study of U.S. female nurses (116). Results showed that weight gain was inversely linked with consumption of high-fiber, whole-grain foods and positively associated with consumption of refined-grain foods (116). The beneficial effects of high-fiber
whole grain consumption described in that study (116) was particularly applicable to our population–the majority of whom are obese and would benefit from increased fiber as a strategy to improve weight control.

In a study of a nationally representative sample of the adult American population, it was shown that energy dense nutrient poor (EDNP) foods were consumed at the expense of nutrient-dense foods in both men and women (117). As such, subjects were at an increased risk due to the high energy intake promoting positive energy balance, lower nutrient density for most studied nutrients leading to marginal micronutrient intake, poorer compliance with dietary guidance, and lower serum levels of vitamins and carotenoids (117). In that study (117), EDNP food consumption persisted, though perhaps not to the degree of our population of low-income women.

A cross-sectional survey in the Lower Mississippi Delta (Delta) region compared food intake data of 1751 adults in the Delta of Louisiana, Arkansas, and Mississippi with national survey data (118). As a group, Delta adults had higher fat intakes, lower protein intakes, and lower intakes of certain micronutrients, i.e. vitamin A, beta-carotene, vitamin C, riboflavin, niacin, vitamin B-6, vitamin B-12, calcium, magnesium, iron, and potassium than the U.S. adults. Comparisons of food and nutrient intake within the Delta population showed that blacks consumed less total energy and macronutrients than whites as well as lower dietary fiber, phosphorus, zinc, copper, calcium, and vitamin A (118).

Although that study (118) did not evaluate diet on the basis of food security status, its sample had greater ethnic diversity with approximately equal numbers of black (n=857) and white (n=842) study participants (118). In spite of these differences, Delta adults were similar to our study with regard to demographics i.e., impoverished, low education level, Southern setting,
and high chronic disease burden. Overall, Champagne’s study revealed a population at risk of poor nutritional status. Moreover, Delta black adult food and nutrient intakes tended to be poorer than whites’ intakes, and poorer nutrient intakes were also linked with low income (118). Limitations in that study (118) that paralleled our own study were the subsequent underreporting known to be associated with self-reported intake and the use of only a single 24-hour recall. Although two 24-hour dietary recalls were used in our study, we evaluated them separately.

The relationship of food security status/food sufficiency on dietary intakes has been addressed in several research studies (4, 23-25, 28). The overall finding was that diets were noticeably poorer with a worsening of food security status/food sufficiency (4, 23-25, 28). Significant differences were detected between groups defined by food security status (no hunger evident, FIS with moderate hunger, and FIS with severe hunger) for energy, protein, vitamin A, iron, magnesium, and zinc as food security status worsened in a sample of 145 women (25). In our study, however, diets did not differ significantly among groups so the effect of food security status on diet was minimal. Moreover, the women in that study (25) were Canadian, limiting comparisons made with our study participants.

Among those with no hunger evident, moderate hunger, and severe hunger, the results of food consumption patterns in 153 women seeking charitable food assistance in Toronto showed that those with severe or moderate hunger reported significantly lower consumption of fruit and vegetables, as well as meat, when compared to those in households with no hunger evident (4). Although the scope of this thesis did not address food guide pyramid servings, our nutrient analysis showed no significant differences (with the exception of mean cholesterol intake) among food security status groups, unlike Tarasuk’s findings (4) for food group servings.
Nutrient intakes in a sample of 193 women living in rural New York State showed that neither the FIS nor the FS groups consumed the recommended number of servings from the five food groups (28). Potassium and fiber, in addition to fruit consumption, were significantly less in the FIS group when compared to the FS group. Among those who were FIS, a significantly greater percentage of respondents consumed less than the RDA for vitamin C and fewer than five fruits and vegetables per day (28).

The significance detected for potassium, fiber, fruit consumption, and vitamin C among groups in that study (28) may have been the result of collapsing individuals who experienced hunger into the FIS group (28). Our study, however, did not show significant differences among the three food security status groups for potassium, fiber and vitamin C. The lack of significance observed among our groups may result from a combination of factors, such as poor diet quality inherent to all food security status groups, or the sample size of study participants, especially in the FISH group (n=9), which was not large enough to detect a difference with adequate power.

Younger adults from FIF had significantly lower intakes of calcium, and older adults from FIF had significantly lower intakes of energy, vitamin B-6, magnesium, iron and zinc when compared to their food-sufficient counterparts after adjustment for family income and other covariates (24). Although selected micronutrients that were lacking differed, a similar study showed that food insufficiency among adult women was significantly associated with lower intakes of energy, magnesium, and vitamins A, E, C, and B-6 when compared to those who were food-sufficient (23).

Both of these two aforementioned studies (23, 24) in food-sufficient and food-insufficient individuals showed significant differences among groups, unlike our study. However, tools used
to assess whether adults had enough to eat differentiated between our study and theirs (23, 24), which limits the degree of comparison that can be made.

In summary, these five studies (4, 23-25, 28) examining the relationship of food security status/food insufficiency with dietary intake showed an effect of food security status on several diet study parameters among groups. Our study, however, did not reflect the findings in the literature on differences in energy or specific nutrients among food security status groups, with the exception of mean cholesterol intake. The relationship on overall diet quality in these five studies (4, 23-25, 28), though, was consistent with the results in our own study, in that across-the-board, diets were poorer and risk of nutrient deficiencies were increased among all study participants regardless of food security status. Even though our small sample of women who were FISH limits the conclusions that can be drawn, our findings show, on average, that mean intakes as well as the number and percentage of individuals who met the DRIs for selected vitamins and minerals were lower in not only the FIS and FISH groups, but also the FS group as well.

**Conclusion**

Approximately 62% of our study participants (n=39) were obese. Significant differences for selected nutrients were observed between the days more frequently for the FIS group versus the FS and FISH groups, which can be partially explained by resource cycle trends observed when food is scarce. However, mean energy and nutrient intakes were not found to be significantly different among food security status groups with the exception of mean cholesterol intake.

Regardless of food security status breakdown, mean intakes of % SFA, cholesterol, and sodium exceeded current ATP III recommendations with the exception of mean cholesterol
intake on Day 2 (85). Mean % MUFA and % PUFA were approximately 50% below ATP III recommendations regardless of food security status or day (85). Based on our diet analysis and demographic profile, our population is at an increased risk of coronary heart disease (CHD).

Mean intakes of all food security status groups failed to meet the established DRIs (80-83) for potassium, vitamin C, folate, dietary fiber, vitamins D, E, and A, and calcium on both days with the exception of Day 1 vitamin C intake. Few study participants met the DRIs on either day for calcium, potassium, fiber, and vitamins A, E, and D.

We can conclude from these results that fruit, vegetable, and dairy consumption in all study participants were particularly poor. Significant differences among food security status groups was limited to mean cholesterol intake only, suggesting that the FSP would benefit from some modifications (i.e. mandatory nutrition education classes when food stamp benefits are first received, more frequent food stamp benefits over the food stamp month, monthly 24-hour dietary recall for each FSP participant expected when collecting food stamp benefits and subsequent one-on-one nutrition counseling by a registered dietitian) if overall diet quality of participants is going to be improved.

**Future Directions**

Future studies should include larger samples of women so that the power of the study is increased, allowing greater detection of differences. It would be of great interest to evaluate more white women to determine any disparities that exist with regard to weight status, nutrient intake, and burden of disease on the basis of ethnicity/race. Thus, future studies should interview female food stamp recipients with a low education level from at least two ethnic groups (i.e., white, black) and compare data collected against middle- and higher-income, educated women from the same two ethnic groups within the state of Louisiana. Although beginning and end of
the monthly resource cycle trends could only be compared between the two ethnic food stamp recipient groups, an average of intake and selected nutrients for Days 1 and 2 could be compared against middle- and higher-income educated counterparts. The data collected from such a study would provide a plethora of information not just on monthly resource cycle trends, if any, in food stamp recipients and the relationship with food security status, but also comparisons could be made against their wealthier, more educated ethnic counterparts.

The majority of our study participants were from rural areas, which suggests that every attempt should be made in future studies to recruit an equal number of participants from urban areas. Only two 24-hour recalls were administered in our study at two points (beginning and end) in the food stamp month; efforts should be made in future studies to administer two 24-hour recalls at the beginning of the food stamp month and two at the end of the food stamp month for a total of four 24-hour dietary recalls, one representing weekend dietary intake and another representing weekly dietary intake. In addition to the inclusion of four 24-hour dietary recalls and collection of grocery food receipts, researchers should also ask study participants more about their general food consumption patterns to determine if there is any disparity between 24-hour recall dietary intake estimates and usual intake. Lastly, the research on the relationship between diet and food security status in food stamp participants is limited in the literature and deserves further study.
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APPENDIX A: INFORMED CONSENT

TITLE OF RESEARCH PROJECT  Effects of Weight History, Resource Cycling, and Fast Food on Overall Diet Quality and Health in Low-Income Louisiana Women

The purpose of this study conducted by the Louisiana State University (LSU) Agricultural Center investigators is to evaluate your diet. This will be done by completing two 24-hour diet recalls—one in person and one approximately 30 days later by telephone. This is a standard test used to assess food intake and consists of asking you what you had to eat the day prior to the recall. You will also be asked to keep your food receipts at during this same time period.

This information will be used to understand more fully what foods people are eating and the impact they have on overall diet quality. There are no risks associated with this study. Although you may receive no personal benefit from participating in this study, society as a whole may benefit through improved understanding of what foods people are choosing to eat and where they are purchasing these foods.

Only LSU researchers involved in this study will have access to these recalls. Results of this study, including any publications, will not identify individuals by name. Data will be presented either in summary form or stripped of individual identifiers. You may choose not to participate in this aspect of the study. You may withdraw from this study at any time without prejudice.

The study has been discussed with me and all questions have been answered to my satisfaction. I may direct additional questions regarding this study to Dr. Carol O’Neil, School of Human Ecology, at 225-578-1631. If I have questions about subjects’ rights or other concerns, I can contact Dr. David Morrison at 225-578-8236.

With full knowledge of the above information, I voluntarily consent to take part in this study.

Name of participant (please print):_____________________________________________

Signature of participant:________________________________ Date:_________________

Mailing address:____________________________________________________________

(Street)  (City)  (Zip)

Phone:_____________________________________________________________

Witness (please print):_____________________________________________________

Signature of witness:________________________________ Date:_________________
INFORMED CONSENT

TITLE OF RESEARCH PROJECT  Effects of Weight History, Resource Cycling, and Fast Food on Overall Diet Quality and Health in Low-Income Louisiana Women

The purpose of this study conducted by the Louisiana State University (LSU) Agricultural Center investigators is to study the relationship between diet, weight, and income. To do this, you will be asked questions about your weight and history of weight, your perceptions of weight and diet, income, nutrition education, and perceptions of diet and health.

This information will be used to understand more fully the relationships among income, diet, and weight. For participating in this study, you will receive a stipend. Further, society as a whole may benefit through improved understanding of weight, diet, and health in a population of low-income women.

Only LSU researchers involved in this study will have access to these recalls. Results of this study, including any publications, will not identify individuals by name. Data will be presented either in summary form or stripped of individual identifiers. You may choose not to participate in this aspect of the study. You may withdraw from this study at any time without prejudice.

The study has been discussed with me and all questions have been answered to my satisfaction. I may direct additional questions regarding this study to Dr. Carol O’Neil, School of Human Ecology, at 225-578-1631. If I have questions about subjects’ rights or other concerns, I can contact Dr. David Morrison at 225-578-8236.

With full knowledge of the above information, I voluntarily consent to take part in this study.

Name of participant (please print):_____________________________________________
Signature of participant:_____________________________Date:____________________

Mailing address:___________________________________________________________
(Street)                                   (City)                            (Zip)
Phone:___________________________________________________________________
Witness (please print):_______________________________________________________
Signature of witness:_____________________________ Date:___________________

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TITLE OF RESEARCH PROJECT  Effects of Weight History, Resource Cycling, and Fast Food on Overall Diet Quality and Health in Low-Income Louisiana Women

The purpose of this study conducted by the Louisiana State University (LSU) Agricultural Center investigators is to evaluate your weight. This will be done by weighing you with a standard scale and measuring your height with an instrument called a stadiometer; a stadiometer is a standard method to measure height. These values will be used to calculate body mass index (BMI), a value designed to categorize people by weight status. Using a tape measure, your waist and hip measurements will also be taken. Together these measurements will allow researchers to assess your weight status and what’s called central abdominal obesity.

This information will be used to understand more fully risk factors potentially associated with development of chronic disease, such as type 2 diabetes mellitus. These are standard medical risks and there are no risks associated with this study. You will personally benefit from participating in this study by learning your weight, BMI, waist circumference, and waist-to-hip ratio. Society as a whole may benefit through improved understanding of weight status in a population of low-income women.

Only LSU researchers involved in this study will have access to these recalls. Results of this study, including any publications, will not identify individuals by name. Data will be presented either in summary form or stripped of individual identifiers. You may choose not to participate in this aspect of the study. You may withdraw from this study at any time without prejudice.

The study has been discussed with me and all questions have been answered to my satisfaction. I may direct additional questions regarding this study to Dr. Carol O’Neil, School of Human Ecology, at 225-578-1631. If I have questions about subjects’ rights or other concerns, I can contact Dr. David Morrison at 225-578-8236.

With full knowledge of the above information, I voluntarily consent to take part in this study.

Name of participant (please print):_____________________________________________
Signature of participant:_________________________Date:____________________

Mailing address:____________________________________________________________
(Street)                                   (City)                            (Zip)
Phone:_______________________________________________________________
Witness (please print):______________________________________________________
Signature of witness:______________________________Date:____________________
APPENDIX B: 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)

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

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

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

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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 ____________

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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 C: FOOD SECURITY QUESTIONS

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

19. How would you rate the nutritional quality of your diet? (circle one)
   Poor (1) Fair (2) Good (3) Excellent (4)

20. About how many calories do you think you eat a day? (circle one)
   Much Too Low (1) Somewhat Low (2) Just About Right (3) Somewhat High (4) Much Too High (5)

21. How would you rate your knowledge of nutrition? (circle one)
   Poor (1) Fair (2) Good (3) Excellent (4)

22. On average, how often do you eat in fast-food restaurants? (circle one)
   Rarely Or Never (1) Several Times Per Month (2) Several Times Per Week (3) Once a Day (4) Most Meals (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?
29. 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?

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

We are interested in whether you have been teased and how this affected you.

**First**, for each question rate how often you think you were teased (using the scale provided, "never" (1) to "always" (5)).

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<th>Sometimes</th>
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<th>Very Often</th>
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**Second**, unless you responded "never" to the question, rate how upset you were by the teasing "not upset" (1) to "very upset" (5).

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<th>Not upset</th>
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<th>Somewhat upset</th>
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1. People made fun of you because you were heavy.  1  2  3  4  5
   How upset were you?  1  2  3  4  5

2. People made jokes about you being heavy.  1  2  3  4  5
   How upset were you?  1  2  3  4  5

3. People laughed at you for trying out for sports because you were heavy.  1  2  3  4  5
   How upset were you?  1  2  3  4  5

4. People called you names like "fatso."  1  2  3  4  5
   How upset were you?  1  2  3  4  5

5. People pointed at you because you were overweight.  1  2  3  4  5
   How upset were you?  1  2  3  4  5

6. People snickered about your heaviness when
you walked into a room alone. 1 2 3 4 5
How upset were you? 1 2 3 4 5

7. People made fun of you by repeating something you said because they thought it was dumb. 1 2 3 4 5
How upset were you? 1 2 3 4 5

8. People made fun of you because you were afraid to do something. 1 2 3 4 5
How upset were you? 1 2 3 4 5

9. People said you acted dumb. 1 2 3 4 5
How upset were you? 1 2 3 4 5

10. People laughed at you because you didn't understand something. 1 2 3 4 5
How upset were you? 1 2 3 4 5

11. People teased you because you didn't get a joke. 1 2 3 4 5
How upset were you? 1 2 3 4 5
APPENDIX D: HEIGHT AND WEIGHT RECORDING CHART

Name: _____________________   Date: ___________________

Machine settings:
Height (stated): _______________
Age (stated): _______________
Weight & BMI: _______________
Weight & BMI: _______________
Weight & BMI: _______________
Weight & BMI: _______________
Waist Circumference: _______________
Waist Circumference: _______________
Waist Circumference: _______________
Waist Circumference: _______________

Comments:
VITA

Caroline Christie Burke was born on May 4, 1981, to parents Ralph and Christie Burke. She graduated from St. Mary’s Dominican High School in May of 1999, and then went on to attend Louisiana State University. She graduated both *cum laude* and with upper division honors distinction with a Bachelor of Science degree in dietetics in the Spring of 2003. In the fall of 2003, Caroline began a graduate program in nutrition at Louisiana State University. Over the past two years, she has worked as a teaching assistant for Mrs. Judy Myhand. She plans to graduate in the Spring of 2005 with a Master of Science degree in nutrition. She will enter an internship program in either July or August. Once she completes an internship program, she will take the Registered Dietitian exam so that she can be a Registered Dietitian.