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OF DIET PROBLEM GROUPS IN THE
1977-78 NATIONWIDE FOOD CONSUMPTION SURVEY

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DEMOGRAPHIC AND FOOD RELATED DESCRIPTORS
OF DIET PROBLEM GROUPS IN THE
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By

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ABSTRACT

DEMOGRAPHIC AND FOOD RELATED DESCRIPTORS OF DIET PROBLEM GROUPS
IN THE
1977-78 NATIONWIDE FOOD CONSUMPTION SURVEY

By Amy B. Slonim

Two questions in the 1977-78 Nationwide Food Consumption Survey (NFCS) were about dieting behavior and factors affecting food intake. About 50 percent of the 24,362 NFCS respondents reported at least one of these dietary behaviors or factors.

Phase I of this study described respondents in terms of factors affecting their food or nutrient intake. Respondents were categorized into groups reporting medical and non-medical factors. These groups were: NONE (50.5%), NON-MEDICAL (39.5%), NON-MEDICAL & MEDICAL (6.0%), and MEDICAL (4.0%). Meal and snack patterns, demographic characteristics, nutrient quality assessment, and food intake and related behaviors comprised typologies for each group.

The groups with some type of medical problem, NON-MEDICAL & MEDICAL and MEDICAL, were comparable in socio-economic descriptors and had the most respondents 55 years of age and older. As expected, they lived in smaller households with more: non-working adults, female only headed households, and lower education levels for head of households. These groups also were more similar in dietary intake from specific food groups and other related behaviors (eating out and eating alone).

The NONE and NON-MEDICAL groups contained the most respondents less than 18 years of age living in larger households with employed head(s) of household. The personal food behaviors such as intake from specific food groups, eating alone and eating out were more alike for these two groups than the groups who identified a medical problem affecting intake.

The two groups identifying some type of non-medical factor affecting intake, NON-MEDICAL and NON-MEDICAL & MEDICAL, had more respondents ingesting less than 60 percent of their Recommended Dietary Allowances (RDA) for seven nutrients. Conversely, the NONE and the MEDICAL groups had more respondents ingesting nutrients at more than 59.9 percent of the RDA. In addition, meal and snack patterns were more alike for NONE and MEDICAL groups and for the groups identifying some type of non-medical problem. It was concluded that meal and snack patterns and total mentions of specific food groups were characteristics which differentiated nutrient quality assessment of the four groups.

Phase II was a theoretical treatment of the data set. A model representative of variable sets of factors potentially affecting food intake was derived and estimated using multivariate techniques. The independent variable sets represented demographic characteristics, food related behaviors, and nutrient intake. Descriptive statistics were generated between the sets of independent variables and the dependent variable, problem versus no problem with dietary intake. In addition, the relationships between the indicator variables representing the independent variable sets were quantified.

The model was estimated using factor analyses, discriminant analyses, and canonical correlation analyses. Low correlation coefficients ($R_c \leq .3$) were determined between the dependent variable and each of the independent variable sets. Moderately high correlations

($R_c \geq .7$) were obtained between the sets of independent variables. The Phase II analyses were critical steps in furthering derivation of mathematical conceptual schemes to represent food related behaviors. The findings from Phase II may be used to further refine and direct future analyses to identify measured indicators of factors affecting food intake.

To Louise Rose Wiener Slonim

and

my father and sister.

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CHAPTER I

INTRODUCTION

In the last decade, the nutritional adequacy of the American diet has received attention in the mass media. Women's and men's magazines not only include meal planning and preparation articles, but also more technical articles on food, nutrition and dieting. Newspaper food editors also cover relevant nutrition issues and book stores stock food and nutrition books.

To begin to assess the U.S. general population's concern about personal food and nutrient intake patterns or problems, the U.S. Department of Agriculture (USDA) staff included two new questions in the 1977-78 Nationwide Food Consumption Survey (NFCS) (Cronin, 1980). The first question gave individuals an opportunity to report whether or not they were on a doctor prescribed special diet, on a group, or on an individual diet regimen. The second question identified nine items that might affect what a person eats or drinks and gave respondents an opportunity to check as many as pertained. These nine items included:

- I'm on a diet to lose weight
- I'm on a diet to put on weight
- I have a chewing problem because of teeth
- I have a medical problem like diabetes or allergy
- Some foods do not agree with me
- I don't feel like eating breakfast early in the morning
- I have no interest in cooking for one person
- I do not like certain foods
- Other

Crocetti and Guthrie (1982) conducted a secondary analysis of the NFCS to explore changes in lifestyle and associated characteristics of the diet and nutrient adequacy of respondents. They found approximately 50 percent of the respondents in the Spring quarter of the survey falling into one or more of the above categories. The large percentage of respondents who placed themselves in these categories afforded a unique opportunity to begin to identify and characterize persons with medical and/or non-medical practices or problems that they perceived as affecting the way they ate or drank. A primary objective of this investigation was to identify and characterize persons who self-reported medical and non-medical factors in the NFCS. The large sample size (approximately 25,000), the collection of data over an entire calendar year (four quarters), and the combination of data obtained on demographics, nutrient intake and food related behaviors added to the uniqueness of this investigation. A second objective of this study was to use statistical methodologies to derive a model incorporating four sets of variables: (1) identification of problem affecting food intake; (2) demographics of respondents; (3) personal and food related behaviors; and (4) nutrient intake. Multivariate analysis techniques were used to explore the correlational relationships between these sets of variables characterizing food related behaviors. The analyses occurred in two phases.

Phase I

In Phase I after the sample for the anlyses was determined, the respondents were grouped into four categories based on reported factors which may have affected their food consumption. The four factor intake categories were: NON-MEDICAL; NON-MEDICAL and MEDICAL; MEDICAL; and

NONE. Variables were used directly from USDA NFCS codes or were constructed to describe the four groups in terms of: (1) socio-economic characteristics; (2) meal and snack patterns; (3) nutrient quality assessment; and (4) food group intake or related personal behaviors.

Traditionally the data from USDA surveys have been used to characterize households and individuals by nutrients consumed by age, sex, region, income, household size, or some combination of these variables. Nutrition education efforts have been criticized for failure to recognize changes in the nature and composition of the food supply and failure to address target populations in relevant social, demographic and lifestyle patterns. Phase I was designed to look for an alternative way to analyze the NFCS data. It was thought that typologies of food consumption patterns might be found among diet problem groups of respondents. These typologies were constructed to provide useful information to nutrition educators.

Phase II

Phase II was a theoretical treatment of the NFCS data set. The relationships between sets of independent variables and the dependent variable, identification of factor or problem with dietary intake were estimated. The independent variable sets represented demographic characteristics, food related behaviors, and nutrient intake. Mulitvariate analysis techniques were used to estimate the mathematical relationships between the four sets of variables. Two five percent random subsamples of the total study population (24,362 respondents) were investigated for purpose of cross-validation. The end result was a model representing the correlational relationships between the sets of independent variables and the dichotomous dependent variable problem versus no problem with intake.

CHAPTER II

REVIEW OF LITERATURE

A variety of surveys: consumer expenditure; household and individual food consumption; and nutritional status have been used to describe food intake patterns of individuals and households. Regardless of survey size, an underlying objective has been to assess dietary intake. The emphases and uses have been as varied as appraising nutrient intake of specific segments of the population, providing baseline data for development of policies and programs on consumer education, nutrition, and food and agriculture, and deriving marketing strategies and consumer product development by food industries. The use of food consumption survey data for practical and theoretical nutrition education research is discussed in this chapter.

The 1940's Committee on Food Habits (NRC, 1945) encouraged some of the first research in the area of food habits. In 1964, Mead noted little progress in theories or methodologies for conducting food habit research. She proposed a multi-dimensional code for describing dietary patterns in physiological, sensory, chemical, nutrition and cultural terms. Almost two decades later, minimal progress has been made in defining the relationship between independent and dependent variables affecting food choices and behavior. A state of the art regarding the development and direction of methodologies applied to describe and quantify food related behaviors is forthcoming in a report of the National Academy of Sciences

Panel FActors Affecting Food Consumption (Kolasa, Lackey and Slonim, 1981).

Food habit research has been conducted incorporating multivariate approaches with varying degrees of success using the theoretical, scientific, and practical expertise of nutritionists, anthropologists, economists, psychologists, and sociologists. The usefulness of multivariate techniques in discovering regularities in the behavior of two or more variables are described in this chapter. Additionally, the model incorporating demographic, nutrient quality, and food intake variables estimated in Phase II of the analyses is presented.

Nutrition Education Research in the 1980's

As we move into the 1980's, nutrition educators are being challenged to build on traditional methods of research and information dissemination with innovative and more effective techniques. The federal government has fostered and supported this goal by sponsoring national conferences such as the 1979 National Conference on Nutrition Education: Directions for the 1980's (U.S. Department of Health, Education and Welfare et al., 1980). The purpose of the Conference was to provide direction and guidance in the form of recommendations, options and priorities to the sponsoring groups and other public, private and voluntary agencies addressing nutrition education needs for the 1980's.

The U.S. Department of Agriculture (USDA) has further demonstrated its commitment by sponsoring a series of workshops at Pennsylvania State University in 1980 to identify priority research issues in nutrition education. The topics of the conferences were: Eating Patterns; Nutrition Communication; Formal Nutrition Education; and Community Nutrition Education. The goals of the Conferences included: (1) defining and delimiting discrete areas of research encompassed in specific areas of nutrition education research; (2) determining methodological and conceptual problems currently limiting work in these areas; and (3) identifying more fruitful directions for future research efforts (Sims, 1980).

In the specific recommendations of the task forces from the National Conference held in September, 1979 (Dwyer, 1980) each group emphasized the need to focus research to gather relevant information from specific segments of the population on food habits, beliefs and related behaviors to be able to target messages more appropriately. Nutrition messages, regardless of their form, must be meaningful to the target groups within their cultural, social, and economic orientations. It has been concluded (Olson and Gillespie, 1981; Sanjur, 1982) that research methodologies and data analyses need to be bolstered to gain insight into individual's or group's food related behaviors.

Bass, Wakefield and Kolasa (1979) defined food behavior as an individual's response to stimuli related to the selection, procurement, distribution, manipulation, storage, consumption and disposal of food. The food that people choose to eat, the reason for their choices, and their eating patterns (frequency, eating partners, location) are behaviors nutrition professionals have sought to understand. Many studies have indicated that food and nutrient intake behavior is associated with several interacting factors such as income, education level, culture, socialization, geographic location, composition of family and life cycle stage. The relationship between these factors and whether or not a person is on a special diet (medically or otherwise prescribed) or has some personal or non-medical factor (i.e., chewing problem or food dislikes) which affects his/her food consumption behavior has not been explored. Analyses of this nature may provide valuable information to professionals in federal, state, or private agencies developing nutrition education tools for consumers; the food industry interested in product development and marketing; and/or legislators in determining and administering programs and policies.

The Nationwide Food Consumption Survey (NFCS) for the first time included two questions which gave individuals an opportunity to report whether or not they were on a doctor prescribed special diet, on a group, or self determined diet regime. USDA also included nine items which allowed respondents to identify factors which may have affected the way they ate or drank. These items included such factors as: being on a diet to lose or gain weight; having a chewing problem; not liking to eat certain foods or breakfast; and foods not agreeing with them. Respondents were asked to check as many as applied to their intake.

To date analyses of USDA survey data have not specifically studied persons on special diets or having self-reported factors affecting their intake. In the highlights from a national workshop on nutrition education research, (Olson and Gillespie, 1981) research priorities for the future were enumerated. Among the prioritized areas for research were the identification of lifestyle factors influencing food choice and dietary behavior and factors in the affective domain influencing dietary behavior. The NFCS afforded an opportunity to describe and quantify demographic and food and nutrient intakes of persons who self-reported problems with their intake that would be current and useful to nutrition educators.

Use of Food Consumption Survey Data

The U.S. government has been responsible for measuring and appraising trends in the U.S. food consumption since the 19th century. Marr (1971) and Pao (1977) traced the development of dietary standards and methodologies used to assess household and individual food consumption from the 19th century European analyses to the 1977-78 USDA NFCS. The data obtained from these investigations traditionally have been used in part to identify the foods that people choose to eat and the subsequent nutrient intake, eating patterns (frequency, eating partners, location), and the relationship of foods/nutrients consumed with age, sex, race, income and other demographic characteristics (Aquwa, 1980).

The results have been used by federal agencies, the food industry, and research and educational institutions. Clark (1974) classified the potential uses of data from nationwide food consumption surveys into four categories: (1) appraisals of food consumption and dietary adequacy; (2) control and regulatory uses (i.e. effects of enrichment of foods); (3) food budgets and guidelines; and (4) economic, marketing and nutrition research (which impact on the development and administration of government programs and policies). Incorporation of individual's or group's perceptions of non-medical factors (social or behavioral) or medical problems that affected their food habits may further enhance the potential uses of these surveys. For example, guidelines may specifically be developed to include messages or terms relevant to population segment's perceptions of problems or factors affecting their intake. Or understanding and appraising dietary adequacy of the sample population may be conducted in groupings based on identified medical or non-medical problems. The findings may aid in identifying marketing strategies or applied nutrition research relevant to people's perceptions of factors affecting their intake.

Jenkins (1982) included an extensive review of dietary and food guide development in the U.S. Historically, USDA has developed food selection guidelines with the objective of translating dietary standards into simple and reliable nutrition education tools useful to consumers in satisfying their nutritional needs (Light and Cronin, 1981). The first so-called food guides were attributed to Caroline L. Hunt who developed "A Week's Food for the Average Family" published in 1921 by USDA and the 1923 bulletin entitled "Good Proportions in the Diet" (Hill and Cleveland, 1970). Since that time USDA has published several food selection guidance tools utilizing the following data sources for updating: nutritional and dietary status of the population, nutritional standards, food consumption patterns, food availability, nutritive composition of foods and food economics (USDA-Consumer and Food Economics Institute, 1976).

In 1976, the Consumer and Food Economics Institute held discussions on the food selection tools developed to date. In review of commentaries and critiques of the subject, the criticisms were summarized into three broad subject categories (Light, 1977):

1. failure to address the most important public health nutrition problems

2. failure to recognize changes in the nature and composition of the food supply

3. failure to recognize changes in social and demographic characteristics and lifestyles of the population

More recently a series of articles were published which discussed food guidance for the public (Guthrie and Scheer, 1981; Dodds, 1981; Pennington, 1981; Lachance, 1981; Light and Cronin, 1981). Varying methods for developing guidance plans and specific suggested guidance tools were presented. Each author emphasized incorporating current consumption patterns and food acceptability to population segment in any food guidance for the general public.

Phase I of this investigation was designed to describe social and demographic characteristics of the study population. Furthermore, nutrient quality assessment variables were constructed (Chapter III) to better address relevant public health nutrition problems. The U.S. Surgeon General's Report on Health Promotion and Disease Prevention (1979) indicated decreasing incidence of nutritional deficiencies due to insufficient intakes of vitamins and minerals. Current dietary concerns in the U.S. have related to excessive intakes of certain macronutrients or unbalanced intakes of macronutrients.

> As our knowledge of nutrition has expanded it has become more appropriate to emphasize, for dietary guidance purposes, the energy producing nutrients, protein, fat and carbohydrate, since excess of these may be related to some of the more prevalent chronic diseases in our society today (Jenkins, 1982:15).

Multivariate Approaches to Understanding Food Related Behaviors

The scientific study of human nutrition, like any other science, has been fundamentally concerned with establishing laws of relationships among factors given certain conditions (Monge, 1980). Nutrition science has been concerned with the body's need for nutrients and how these nutrients function in biochemical mechanisms. The application of nutrition science in clarifying food related behaviors has necessitated the incorporation of various environmental external factors and internal factors in deriving conceptual frameworks or models. The formulation of laws relating variables has been a theoretical endeavor dependent upon empirical techniques. The application of mathematics to this process has aided in the: (1) identification of consistent relationships among variables; (2) understanding of complex information in a concise and meaningful way; and (3) creation of derivations which are content free and have allowed predictive capabilities which may be tested (Fink, 1979).

Multivariate analysis techniques have been used by many disciplines in discovering regularities in behaviors of two or more variables. These techniques have facilitated the development of 'multivariate profiles' which have grounded understandings of relationships between variables for model and theory development and testing. Multivariate analysis techniques have been built from mathematical methods including matrix algebra, geometry, the calculus, and statistics.

The consensus in the nutrition professional community has been that more adequate theories are needed related to food behaviors (Olson and Gillespie, 1981). Blalock (1969) noted that "theories do not consist entirely of conceptual schemes or typologies, but contain lawlike propositions that interrelate the concepts or variables two or more at a time." A short run goal of theory development may include the process of finding predictor variables causally related to the variable(s) to be explained. However, in the long run it is theory that will provide the terms by which complex interrelationships may be explained. As Woelfel and Fink (1980) discussed, mathematics may be helpful in various stages of theory building in understanding complex information in rich and simplified ways. Relationships among variables may be derived from mathematics in content free terms which allow prediction and eventual modeling and testing.

Phase II of this investigation was designed to quantify the relationships between sets of independent variables representing demographic characteristics, food related behaviors and nutrient intake and the dependent variable, identification of problem with intake (See

Figure 1). Multivariate analysis techniques were used to discover 'multivariate profiles' of regularities in behavior among variables. The findings from this investigation may aid in further defining explanatory variables and causal relationships between factors related to food behaviors. It is through grounded conceptual schemes and deductive reasoning that theories will be derived in the field of applied nutrition science. The analyses in Phase II are a step in the direction of grounding conceptual schemes, through the derived mathematic representation of relationships between sets of variables.

Summary

Although the Committee on Food Habits in 1945 encouraged multi-dimensional approaches to the study of food related behaviors, little progress has been noted in the development of theories in this arena. Multivariate analyses techniques have been used with varying degrees of success in furthering theoretical gains in the applied field of nutrition. The model investigated in this study incorporated understandings previously derived between variables affecting food related behaviors (Kolasa, Lackey and Slonim, 1981). Mathematical techniques were used to quantify relationships among sets of variables to ground conceptual schemes and specific factors which are interrelated in food habits. Findings from this investigation may have nutrition education and theory building implications.

Objectives of Investigation

Phase I

1. To identify NFCS respondents four years of age and older who self-reported a medical or non-medical problem which may have affected

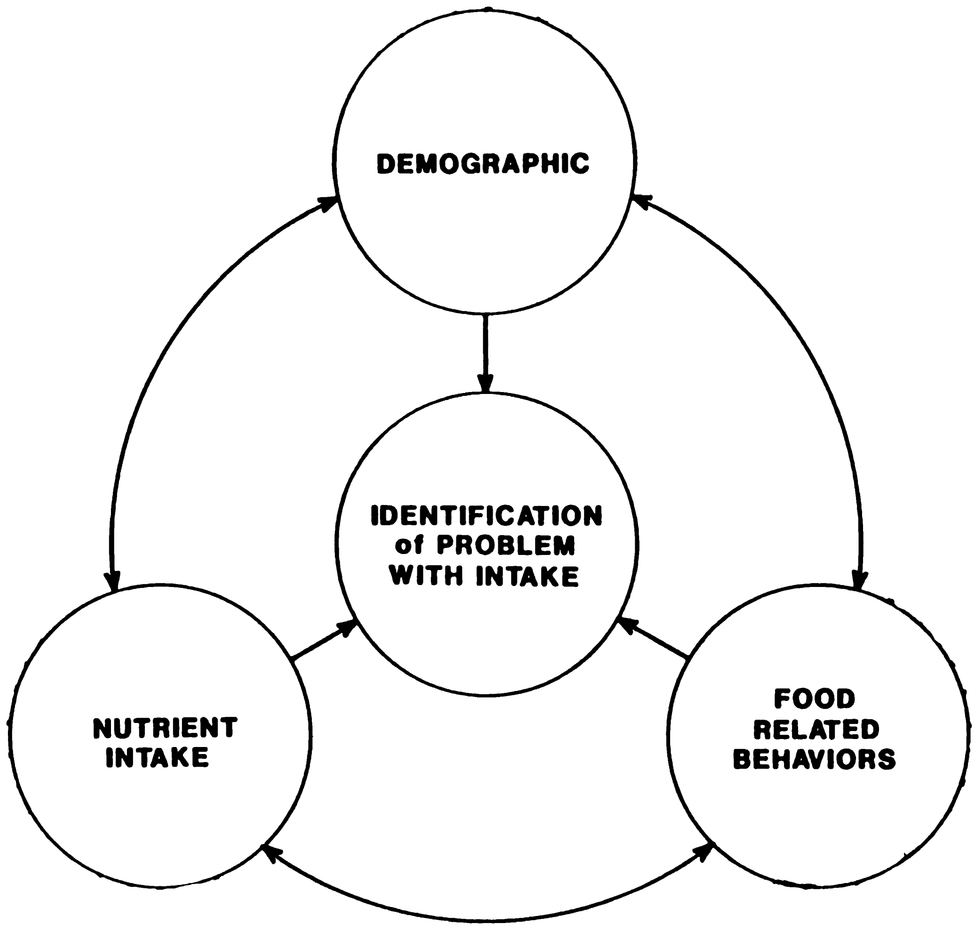


FIGURE 1. Model to be Estimated in Phase II.

their eating pattern or nutrient intake.

2. To characterize respondents identified in #1 above in terms of socio-economic factors, meal and snack patterns, nutrient intake assessment, and food and related personal behaviors.
3. To discuss implications from #1 and #2 above as they relate to nutrition educaton and research.

Phase II

4. To identify sets of indicator variables representing: demographics, nutrient intake, and food related behaviors of NFCS respondents.
5. To quantify relationships between sets of independent variables identified in #4 above and the dichotomous dependent variable, identification of problem affecting intake.
6. To apply canonical analyses to determine relationships between the three sets of independent variables identified in #4 above used to characterize food behaviors.

CHAPTER III

METHODS

When conducting a secondary analysis of data originally collected for other purposes there are issues that need examination. The data may not be in a format best suited to the proposed secondary analyses. This chapter includes discussion of several points about the design, field work, coding and editing of the Nationwide Food Consumption Survey (NFCS) which affected subsequent analyses and their interpretation. These include the decisions to: not weight the individual sample to correct representiveness; merge the records for three days of food intake into a single record; exclude selected variables due to wording in questionnaire or due to non-completion rates; and merge the data for the four quarter subsamples into one data set.

Additionally, this chapter includes the methods used in Phase I to select a sample and categorize respondents into four intake factor categories. The variables used to characterize the four groups in terms of socio-economic, meal and snack patterns, nutrient quality assessment, and food related behaviors are then discussed. The recoding and labeling of meal occasions and multiple meals is described. The most frequent patterns of number of meals eaten in each of three days was used to derive the meal pattern variable. The nutrient quality assessment measurement incorporated two indices. One identified the number of nutrients ingested at less than or equal to 59.9 percent of the Recommended Dietary

Allowances (RDA) (NAS Food and Nutrition Board, 1980); this is called a marginality score. The other considered total caloric intake of respondents in proportions of protein, fats, and carbohydrates, a PFC score. The combination of the marginality score and the PFC score yielded a composite index. Variables constructed to describe food related behaviors included: 32 food group categories; a combination of meal and snack eating-out behavior; use of vitamin and mineral supplements; three day behavior of eating alone; and weight status.

The final section of this chapter includes the sample and variable selection and statistical analyses used in Phase II. The preliminary examination and transformation of variables is discussed. Three types of multivariate analysis techniques were used to estimate the model incorporating four sets of variables: (1) identification of problem affecting intake; (2) demographics of respondents; (3) personal and food related behaviors; and (4) nutrient intake. The multivariate methodologies used were discriminant analysis, factor analysis, and canonical correlational analysis.

Consequences of the Survey Design and Fieldwork

In a Report to the Select Committee on Nutrition and Human Needs, the U.S. General Accounting Office (1977) described the history, funding, and eventual contracting of the NFCS and listed three consequences of the design. As a secondary analysis researcher, these three consequences were considered in the project design, analyses and interpretation. First, the sampling scheme of households did not yield a representative sample of individuals in the U.S. Secondly, the three day dietary intake technique used to assess individuals food consumption was not validated. And, finally, the wording and response options for several of the questions limited the potential for the clarity and analysis of the data obtained. Each of these consequences will be described separately and the implications identified.

NFCS Sample Design

A random probability multistage, stratified sampling design intended to represent all private households in the 48 adjacent states was used in the Survey. The sample design imposed limitations on utilizing the individual data for analysis. The design was based on the household as the sampling unit; therefore, the probability of selection of a sampling unit was limited to the household and did not apply to individuals within households. Furthermore, the individual data were inspected to see if they represented the 1977 U.S. population age and sex distribution as determined by the U.S. Bureau of the Census (1978). ANAREM (1980) concluded that the NFCS respondents did not yield a representative age/sex sample of individuals in the United States in 1977. The selection of individuals varied from interviewing wave to wave. For example, all household members were to be interviewed in the spring quarter, but then only half of the persons 19 years of age and older were to be interviewed within each household in the other three quarters. The result of this was that different proportions of children and adults in the populations were found between the first and later three quarters.

Beyond the selection process, completion rates also affected the representativeness of the sample. The non-compliance rate was not random. Crocetti and Guthrie (1980) investigated the completion rates for the individual sample. They found that young men and large households had disportionately high non-compliance rates.

In addition, the recipients of contracts to conduct secondary analyses did not receive a complete report on the sampling process employed by fieldworkers. To ascertain the impact of the design and field work execution on the individual sample, the following would be needed for each stratum for each quarter: (1) sample size by number of members in the household; (2) breakdown of reasons why questionnaires were not completed; and (3) demographics on neighborhoods of completed and non-completed individual questionnaires. This information has not been supplied to date and is not expected.

Weighting is a means for correcting non-representativeness in sample populations. USDA provided contractees with a set of weights recommended for assignment to various strata of individual respondents. Since USDA provided no explanation or formula for the derivation of the weights recommended, they were not used in these analyses.

Due to the sample design and the limited information provided on the field work execution and the non-compliance rates, the individuals surveyed are not a random sample of the U.S. population in 1977. The NFCS respondents are, however, a describable population. Therefore, the typologies determined in Phase I were carefully identified in terms of socio-economic status for each group. Characterizations were made based on the findings of the analyses and not with regard to representativeness of the U.S. population.

Dietary Intake Methodology

The second major design weakness that the Comptroller General U.S. (General Accounting Office, 1977) stressed was the lack of validation in the dietary intake methodology. In choosing methods for obtaining food consumption data there are certain practical considerations which must be addressed. These include such matters as number of respondents to be surveyed and their required cooperation and time, the necessary training for field workers, the resources available for coding and analyses, and the objectives of the study (Caliendo, 1980).

The dietary intake methodology used in the individual questionnaires included one 24-hour dietary recall and two-day food records on three consecutive days. The 24-hour recall relied on the memory of the respondent and a trained interviewer to obtain the data. The two-day records required respondents to record every item of food or beverage consumed on a special record sheet with indication of the amount ingested, time consumed, and a label for the kind of meal or snack intake.

The GAO Report (1977) indicated that nine different methods for collecting information from households and individuals were investigated. The eventual techniques were selected since they yielded data "in the mid-range of the array of results" (U.S. General Accounting Office, 1977). The selection process used does not suggest anything about the validity of the different methods or how the methods differ from one another. The concluding comment of the Report related to dietary intake methodology was that in general procedures should be validated prior to usage in a survey.

Researchers have investigated the validity and sources of variance in various dietary intake methodologies (Murray, 1970; Marr, 1971; Burk and Pao, 1976; Houser and Bebb, 1978; Beaton et al., 1979; Stunkard and Waxman, 1981; Karvatti and Knuts, 1981; and Carter, Sharbaugh and Stapell, 1981). For example, Beaton et al. (1979) discussed the sources of variance in 24-hour recall data and found significant differences in the day of the week interviewed. This would have been avoided if field workers had obtained an equal distribution of the days of the week in which initial interviews were conducted. However, upon inspection of the data Crocetti and Guthrie (1980, 1982) found the weekends were underrepresented. An even distribution across all days of the week would result in approximately 14.3 percent (1/7th) representation per day of week. In the Spring quarter, Saturday accounted for only 3.3 percent and Friday 10 percent of the total day of the week distribution. The combined Friday/Saturday (13.3%) was less than the desired 14.3 percent per day. In addition, reports on the problems and outcomes of the 24-hour recall and the two-day record suggested that systematic bias may be introduced by the recall method. The 24-hour recall may produce fewer food items than the food record method.

In light of the concerns discussed above, in the present study data for the three day individuals food intake were merged and an average of the attributes was used in all analyses. Pooling the three day data on food intake offered advantages in smoothing out daily variations. The large sample size and the merging of the data for the three days aided in the reliable use of these data.

Wording of NFCS Questions

The third area of criticism from the GAO Report (1977) related to the wording and response options of the actual questions in the questionnaires. To begin with, several of the variables were ascribed to households rather than individuals. For example, education, working status, and occupation were obtained for only the head(s) of households. In assessing demographics of the population, variables would have proved more representative of actual respondents if they had been obtained for more than head(s) of household. Generational differences may exist, but it was not possible to assess them. This limited the interpretation of the data.

In addition to being ascribed only to the head(s) of household, the occupation variable was not categorized on the basis of the U.S. Labor Dictionary of Occupational Titles (1977). The categories in the Dictionary are established according to levels of skill and job responsibility and according to industry, in order to reflect income, lifestyle and responsibilities of persons in the categories. The NFCS provided respondents seven options which mixed unskilled and skilled labor categories. As a result, the variable for occupation did not differentiate respondents well based on their jobs and was not used in this investigation.

Several questions in the survey form for individuals had the category "other" as an option. Included were such questions as: "Reason why the day of intake was not normal"; "Race"; "Are you on a special diet? If yes, how would you describe it?" and "These are some things that might affect what a person eats and drinks. Indicate which ones, if any, pertain to you." Crocetti and Guthrie (1980) found that in the Spring quarter, of those respondents that reported a non-normal Day 1, 65 and 63 percents of the black females and males, respectively, gave "other" as the reason. Forty-two percent of the white males and females reported "other" as their response. There was no way reliably to interpret such questions. If these questions had been pretested effectively, the large percentages of individuals in the "other" categories could have been avoided. Some question responses had to be omitted from analyses in this study (for example "Was this a normal intake day?") due to the large percentages of respondents placing themselves in the "other" category option.

Completion Rates of NFCS Respondents

The final problems encountered in utilizing the NFCS data involved low completion rates and under-reporting of intake items. In the Spring Quarter, Crocetti and Guthrie (1981a.) found that only 65 percent of the respondents completed the three questions on education, occupation and income. In view of the low completion rates an attempt to establish a socio-economic status index had to be abandoned.

There was no accurate way to estimate the level of under-reporting for particular food items, except to compare these data with other reports. For example, the U.S. Surgeon General's Report Healthy People (1978) and Hyman et al. (1980) indicated substantially higher per capita consumption of alcohol than was found in the initial analyses of the NFCS. In addition, the percentages of respondents reporting candy consumption appear low in relation to other national data. "It may have been due to a reluctance to report an item that is popularly classified as a 'junk food' or because candy may be popped into the mouth and forgotten" (Cronin, Krebs-Smith, Wyse and Light, in press 1982).

Summary

In summary, the sample design, the dietary intake methodology used, the wording of questions, the low completion rates and level of under-reporting are among the limitations which were considered in conducting this secondary analysis of the NFCS. These limitations were considered in the selection of the study population, construction of variables and the subsequent interpretation of results from analyses.

Seasonality

The original sampling scheme for the NFCS called for four random subsamples to be executed over an entire calender year to permit control for seasonal variation of food and nutrient intake. Crocetti and Guthrie (1982) investigated seasonal variation utilizing the NFCS data set. They explored all four quarters in terms of variation in meal and snack patterns; variation in intake for major groupings of foods; and variation in intake of individual nutrients and found no seasonal variation. In view of the evidence supplied by Crocetti and Guthrie (1982) that seasonality did not have a substantial effect on the eating behavior and nutrient intake of the study population, it was decided to merge the four quarters and analyze the study population as an aggregate of the entire year.

Phase I: Methods

The first task in Phase I was the basic selection and exclusion of individuals to be included in analyses. Once the sample was selected respondents were categorized by the primary researcher into the following groups:

NON-MEDICAL — respondents who identified one or more of the factors affecting what they eat or drink and/or identified themselves as being on a group or individual special diet. The only factor excluded from the multiple item list of factors affecting what a person eats or drinks in this category was: "I have a medical problem ... ."

NON-MEDICAL & MEDICAL — respondents who identified one or more of the non-medical factors described above and identified one or more medical problems. A medical problem included being on a doctor prescribed diet and/or having a problem like diabetes or an allergy.

MEDICAL — respondents who identified one or both of the medical problems.

NONE — respondents who did not fit in any of the above categories. These were the individuals who responded negatively or had no answers to the two questions described above.

The essence of the first objective of this study was to determine if persons who self-reported some non-medical or medical problems had identifiable differences in terms of lifestyle or food and nutrient intake from those persons who did not identify problems. These groups were derived to aid in characterizing the major descriptive differences between NFCS respondents who reported no problems or factors affecting their intake from those respondents who did identify factors or problems.

The next sections describe the variables used in Phase I to characterize the four groups in terms of their: (1) socio-economic characteristics; (2) meal and snack patterns; (3) nutrient intake; and (4) food group intake and personal behaviors. In some cases variables were used as they had been directly coded from the NFCS questionnaires. In other instances variables were defined in terms of frequency or usage reported in the study or reconstructed to incorporate information from several response categories. An attempt was made to develop variables which would be useful to nutrition educators and relevant to social, demographic or lifestyle patterns.

Socio-Economic Characteristics

Socio-economic variables were used to differentiate the demographic characteristics of the groups. Age was calculated based on the date of birth indicated in the questionnaires. This information was used to derive census age category groupings and RDA age/sex groupings. Sex, race and region were used as recorded on the interview schedules. Many other variables such as household size, family composition, respondent's relationship to the head of household, poverty index, urban status, working status and type of head of household, and education of head of household were constructed either by condensing categories from the questionnaire or incorporating two or more variables in a composite variable.

Meal and Snack Patterns

NFCS respondents were asked to indicate the name of every eating occasion recorded. The NFCS coding categories included: breakfast; brunch; lunch; dinner; supper; beverage (coffee break); and snack. In the initial data examination a frequency count of all patterns of meals and snacks was computed for the three days. Two problems were encountered: (1) there were a large number of eating occasions left uncoded on the USDA micro data tapes and (2) there were a large number of individuals reporting four or more meals per day. For various reasons (e.g. respondents employed a term or name for the eating occasion not included in the list) many of the eating occasions were left uncoded. Crocetti and Guthrie (1982) recoded when possible the food intake occasions which had been left uncoded by USDA employing very stringent criteria (see Crocetti and Guthrie (1982) for criterion used). These recoded categories were used in Phase I. This resulted in 13 percent of the individuals having changes made in their labels for food intake occasions.

In further examination of the "four or more" meals problem, it was determined that many of the meals consisted of "multiple" breakfasts or dinners recorded as taking place at different times, but within 1 to 1½ hours of each other. It was decided to consider breakfasts within 1½ hours of each other and all other meals within 1 hour of each other as single meals.

After correcting for the two aforementioned problems, frequency distributions were run listing the patterns of all possible combinations of meals for the three days and the total number of snack events. The most frequent patterns of meals were 333 (57%), 332 (17%), 322 (8%), 222 (7%). The labels 332 and 322 did not indicate the sequence of days with three and two meals. For example, 332 merely indicated that on two days three meals were recorded and on one day two meals were reported. All records not falling into one of the four major meal pattern categories were placed in an "other" category.

Snack events consisted of either snack and/or beverage labels reported with the same time label. In analyses, two major snack identification groups were used: any mention of a snack intake (snacker) and no mention of a snack intake (non-snacker).

For all analyses, meal pattern categories included: 333, 332, 322, 222, and "other". Snack patterns were reported in terms of snackers and non-snackers.

Nutrient Quality Assessment

Nutrient intake quality was the third area in which the study population was examined. Nutrient quality data was obtained from the three-day food intake records of respondents (it did not include vitamin and mineral supplement data). A composite index was constructed from the combination of the marginality score and the protein, fats, and carbohydrates (PFC) score to assess nutrient quality. The marginality score (MS) was constructed to give information about the number of micronutrients that were ingested at a level designated as "marginal". Marginal for this investigation was determined at less than or equal to 59.9 percent of the RDA for that particular nutrient and age/sex category of the respondent. The 59.9 percent for the RDA cutpoint was determined with approval of the USDA project officer and a group of nutrition professional consultants. This cutpoint was determined based on the frequency distribution of respondents in age/sex categories and percent RDA intake for nutrient and to reflect a reasonable cutpoint for "marginal" for all micronutrients. The "scored" was a constructed value. Worksheet #1 (Appendix A-1) illustrates the steps used in developing the scoring system for seven nutrients. Crocetti and Guthrie (1981 c. and 1982) elaborate on the development of this index. Each of the seven nutrients were assigned a weight according to the percent RDA achieved, and the seven weights were summed to yield scores. The individual scores ranged from seven (greater than or equal to 80 percent of the RDA for each of the seven nutrients) to 63 (those cases where each of the seven nutrients averaged less than or equal to 59.9 percent of the RDA).

The PFC score was developed to address the total caloric intake of respondents in the proportions of protein, fats, and carbohydrates (PFC). The PFC score method of development is shown in Worksheet #2 (Appendix A-2) and further discussed by Crocetti and Guthrie (1981 b. and c. and 1982). The recent emphasis on the distribution of these three macronutrients in terms of caloric intake calls attention to this dimension of nutrient quality assessment not specified in the RDA. It should be pointed out that there is neither firm basis nor authority for setting the cut points as shown.

The PFC score was a constructed value in which individuals are assigned scores determined by the patterns found for the proportions of intake of protein, fats, and carbohydrates. A score which was identified in the "okay" category indicated that each of the three micronutrients were within the specified ranges indicated in Appendix A-2. All other categories were determined by the number and specific macronutrient which fell outside of the specified "okay" percent intake categories.

A single composite index was constructed to explore the nutritional quality of the diet of the respondents which combined the MS and PFC scores. Several combinations were examined (Crocetti and Guthrie, 1982), and the final 12 category composite is identified below.

12 Composite Index Categories*

Number of Marginal Nutrients	PFC Index		
	All "okay"	ONE Outside Range	TWO or MORE Outside Range
NONE	A	B	C
ONE	D	E	F
TWO	G	H	I
THREE - SEVEN	J	K	L

*See Appendix A-5 for detailed descriptions of each category A - L.

Each cell in the above table represented one category group used in nutrient intake analyses. For example, the A cell (NONE/ALL "OKAY") represented those individuals who had no micronutrients equal to or below 59.9 percent RDA for the three day average for the seven MS nutrients and their PFC ratio was all in the specified "okay" ranges. Those respondents in the L cell (THREE-SEVEN/TWO OR MORE OUTSIDE OF RANGE) were those individuals that had three or more nutrients that were equal to or below 59.9 percent for the three-day average RDA for the seven nutrients. This group also had two or more macronutrients falling outside of the specified ranges in the PFC score. This composite index was used to assess nutrient quality in analyses.

Food Group Intake and Personal Behaviors

The major task in developing variables to assess food group intake patterns lies in establishing and defining category groups. Crocetti and Guthrie (1981 b.) defined two types of groups, one based on nutrient content of foods and the other based more on usage and function of food products in the U.S. diet. Crocetti (Crocetti and Guthrie, 1982) developed food group categories primarily to reflect usage and function of food items in the U.S. diet rather than nutrient content of foods. Thirty-two groups were determined based on: function and content of ingredients as they are marketed and/or as they appear or are used in meal planning in commercial restaurants or in households' food selection; major food subgroups coded by the USDA; and the frequency that respondents mentioned specific food items (Appendix A-3 is a listing of the 32 categories).

Guthrie (Crocetti and Guthrie, 1981 a.) developed 13 groups to assess food consumption in terms of nutrient contribution to the diet of respondents. It was a composite of the Crocetti (Crocetti and Guthrie, 1981 a.) 32 food groups. Given the objectives of Phase I only the Crocetti groups were used for analyses (see Appendix 3).

Several other variables were developed which combined data obtained in the NFCS questionnaires. These variables were constructed to characterize: eating outside the household; eating alone; use of vitamin and mineral supplements; and weight status. Weight status was constructed from the self-reported height and weight data obtained from respondents in the questionnaires. From this information provided, the following variable was used to compare weight status among respondents:

"Underweight", "Normal", and "Overweight" Status

"Underweight" = $\leq$ -15% of RDA range mid-points

"Normal" = -14.9% to +24.9% of RDA range mid-points

"Overweight" = $\geq$ +25% of RDA range midpoints

The values used to derive the cutpoints were from the ranges recommended by the Food and Nutrition Board, Recommended Dietary Allowances Committee (1980). The mid-points in the ranges reflect sex/age groups for individuals less than 18 years of age and height groups for persons 18 years of age and older. The percentage cut-points used for the under and overweight categories vary due to the documented greater potential physiological hazards of being underweight.

Analysis Phase I

Once the variables for Phase I were developed as described in the previous four sections, frequency distributions for the variables were cross tabulated with the medical and non-medical factor intake category groups. Cambridge Computer Associates (1967) statistical computer package, "Crosstabs," was used to characterize individuals with self-reported problems. Contingency coefficients were estimated as the measure of association between category groups used.

Phase II: Methods

The sample selected for analysis in Phase I was also used as the study population for Phase II. The first task of Phase II was to describe and select indicator variables to be used in the model presented in Chapter II. The three sets of independent variables included were: (1) demographic characteristics; (2) personal and food related behaviors; and (3) nutrient intakes. The analytic procedures to derive indicator variables for each of the sets and to estimate the relationship between the three sets and the dependent variable (problem versus no problem group) are described in this section. Discriminant analysis, factor analysis and canonical correlation were all applied in deriving the variables to be used in the independent variable sets and in estimating relationships between variables in the model.

A data tape was obtained from the Crocetti and Guthrie (1982) secondary analysis of the NFCS. It contained data on variables as they had been coded by USDA on the household and individual questionnaires. It also contained variables that were constructed for analysis in Phase I (See Chapter III, Section II).

Description and Transformation of Variables

The first task in Phase II was to describe all variables included on the tape obtained from Crocetti and Guthrie (1982). A 10 percent random subsample was generated from the study population. SPSS, Statistical Package for Social Sciences (Nie et al., 1975) Subprogram on Frequecies was used to examine missing values and frequency distributions of dichotomous and polychotomous variables. Multivariate analysis techniques used in this investigation assume linearity[1] among the variables. As Green and Carroll (1976:7) indicated:

> The assumption of linearity in the parameters, is not nearly so restrictive as it may seem. First, various preliminary transformations (e.g., square root, logarithmic) of the data are possible in order to achieve linearity in the parameters. Second, the use of "dummy" variables, coded, for example, as elementary polynomial functions of the "real" variables, or indicating category membership by patterns of zeroes and ones, will enable us to handle certain types of nonlinear relationships within the framework of a linear model.

The statistical techniques used in this study can utilize binary-coded (zero-one) variables, but not multiple categorical variables. Therefore, all polychotomous variables were recoded as a set of dichotomous "dummy" variables.[2]

The SPSS (Nie et al., 1975) Subprograms Condescriptives and Oneway produced information on the number of missing values, and on the means, standard deviations, ranges, skewness, and tests for homogeneity of variance for all non-categorical independent variables. Beyond assuming relationships between parameters were linear, using general linear model (GLM) multivariate analysis techniques for statistical testing and parameter estimation it is "necessary to make various assumptions in the form of restrictions on the model and the error term U_t" (Hanuskek and Jackson, 1977:47). Hanuskek and Jackson (1977:47-50) continue by summarizing these assumptions:

1. $|r_{23}| < 1.0$ The explanatory variables may be correlated, but not linear dependent.

2. Fixed X. The correlation/covariance between exogenous (independent) variables and error of prediction = zero.

3. $E(U_t-\bar{U}) = 0$ All observations on the dependent variable implicity include an unmeasurable error term.

4. (a) $E(U_t-\bar{U})^2 = \sigma^2_t = \sigma^2$ for all t.
   (b) $E(U_t-\bar{U})(U_s-\bar{U}) = \sigma_{ts} = 0$ for $t \neq s$
   All possible error terms associated with one observation are independent of, and thus uncorrelated with, the error terms at other observations (homoskedasticity) and the error of different observations do not covary (non-autocorrelated).

Monge (1980:24) states that "if these assumptions are warrented, then statistical theory regarding sampling distributions and properties of estimators can be used to formulate inferences about the parameters." The application of the multivariate techniques for this investigation varied in their purposes and therefore the violation of the assumptions would vary in the affect on the results. For instance, factor analyses were applied for exploratory purposes, to explore and detect patterns in the variables. Factor analyses were not used for purposes of statistical testing or parameter estimation. Therefore, the violation of these assumptions was secondary. In general the multivariate analysis techniques were not specifically for purposes of statistical testing. The techniques were applied for parameter estimation primarily. This is a critical point in the examination of GLM assumptions and assumptions specific for various analyses applied. The violation of the assumptions becomes secondary. In each section the criteria for assumption examination and violation is specified.

The assumptions related to normal distribution, homoskedasticity, and non-autocorrelation were explored for the independent variables when appropriate. It was assumed that if the independent variables were homoskedastic and non-autocorrelated, then the error terms would also be found in these forms. Large positive skewness was used to indicate that the independent variables were <u>not</u> normally distributed about the mean. Measures of homogeneity of variance, homoskedasticity, were obtained from analyses of variance (ANOVA) with the problem versus no problem group variable. Variables which were highly skewed $\geq |3.0|$ (Stoyanoff, 1981) and/or had a maximum/minimum ratio $\geq |2.0|$ were transformed to correct for non-normal distributions and heteroskedasticity. Single bend transformations, such as square root and logarithmic, were explored for the variables not meeting the two aforementioned assumptions. The SPSS Subprograms Condescriptives and Oneways were rerun on the final linearized functional forms obtained for transformed variables. The transformed variables were used in all further analyses.

Tests for Multicollinearity

The second task in Phase II was to determine those variables for inclusion in the model representing the three sets of independent variables. Discriminant Analysis and Factor Analysis SPSS Subprograms (Nie et al., 1975) included the statistical techniques used to make these decisions. From the 10 percent random subsample generated from the initial analyses in Phase II, two random subsamples were determined. Each of these subsamples represented 50 percent of the 10 percent initial subsample (or each of the subsamples reflected five percent subsamples of the total study population N = 24,362). The two subsamples were generated for purposes of cross validation.

Criteria was determined to aid in making decisions regarding inclusion of descriptive variables for each of the three independent sets in the model as specified in Figure 1, Chapter II. The initial decision making criterion for exclusion of variables included redundancy of information used in developing or constructing variables. For example, the Crocetti 32 food groups and the Guthrie 13 food groups (Crocetti and Guthrie, 1981 b.) were created from the same respondent data. Therefore, only one set was used in the analyses for Phase II. The second criterion applied was a series of variables adding up to a composite total. An example of this would be the three variables representing the three day average percent intake of protein, fat and carbohydrate which added up to a composite 100 percent. All three variables could not be used in the analyses because they were linearly dependent which violates the basic assumption of the GLM . Consequently, only two of the three were used in the model. These two criteria eliminated several potential indicator variables from inclusion in the variable sets within the model.

The goal of the next series of computer runs was to derive the three sets of variables which reflected linear independence. Multicollinearity is the condition in which one or more of the variables included in a sample of data are linearly dependent (Hanushek and Jackson, 1977). Severe multicollinearity has the effect of making the determinant of the correlation matrix approach zero. When linear dependency exists the dimensionality of the space needed to represent the variable vector is less than the number of variables.

Multicollinearity reflects some level of covariation among independent variables which may have the following implications in relation to multiple regression (Neter and Wasserman, 1974:344):

> (1) The estimated coefficients tend to be quite imprecise and the true coefficients tend to lose their meaning.
>
> (2) The coefficients of partial correlation between the dependent variable and each of the independent variables tend to become erratic from sample to sample.
>
> (3) As the correlations between the exogenous variables increases, the variance between the estimated coefficients becomes larger.
>
> (4) Standard errors of coefficients will tend to get larger.

SPSS Factor Analysis Subprogram (Nie et al., 1975) was used to: (1) obtain correlation matrices for the three sets; (2) calculate the determinant of the correlation matrices; and (3) derive rotated factor matrices to demonstrate independence among the variables included in each set. The rotated factor matrices showed that each of the major factors or axes determined in the factor eigenanalyses were primarily explained by <u>one</u> of the indicators in the set. If several indicators had mutually explained the major factors or axes linear dependency would have been exhibited in the sets of variables.

To check for linear independence among indicator variables and make decisions regarding the exclusion of variables which contribute to the dependency, correlation matrices and their determinants were generated for the three sets of independent variables. The end result of this series of computer runs was a set of relatively independent variables representing each of the three composite theoretical factor groups which affect food related behaviors. "Relatively independent" was quantified by determinants of correlation matrices greater than zero, positive log determinants of covariance matrices, and major factors or axes determined in factor eigenanalyses primarily explained by one of the indicators in the variable sets.

Discriminant Analysis

Three discriminant analyses via SPSS Subprogram Discriminant (Nie et al., 1975) produced the correlational relationships between the dependent variable, the problem versus no problem groups, and the three sets of independent variables: (1) demographic characteristics; (2) personal and food related behaviors; and (3) nutrient intake. Discriminant analysis may be treated as a special case of canonical correlation analysis, the general procedure for investigating the relationship between two sets of variables (Knapp, 1978). As Knapp (1978:414, 415) stated:

> Discriminant analysis is actually a multivariate analysis of variance in reverse, that is, there is one categorical dependent variable of group membership and there are two or more continuous independent variables. The p independent variables are treated as though one were carrying out a multiple regression analysis, and the dependent variable of k categories is coded in the same way that an independent variable is treated in one-way analysis of variance, that is, by creating q = k-1 dummy dichotomies. A standard p x q canonical analysis is then applied to the resulting system, and the F test of the largest canonical correlation coefficient determines whether or not the k groups are significantly separable on the p variables.

The specific underlying assumptions for statistical tests (as oposed to estimation alone) of discriminant analyses are summarized by McLaughlin (1980:178):

(1) Multivariate normality-p independent variables have multivariate normal distributions in each of the populations from which the k groups are sampled.

(2) Homogeneity of the population dispersions-population variance-covariance matrices are equal (common covariance matrices).

(3) Mutual exclusivity and exhaustiveness of k groups.

The seriousness of the violation of these assumptions was viewed in light of the use for estimation rather than statistical testing. The dichotomous (dummy coded) independent variables did not meet the first assumption. The seriousness of this violation was determined through evaluation of the second assumption. It was decided by the researchers that if the covariance matrices log determinants were comparable for the problem versus no problem groups for each of the sets of indicator variables than discriminant analyses could be applied without serious consequences to the estimated parameters. Therefore, the criterion of comparable covariance matrices was used to evaluate the consequences of violation of the underlying assumptions of discriminant analyses.

Canonical Analysis

The final task in Phase II determined the correlational relationships between the three sets of independent variables. SPSS, Canonical Correlation (Nie et al., 1975) and BMDP, Canonical Correlation Analysis (Dixon and Brom, 1979) produced canonical correlations and canonical variable loadings for each canonical variate accounting for large proportions of the variance in the observed variables. In canonical analysis, the reference axes determined are called canonical variates. The canonical variates represented mathematical structures derived from eigenanalyses. Canonical Variate 1 for example is the first reference axis derived and accounts for the greatest proportion of variance between the two sets of observed variables. The canonical variable loadings helped identify those specific variables which accounted for the proportion of variance explained by each of the canonical variates. The results of these analyses are discussed in Chapter V.

FOOTNOTES

[1] A model is called linear (or linear in the parameters) when the effects of the various predictor variables are treated as additive. In the expression $y = b_1x_1 + b_2x_2 + \ldots . b_nx_n$, y is composed of a linear combination of variables and regression parameters, the parameters being each of the first degree (Monge, 1980; Green and Carroll, 1976).

[2] Green and Carroll (1976:8-9) and Nie et al. (1975:374-375) describe how the recoding is done.

CHAPTER IV

RESULTS AND DISCUSSION: PHASE I

The findings from Phase I of this investigation are presented in this chapter. The selection of the study population from the 1977-78 Nationwide Food Consumption Survey (NFCS) and the factor intake category groups by which the study population was analyzed are described. The factor intake category groups were determined based on the self-reported factors and problems respondents identified as affecting their food consumption. Results from cross tabulations between the factor intake categories and each of the following: meal and snack patterns, socio-economic characteristics, nutrient quality assessment, and food intake and personal behaviors are discussed. The results from cross tabulations build upon cross tabulations in previous sections. The end product is a composite typological description of each factor intake category group.

The Sample

The first task in this analysis was the selection from the NFCS data tapes of individuals for the study population. The following criteria were used sequentially in the deletion process: (1) less than four years of age; (2) no age; (3) no race; (4) reported pregnant/nursing; (5) diet record for one day only; (6) diet record for two days only; (7) no relation to the household; and (8) "other race". Table 1 displays the sequential deletion of individuals to determine the 24,362 respondents

Table 1. Sequential Deletion of Respondents from Data Set for Four Quarters and Total Year of 1977-78 NFCS

	Spring N=8,778			Summer N= 6,584			Fall N=7,696			Winter N=7,712			Total N=30,770		
Reasons for Deletion	#	%*	Retain	#	%*	Retain	#	%*	Retain	#	%*	Retain	#	%*	Retain
4 Years Old or Less	453	5.2	8,325	539	8.2	6,045	631	8.2	7,065	639	8.3	7,073	2,262	7.4	28,508
No Age Stated	3	+	8,322	2	+	6,043	11	0.1	7,054	4	+	7,069	20	0.1	28,488
No Race Stated	30	0.3	8,292	13	0.2	6,030	7	0.1	7,047	11	0.1	7,058	61	0.2	28,427
Pregnant/Lactating	110	1.2	8,182	63	1.0	5,967	59	0.8	6,988	67	0.9	6,991	299	1.0	28,128
Diet Record: 1 Day Only	500	5.7	7,682	422	6.4	5,545	438	5.7	6,550	460	6.0	6,531	1,820	5.9	26,308
Diet Record: 2 Day Only	281	3.2	7,401	135	2.1	5,410	145	1.9	6,405	171	2.2	6,360	732	2.4	25,576
Unrelated to the Household	100	1.1	7,301	72	1.1	5,338	100	1.3	6,305	76	1.0	6,284	348	1.1	25,228
"Other" Race	219	2.5	7,082	165	2.5	5,173	272	3.5	6,033	210	2.7	6,074	866	2.8	24,362
TOTAL	1,696	19.3	7,082	1,411	21.4	5,173	1,663	21.6	6,033	638	21.2	6,074	6,408	20.8	24,362
%*			(80.7)			(78.6)			(78.4)			(78.8)			(79.1)

* Percent based on starting number of individuals.

\+ Less than 0.1 percent of starting number of individuals.

used for this investigation.

The first group deleted were infants and children less than four years of age (7% of the total population); they presented analytic problems since the nutrient needs and eating patterns of these age groups vary markedly from adult patterns. Additionally, these respondents were unlikely to have filled out their diet records. Therefore, the standard methodologic formats or indices used would not have adequately accommodated these respondents.

The next two groups deleted were those persons with no age or race stated. These groups were small in number; and age and race were used extensively throughout this analysis.

Pregnant and lactating women were then deleted due to the specialized nutrient needs and eating patterns of this group. This group had only a few individuals (about 1% of the total population).

The largest number of deletions (8% of the sequentially deleted population) included all those cases without a complete three day food intake record. Retention posed analytic problems without satisfactory solutions. Treating them as a separate analytic group was considered. The sequence of days within the three requested showed numerous and varied permutations which limited the possibility for grouping even further. Additionally, the significance of these variations was not clear. A weighting scheme was considered however, there was no theoretical ground for any specific weighting.

The final two categories omitted in the sequential deletion process from the four quarters and the total year were unrelated individual members in the household and the "other race" category. Three hundred and forty-eight persons (1%) represented roomers or boarders in the households interviewed in the survey. Socio-economic variables used in analyses of the study population were described by the head(s) of the household attributes. To characterize roomers and boarders by an unrelated head(s) of households' socio-economic status would have been inaccurate.

The undefined category of "other race" included 866 persons (3%) of the study population, once the first seven categories for deletion had been applied. Race was used as a discriminating variable in many analyses throughout the investigation. "Other race" did not include enough individuals for meaningful analysis compared with the race categories: "white" and "black."

The cases chosen for deletion were examined to see if they were random and if deletion would further bias analyses of the population retained. From Crocetti and Guthrie's (1982) tables representing the distribution of deletion categories by sex/race/age, it was determined that the deletions resulted in random and approximately unbiased rejection of similar proportions of individuals from each quarter.

Factor Intake Categories

Factor intake category groups were derived as illustrated in Figure 2 from the 24,362 respondents (see Table 1). Approximately 50 percent of the persons included in this investigation reported some factor which potentially affected their food consumption. The largest group (39.5%) included respondents who identified one or more of the factors in the question: "these are things which may affect the way you eat or drink" (excluding the medical problem) or reported being on a group or individual special diet. Ten percent reported a medical factor, of which, 60 percent (1,454 respondents) also identified at least one non-medical factor. The 12,308 (50.5%) respondents who did not fit into one or more of these

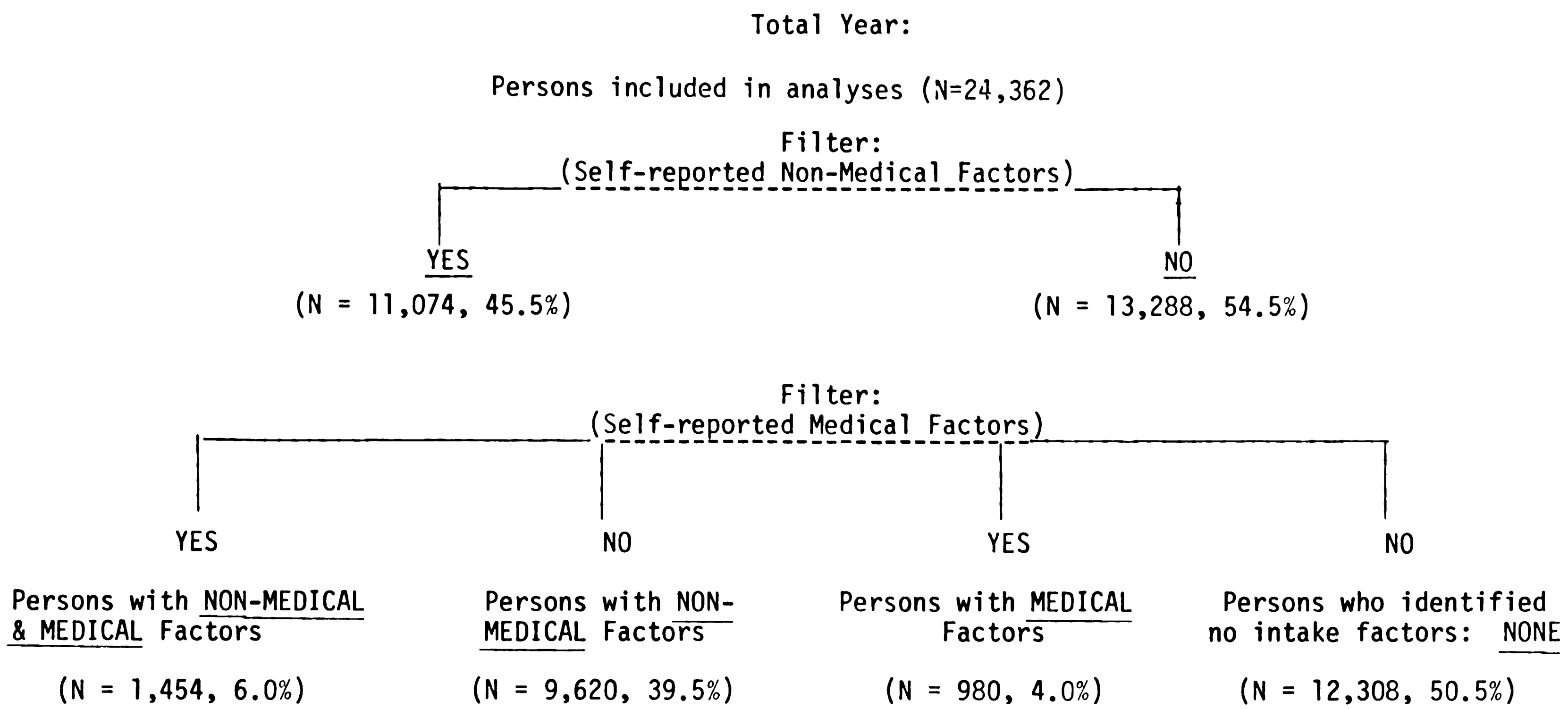


FIGURE 2. 1977-78 NFCS Population Segments Identifying Medical and Non-Medical Factors Which May Affect Their Food Consumption

categories acted as the control group in the study. The four category groups were combined into one variable to cross tabulate with the variables used to identify and characterize meal and snack patterns, socio-economic descriptors, nutrient quality and food intake and personal behaviors. Each group description builds upon descriptions in previous sections. The end product is a typology of each group.

The contingency coefficient[1] (C.C.) was used as a measure of association. It was based upon chi-square and takes the N of the sample into consideration. Due to the large sample size (large N's), the statistical tests applied to assess if systematic relationships existed between the categories always indicated low or no association between groups (contingency coefficients $\leq .3$ and chi-square p's $\leq .001$). Therefore, the contingency coefficients and the significance level of all reported tables in this chapter were C.C. $\leq .3$ and $p \leq .001$ unless otherwise noted.

NON-MEDICAL Category

To identify the specific factors reported as affecting the way the respondents in the NON-MEDICAL category ate or drank, Table 2 was produced. Table 2 represents the percent distribution of respondents with NON-MEDICAL intake factors by number and type of factor affecting intake. "Don't like certain foods" (35%), and "I don't feel like eating breakfast early in the morning" (23%) were the items most often mentioned by the total group (N = 9,620). "I'm on a diet to put weight on" (1%), "I have a chewing problem because of teeth" (3%), being on a group or individual special diet (6%), and "I have no interest in cooking for one" (6%) were the items respondents least often mentioned. Sixty-seven percent of the respondents mentioned one non-medical factor. Two, three and four to six

Table 2. Percent Distribution of Respondents with NON-MEDICAL Intake Factors by Number and Type of Factor of Non-Medical Factor(s) Affecting Intake (N=9,620)

Number of Non-Medical Factor(s)	Type of Non-Medical Factor %									TOTAL	
	Diet to Lose	Diet to Gain	Non-Medical Special Diet	Chewing Problem	Foods Don't Agree	Don't Like Breakfast	Don't Like Cooking for 1	Don't Like Certain Foods	Other	%	#
ONE	8.4	0.9	1.3	2.6	7.7	23.7	3.5	46.9	5.1	100	6,456
TWO	13.8	0.8	10.3	2.9	12.5	23.6	6.9	25.7	3.3	100	2,295
THREE	13.3	0.4	8.2	4.0	14.0	23.7	10.9	22.7	2.8	100	671
FOUR-SIX	14.2	1.0	9.4	5.4	15.2	19.6	12.5	19.5	3.2	100	198
TOTAL %	11.2	0.8	5.8	3.1	10.6	23.4	6.2	34.7	4.1	100	9,620

factors were mentioned by 24 percent, seven percent, and two percent, respectively, of the population segment.

Table 3 has the distribution of respondents with NON-MEDICAL intake factors by sex and race and number of reported factors. All sex/race categories had more than 62 percent of the respondents with one problem. The black males had the most (80%) and the white females the least (62%) with one problem reported. The white females most often report two or more factors. In general, the males and blacks identified fewer multiple item responses than the females and whites.

NON-MEDICAL AND MEDICAL Category

Table 4 has the percent distribution of respondents with NON-MEDICAL & MEDICAL intake factors by the number and type of non-medical factors reported. In this group (N = 1,454), "Some foods don't agree with me" (24%), "I'm on a diet to lose weight" (20%), and "I don't like certain foods" (19%) were the most frequently reported non-medical factors. The distribution of respondents in the number of non-medical factors reported was: one (56%), two (27%), three (12%), and four to seven (6%). This category group seemed to have reported more multiple item responses than the NON-MEDICAL only group (Table 5). The two medical factors were identified by approximately the same percentages within the one and two problem category groups (Table 6).

Table 7 represents the percent distribution of respondents with reported NON-MEDICAL & MEDICAL intake factors by sex and race and type of non-medical factor. Males had more responses in the "I do not like certain foods" than the women; women had more in the "I am on a diet to lose weight" category than men. Women were found (distributed by RDA age/sex categories) to begin reporting being on diets to lose weight in

Table 3. Percent Distribution of Respondents with NON-MEDICAL Intake Factors by Sex and Race and Number of Factors Affecting Intake (N = 9,620)

Sex and Race	Number of Factors %				TOTAL	
	1	2	3	4-6	%	#
MALE						
White	72.0	21.7	5.0	1.3	100	3,506
Black	80.0	16.3	3.2	0.4	100	465
FEMALE						
White	62.4	26.2	8.7	2.8	100	4,957
Black	66.9	23.1	7.5	2.4	100	692
TOTAL	67.1	23.9	7.0	2.1	100	9,620
MALE	73.0	21.1	4.8	1.2	100	3.971
FEMALE	63.0	25.8	8.5	2.7	100	5,649
WHITE	66.4	24.3	7.1	2.1	100	8.463
BLACK	72.2	20.4	5.8	1.6	100	1,157
TOTAL	67.1	23.9	7.0	2.1	100	9,620

Table 4. Percent Distribution of Respondents with NON-MEDICAL & MEDICAL Intake Factors by Number and Type of Non-Medical Factor(s) Affecting Intake (N = 1,454)

	Type of Non-Medical Factor %									TOTAL	
Number of Non-Medical Factor(s)	Diet to Lose	Diet to Gain	Non-Medical Special Diet	Chewing Problem	Foods Don't Agree	Don't Like Breakfast	Don't Like Cooking for 1	Don't Like Certain Foods	Other	%	#
ONE	30.0	0.6	5.7	3.9	23.6	9.8	2.7	14.2	9.5	100	818
TWO	17.1	1.3	4.3	5.3	25.9	16.3	6.0	21.0	3.0	100	388
THREE	14.2	0.6	5.0	7.0	23.8	17.6	8.6	20.8	2.6	100	167
FOUR-SEVEN	13.2	2.3	2.6	8.0	19.5	20.1	12.9	20.7	0.6	100	81
TOTAL %	20.3	1.1	4.7	5.6	23.8	14.9	6.4	18.6	4.7	100	1,454

Table 5. Percent Distribution of Respondents with NON-MEDICAL & MEDICAL Intake Factors by Number of Non-Medical Factor(s) Affecting Intake (N = 1,454)

Number of Non-Medical Factor(s)	%
ONE	56.3
TWO	26.7
THREE	11.5
FOUR-SEVEN	5.6
TOTAL	100.0

Table 6. Percent Distribution of Respondents with NON-MEDICAL & MEDICAL Intake Factor(s) by Number and Type of Medical Problem (N = 1,454)

	Type of Medical Problem %		TOTAL	
Number of Medical Problem(s)	Medical Problem Like Diabetes	Dr. Prescribed Special Diet	%	#
ONE	59.4	59.3	51.0	1,083
TWO	40.6	40.7	49.0	1,042
TOTAL %	100.0	100.0	100.0	

Table 7. Percent Distribution of Respondents with NON-MEDICAL & MEDICAL Intake Factor(s) by Sex/Race and Type of Non-Medical Factor(s) Affecting Intake (N = 1,454)

	Type of Non-Medical %									TOTAL	
Sex/Race	Diet to Lose	Diet to Gain	Non-Medical Special Diet	Chewing Problem	Foods Don't Agree	Don't Like Breakfast	Don't Like Cooking for 1	Don't Like Certain Foods	Other	%	#
Male-White	16.7	1.1	3.7	6.1	24.2	12.0	4.2	25.8	6.3	100	443
Male-Black	18.0	0.0	4.5	0.0	31.5	12.4	6.7	24.7	2.2	100	43
Female-White	21.5	1.1	3.9	5.7	25.2	15.5	8.4	14.7	3.9	100	851
Female-Black	26.2	1.1	2.3	6.1	25.1	17.5	1.5	16.7	3.4	100	117
TOTAL	20.3	1.1	4.7	5.6	23.8	14.9	6.4	18.6	4.7	100	1,454
MALE	16.8	1.0	3.8	5.5	24.9	12.1	4.5	25.7	5.8	100	886
FEMALE	22.1	1.1	3.7	5.8	25.2	15.7	7.6	15.0	3.9	100	968
WHITE	20.0	1.1	3.9	5.8	24.9	14.4	7.1	18.2	4.6	100	1,294
BLACK	24.1	1.0	2.8	4.5	26.7	16.2	2.8	18.8	3.1	100	160

the 11-15 age category.

MEDICAL Category

Table 8 shows the distribution of the respondents who identified a MEDICAL intake factor by the number and type of factor. Of those respondents (53%) who list one medical problem, 69 percent (357 individuals) identified it as being "a medical problem like diabetes." Forty-seven percent of the total group (N = 980) self-reported both types of medical problems.

Discussion: Intake Factor Category Groups

The U.S. population on special diets has been studied elsewhere. The results are reported here for comparison with our results. The percent of the population 12-74 years of age on a special diet were determined by National Center for Health Statistics (NCHS, 1978) using the Health and Nutrition Examination Survey (HANES) data. Approximately 11 percent of the total population were on a special diet. The category "special diet." was further described by reason for and kind of diet. The reasons included: overweight, diabetes, ulcer, heart trouble or high blood pressure, and other. The kinds of diets included: low fat, low salt, low carbohydrate, low calorie and other. Approximately 40 percent of the respondent's identified "overweight" as the reason for the diet and 34 percent identified "other". Forty-three, 39 and 38 percent respectively, reported "other", "low calorie", and "low fat" as the kinds of diets. More females (13%) than males (8%) reported being on a special diet. More white (11%) than the black (9%) HANES respondents reported being on a diet. Similarly to HANES our study population had more females than males and more whites than blacks report being on a diet.

Table 8. Percent Distribution of Respondents with MEDICAL Intake Factor(s) by Number and Type of Medical Problem (N = 980)

	Type of Medical Problem %		TOTAL	
Number and Type of Medical Problem	Medical Problem Like Diabetes	Doctor Prescribed Special Diet	%	#
1 - Medical Problem Like Diabetes	43.6	--	36.4	357
1 - Doctor Prescribed Special Diet	--	25.8	16.4	161
2 - Medical Problem and Doctor Prescribed Diet	56.4	74.2	47.1	462
TOTAL %	100.0	100.0	100.0	980
TOTAL #	819	623		

About 15 percent of the HANES respondents had a chewing problem (NCHS, 1977). The NCHS report also included 1974 Health Interview Survey weight control data among persons 17 years of age and over. Of those overweight persons approximately: 64 percent were trying to lose; 23 percent were trying to lose on physician's advice; and 57 percent identified being on a diet (of any kind).

General comparisons of the NCHS and NFCS findings were attempted. The total percent of persons identifying some type of special diet were comparable in both studies, HANES (10%) and NFCS (approximately 10%). In both HANES and NFCS more females and whites than males and blacks reported being on special diets or having some problem with their intake, respectively.

In general the NCHS (1977, 1978) findings and our results were comparable regarding proportions of the population with factors which may affect their intakes. The largest difference was the large percentage of HANES respondents and small percentage of NFCS respondents identifying chewing problems. This likely is due to data collection differences.

Identification of Meal and Snack Patterns, Socio-Economic, Nutrient and Food Characteristics of Factor Groupings

In following sections, the four factor intake category groups were crosstabulated with variables used to identify and characterize meal and snack patterns, socio-economic descriptors, nutrient quality assessment, and food intake and personal behaviors. Each is discussed separately; however, understandings gained from the analyses with each of the descriptor groupings built upon one another. Therefore, discussions of each include findings from previous sections. The end result was a composite typology of each of the four category groups: NONE, NON-

MEDICAL, NON-MEDICAL & MEDICAL, and MEDICAL. Whenever appropriate, findings from this investigation are compared to Crocetti and Guthrie (1982), other NFCS investigations, NCHS data, and other relevant research.

Meal and Snack Patterns

It's generally believed that Americans no longer eat in a traditional three meals a day pattern. The data obtained from the NFCS supports the belief that large percentages of the U.S. population are not eating the traditional three meals a day; and that snacks are being eaten.

The distribution of respondents by meal pattern and intake factor category groups are illustrated in Table 9. The NONE and MEDICAL groups had the most respondents in the 3,3,3 pattern (meal patterns are described in Chapter III). Conversely, the two non-medical groups identifying some type of factor had more individuals in the composite of the non-3,3,3 patterns (3,2,2, 2,2,2, and 'other' categories).

The investigation of snacking behaviors (Table 10) demonstrated that each of the groups had significant percentages of respondents (73%) reporting at least one snack in the three-day intake period. The groups reporting non-medical problems had the largest percentages of respondents reporting the consumption of one or more snacks. In crosstabulating snacking behavior with meal patterns, the 2,2,2's had more respondents that reported snacking in each of the factor intake categories. It was the groups reporting non-medical problems that also had the largest percentages of respondents in the non-3,3,3 meal patterns.

These findings agree with those of Crocetti and Guthrie (1982): the fewer labeled meals consumed by respondents, the more snack events reported. Nutrition educator's and marketer's strategies must

Table 9. Percent Distribution of Respondents by Intake Factor Category Groups and Meal Patterns (N = 24,362)

Intake Factor Category Groups	Meal Patterns % 3,3,3	3,3,2	3,2,2	2,2,2	Other	TOTAL #
NONE	63.4	16.3	6.9	5.4	8.0	12,308
NON-MEDICAL	48.9	17.0	10.5	10.0	13.6	9,620
NON-MEDICAL & MEDICAL	56.1	14.9	7.6	9.4	12.1	1,454
MEDICAL	66.7	16.4	4.5	5.7	6.6	980
TOTAL %	57.4	16.5	8.2	7.4	10.4	
TOTAL #	13,986	4,010	2,009	1,813	2,544	24,362

Table 10. Percent Distribution of Respondents by Intake Factor Category Groups and Snacking Behavior* (N = 24,362)

Intake Factor Category Groups	Snacking Behavior* % Snacker	Non-Snacker
NONE	74.3	25.7
NON-MEDICAL	80.7	19.3
NON-MEDICAL & MEDICAL	77.4	22.6
MEDICAL	73.0	27.0
TOTAL %	77.0	23.0

*Snacking Behavior categorized respondents by whether or not they identified consuming any 'snacks' in the 3 day intakes (Snacker) or no intake occasions labeled 'snack' (Non-Snacker).

incorporate the realizations that the three meals a day pattern does exist for some, yet is supplemented with snacks. Additionally, large percentages of the population are eating non-three meal a day patterns and are also eating snacks.

Socio-Economic Descriptors

The distribution of respondents in the intake factor category groups crosstabulated with socio-economic descriptors: census age categories; size of household; family composition; relationship of respondent to head of household; poverty level index; education of head of household; working status of head(s) of household and four census regions are illustrated in Tables 11-18.

The NONE category and the NON-MEDICAL category had more respondents: less than 18 years of age; living in households sized four to 14; in families composed of adults and children and teens; with above poverty level incomes; and working male and female headed households. The NONE category had more children (< 18 years) than the NON-MEDICAL category. And the NON-MEDICAL had more adults (25-55 years) and more respondents with above poverty level incomes than the NONE group. Otherwise the socio-economic descriptions of the two groups were similar. This may be an important finding for nutrition education efforts generated for these two population groups.

On the other hand, the categories which reported some kind of medical problem, NON-MEDICAL & MEDICAL and MEDICAL, were similar in socio-economic composition. Each of these groups had more respondents in the older age categories. The NON-MEDICAL & MEDICAL group had more in the 45-75 years categories while the MEDICAL had the largest in the 55 years and older census categories. These groups also had the largest percentages of

Table 11. Percent Distribution of Respondents by Intake Factor Category Groups and Census Age Groupings (N =24,362)

Intake Factor	Census Age Groupings %											TOTAL	
Category Groups	4	5-<11	11-<18	18-<22	22-<25	25-<35	35-<45	45-<55	55-<65	65-<75	75+	%	#
NONE	3.0	29.6	13.0	6.5	3.5	10.8	9.0	8.7	7.7	5.4	2.7	100	12,308
NON-MEDICAL	1.9	19.4	12.2	7.1	4.8	16.2	11.0	10.3	8.3	5.7	3.0	100	9,620
NON-MEDICAL & MEDICAL	0.6	6.1	4.2	2.8	2.3	9.1	10.2	16.3	20.0	18.8	9.6	100	1,454
MEDICAL	1.3	8.6	3.1	1.9	1.3	4.9	8.1	11.6	22.4	23.1	13.7	100	980
TOTAL %	2.4	23.4	11.8	6.3	3.9	12.6	9.8	9.9	9.3	7.0	3.7	100	
TOTAL #	580	5,689	2,868	1,538	944	3,074	2,389	2,416	2,256	1,705	903		24,362

Table 12. Percent Distribution of Respondents by Intake Factor Category Groups and Size of Household (N = 24,353*)

Intake Factor Category Groups	Size of Household %					TOTAL	
	1	2	3	4	5-14	%	#
NONE	5.9	15.4	15.0	23.6	40.1	100	12,308
NON-MEDICAL	10.3	18.8	15.5	22.2	33.1	100	9,611*
NON-MEDICAL & MEDICAL	20.6	32.3	16.4	14.9	15.7	100	1,454
MEDICAL	18.8	36.8	14.3	14.5	15.6	100	980
TOTAL %	9.1	18.6	15.3	21.3	34.9	100	
TOTAL #	2,197	4,531*	3,715	5,396	8,505		24,363*

*Excludes 9 individuals who had "no answer" to size of household.

Table 13. Percent Distribution of Respondents by Intake Factor Category Groups and Family Composition (N=24,362)

Intake Factor Category Groups	Family Composition %				TOTAL	
	Adults Only	Adults and Children<11	Adults and Teens 11-18	Children and Teens	%	#
NONE	26.9	22.5	22.2	28.5	100	12,308
NON-MEDICAL	33.9	21.6	21.8	22.7	100	9,620
NON-MEDICAL & MEDICAL	61.7	12.0	16.0	10.2	100	1,454
MEDICAL	65.1	11.3	12.9	10.7	100	980
TOTAL %	33.3	21.1	21.3	24.4	100	
TOTAL #	8,102	5,135	5,188	5,937		24,362

Table 14. **Percent Distribution of Respondents by** Intake Factor Category Groups and Relationship of Respondent to Head of Household (HHD) (N = 24,362)

	Relationship of Respondent to HHD %						TOTAL	
Intake Factor Category Groups	Male Head Male HHD Only	Female Head, Female HHD Only	Male Head, M & F HHD	Female Head, M & F HHD	Child 18 Yrs.	Adult 18 Yrs.	%	#
NONE	2.2	6.5	18.8	18.0	45.7	8.8	100	12,308
NON-MEDICAL	3.7	10.9	18.3	18.0	45.7	8.5	100	9,620
NON-MEDICAL & MEDICAL	5.0	22.1	21.9	34.3	10.8	6.1	100	1,454
MEDICAL	4.8	19.5	26.8	29.6	13.0	6.3	100	980
TOTAL %	3.1	9.7	19.1	22.3	37.4	8.4	100	
TOTAL #	748	2,359	4,658	5,430	9,120	2,047		24,362

Table 15. Percent Distribution of Respondents by Poverty Level Index and Intake Factor Category Groups (N = 24,362)

	Factor Intake Category Groups %				TOTAL	
Poverty Level Index	NONE	NON-MEDICAL	NON-MEDICAL & MEDICAL	MEDICAL	%	#
0.00 - +0.99	9.1	9.6	11.4	14.4	10.0	2,425
+1.00 - +1.30	6.2	5.7	8.2	8.6	6.2	1,521
+1.31 - +1.50	3.0	3.2	2.4	3.8	3.1	758
Below Poverty Level: Subtotal	19.0	18.5	22.0	26.7	19.3	4,704
+1.50 - +1.99	9.8	9.0	8.2	10.6	9.4	2,299
+2.00 - +2.99	18.8	19.2	14.9	16.0	18.6	4,541
+3.00 - +3.99	12.3	13.5	12.4	9.5	12.7	3,090
+4.00 - +4.99	6.2	7.1	6.2	5.0	6.5	1,587
+5.00 - +9.99	7.1	9.1	9.4	7.9	8.1	1,968
+10.00 and Above	0.8	1.1	1.3	0.9	0.9	230
Above Poverty Level: Subtotal	55.1	59.1	52.3	49.9	56.3	13,715
TOTAL Answered	74.1	77.6	74.3	76.6	75.6	18,419
TOTAL Not Answered	25.9	22.4	25.7	23.4	24.4	5,943
GRAND TOTAL %	100.0	100.0	100.0	100.0	100.0	
GRAND TOTAL #	12,308	9,620	1,454	980		24,362

Table 16. Percent Distribution of Respondents Intake Factor Category Groups and Education Level of Head of Household (N = 24,362)

Intake Factor Category Groups	Education Level of Head of Household %							TOTAL	
	None and Some Grade School	Grammar School Graduate	Some High School	High School Graduate	Some College	College Graduate/ Post-Grad	NA	%	#
NONE	8.2	8.0	15.4	34.6	16.3	17.3	0.1	100	12,308
NON-MEDICAL	7.2	7.4	15.0	34.3	17.8	18.3	0.1	100	9,620
NON-MEDICAL & MEDICAL	12.9	12.6	16.6	27.8	13.3	16.6	0.2	100	1,454
MEDICAL	14.9	14.2	18.7	24.0	13.9	14.1	0.3	100	980
TOTAL %	8.3	8.3	15.4	33.6	16.6	17.5	0.1	100	
TOTAL #	2,033	2,020	3,764	8,193	4,050	4,273	29		24,362

*Male Head's Education when both male and female Head of Household (HHD), but if male had no answer for education then the female head's education was used when available.

Table 17. Percent Distribution of Respondents by Working Status of Head(s) of Households (HHD) and Intake Factor Category Groups (N = 24,362)

Working Status of Head(s) of Households	Intake Factor Category Groups %				TOTAL	
	NONE	NON-MEDICAL	NON-MEDICAL & MEDICAL	MEDICAL	%	#
MALE HEAD ONLY						
Working	1.9	2.9	2.5	2.4	2.4	578
Not Working	0.9	1.4	2.6	2.9	1.3	310
Subtotal	2.8	4.3	5.1	5.3	3.7	888
FEMALE HEAD ONLY						
Working	7.6	9.6	7.9	4.5	8.3	2,016
Not Working	8.3	8.3	18.0	19.5	9.3	2,265
Subtotal	15.9	17.9	25.9	24.0	17.6	4,281
MALE AND FEMALE HHD						
Male Only Working	36.6	34.5	28.0	24.9	34.8	8,459
Female Only Working	2.9	2.5	3.7	3.4	2.8	684
Both Working	33.4	34.0	21.2	16.8	32.2	7,844
Subtotal: Working	72.9	71.1	52.9	45.1	69.9	16,987
Neither Working	8.4	6.7	16.0	25.6	8.9	2,155
Male & Female HHD	81.3	77.8	68.9	70.8	78.7	19,142
Subtotal Working	82.4	83.6	63.4	52.0	80.5	19,581
Subtotal Not Working	17.6	16.4	36.6	48.0	19.5	4,730
TOTAL ANSWERED %	100.0	100.0	100.0	100.0	100.0	
#	12,277	9,607	1,454	975		24,311
(% of Grand Total)	(99.7)	(99.9)	(99.9)	(99.5)		(99.8)
TOTAL "NO ANSWERS"	(0.3)	(0.1)	(0.1)	(0.5)		(0.2)
GRAND TOTAL %	100.0	100.0	100.0	100.0		100.0
GRAND TOTAL #	12,308	9,620	1,454	980		24,362

Table 18. Percent Distribution of Respondents by Intake Factor Category Category Groups and Four U.S. Census Regions (N = 24,362)

	Four U.S. Census Regions %					TOTAL
Intake Factor Category Groups	North-East	North-Central	South	West	No Answer	#
NONE	27.6	22.0	20.7	15.3	14.4	12,308
NON-MEDICAL	32.9	28.7	17.1	11.4	9.8	9,620
NON-MEDICAL & MEDICAL	48.9	36.9	7.7	3.8	2.7	1,454
MEDICAL	51.1	32.6	9.6	3.9	2.9	980
TOTAL %	31.9	26.0	18.1	12.6	11.4	
TOTAL #	7,772	6,330	4,406	3,071	2,783	24,362
CENSUS DATA* %	22.9	27.0	32.4	17.7+		

* From: Table No. 29, U.S. Bureau of the Census, Statistical Abstract of the U.S., Washington, DC, 1978 (99th edition). Based on the 1977 Census of U.S. population.

\+ Excludes Alaska and Hawaii in that the 1977-78 NFCS only included the 48 continental states.

respondents living in female headed households with fewer than four persons. These groups were composed primarily of adults living in the North-East and Central census regions. Both of the groups had more in the lower education level categories than did the NONE and NON-MEDICAL groups. The MEDICAL group had the largest percentage of respondents in the not working status categories and in the below poverty level income group. The NON-MEDICAL & MEDICAL group had a mixture of working and non-working head(s) of households.

The percent distributions of respondents by urban and rural urbanization categories also were investigated. All four intake factor category groups had comparable proportions of urban (approximately 68%) and rural (approximately 32%) categories.

The findings from the crosstabulations of the factor category groups with the socio-economic descriptors were compared to the HANES data (NCHS, 1978). From the HANES data the percent of the population 12-74 years on a special diet were determined by specific age categories and family income. In the older age categories, more persons reported special problems than younger age groups (for example, the 12-17 years age groups and the 65-74 years age groups had 3% and 21%, respectively). An inverse relationship existed between family income and percent of the population identifying a special diet. Thirteen percent of families with income less than $4,000 and nine percent of families with incomes $15,000 and more reported special diets (NCHS, 1978).

The cross tabulation of intake factor category groups by socio-economic variables further supported findings from previous investigations. Todhunter (1976) found over half of non-institutionalized elderly living alone. Learner and Kivett (1981) reviewed the literature on elderly and reported greater longevity of women and acknowledged widespread chronic disease conditions and poor health. They (Learner and Kivett, 1981) found low income and educational levels in their population study of rural elderly in North Carolina. The findings from our investigation were similar to those of Todhunter (1976) and Learner and Kivett (1981) in the descriptions of the two groups self-reporting medical problems. The two groups, NON-MEDICAL & MEDICAL and MEDICAL, had more older adults living in smaller households with lower incomes and lower educational levels than the other categories.

Combining the findings from this section with previous sections expands the typology of each of the groups. For instance, the NON-MEDICAL category could be characterized as children and adults (25-55 years), living in households of three or more with working head(s) of household(s) and incomes above the poverty level. This group was composed of snackers also eating two or three meals a day. They further reported "not liking certain foods" and "not liking to eat breakfast early in the morning" as affecting the way they ate or drank. Conversely, the MEDICAL group may be characterized as adults 55 years and older, living in one or two person female headed households in the North-East or North Central with lower incomes and educational levels, and larger percentages not working. This group tended to eat the three meal a day pattern and snack. These respondents identified themselves as "being on a medically prescribed diet" or "having a medical problem like diabetes or allergies. "

The information obtained from these typologies can be used for targeting of nutrition messages or product marketing strategies. For example, nutrition educators may want to develop nutrition information for parents of children regarding breakfast or morning snacks for the "on-the-go working parent." Or the nutrition professional developing information for the elderly population may first want to assess existing medical problems and then gear information for low income and education levels, noting that this group is apt to be eating three meals a day. The food industry marketing a new product for the elderly may only want to make it accessible in the Northeast and North Central regions and may want to use marketing strategies aimed at low income households at low cost, for persons with medical problems. These are just a few examples of the possible uses of the information obtained.

Nutrient Quality Assessment

A composite index combining the marginality score (MS) for seven nutrients and the PFC index (see Chapter III) was used to assess nutrient quality of intake factor category groups. The MS crosstabulated with the intake category groups is illustrated in Table 19. This table showed that the NONE (65%) and the MEDICAL (61%) groups had more respondents with one or no micronutrient intakes at levels less than or equal to 59.9 percent of the RDA. Conversely, the NON-MEDICAL (49%) and the NON-MEDICAL & MEDICAL (51%) groups had more respondents with two or more micronutrient intakes at the marginal level of intake.

The ratio of protein, fats and carbohydrates in the diets of respondents as categorized in the PFC index is shown in Table 20. The four intake factor groups had comparable proportions in the all "okay" (approximately 20%) versus all other categories. In all groups, fat was the most likely to be outside of the specified ranges used in the development of the PFC index. Both fats and carbohydrates were the second most likely macronutrients to be outside of their specified ranges in the ratio. The all "okay" category had the third largest percent of respondents in each group. All (five) other possible combinations had less than or equal to seven percent of the total in each group.

Table 19. Percent Distribution of Respondents by Intake Factor Category Groups and Number of Marginal Nutrients In Marginality Index (N = 24,362)

Intake Factor Category Groups	Number of Marginal Nutrients %					TOTAL
	None	One	Two	Three	Four - Seven	#
NONE	47.3	17.8	11.5	8.1	15.7	12,308
NON-MEDICAL	33.9	17.0	13.3	10.8	25.0	9,620
NON-MEDICAL & MEDICAL	30.8	18.2	12.7	12.3	26.1	1,454
MEDICAL	39.8	21.6	11.3	10.1	17.1	980
TOTAL %	40.7	17.6	12.3	9.5	19.9	24,362

* Marginal was defined as less than or equal to 59.9 percent of the RDA for 3 day average intakes. Micronutrients included: calcium, iron, magnesium, vitamin A, vitamin B_6, vitamin B_{12}, and vitamin C.

Table 20. Percent Distribution of Respondents by Intake Factor Category Groups and PFC Index Categories (N = 24,362)

Intake Factor Category Groups	PFC Index Categories %				TOTAL
	All "okay"	Fat outside of range	Fat & CHO outside of range	All Others	#
NONE	19.2	48.6	30.1	2.1	12,308
NON-MEDICAL	20.0	43.5	32.0	4.5	9,620
NON-MEDICAL & MEDICAL	22.4	37.2	33.4	7.0	1,454
MEDICAL	22.0	39.9	33.6	4.5	980
TOTAL %	19.8	45.5	31.2	3.5	24,362

A 12 category (A-L) composite index for assessing nutrient quality was derived from combining the marginality score and PFC index (see Appendix A-5 for description of each group). Category A contained those respondents that had no micronutrient intakes labeled marginal ($\leq$ 59.9% of the RDA) and their ratio of PFC was within the specified "okay" ranges. Categories A, B, C contained those respondents who had no marginal micronutrient intakes, and were "okay" (A); one outside of the range (B); or two or more outside the ranges (C) in their PFC ratio calculation. Category L contained those respondents who were marginal in three or more micronutrients and had two or more macronutrients in their PFC index outside of ranges. The combination of categories J, K, L contained those respondents with four or more micronutrients at 59.9 percent of the RDA and their PFC ratio was all "okay" (J); one outside the ranges (K); or two or more outside the ranges (L). The categories C, F, I, L contained those respondents who had their PFC ratio in the two or more macronutrients outside the ranges category and had none (C); one (F); two (I); three or more (L) marginal micronutrient intakes.

The percent distribution of respondents by factor intake category groups and composite index (Table 21) showed the two groups identifying non-medical factors, NON-MEDICAL & MEDICAL (15%) and the NON-MEDICAL (14%) with the most respondents in the L category. When the composite groups reflected the PFC index, the intake factor groups were more alike than when they reflected the marginality score. For example, C, F, I, L were composite categories with two or more macronutrients outside of specified ranges (see above explanation). The NONE, NON-MEDICAL, NON-MEDICAL & MEDICAL and MEDICAL included a total of 31, 35, 38, and 37 percents of the composition C, F, I and L index categories, respectively. For the categories where three to seven micronutrients were marginal (J,

K, L), NONE (24%), NON-MEDICAL (36%), NON-MEDICAL & MEDICAL (38%), and MEDICAL (27%) were more different.

Table 22 showed that females had the larger percentages in the J, K, L (38%) or L alone (14%) composite index categories and the smaller percentages in the A, B, C categories (32%) compared to males (53%). Blacks had slightly more in the lower (J, K, L) categories and fewer in the higher (A, B, C) categories than whites. The crosstabulations of the composite index with RDA sex/age categories showed that the younger age categories regardless of sex had larger percentages of respondents in the A, B, C categories. The older age/sex groups had more in the J, K, L categories than the younger age/sex categories.

Snacking behavior by six representative composite index categories showed more snackers in the A, B, C categories than non-snackers (Table 23). Table 23 also illustrates that the 2,2,2's had the fewest (17%) in the A, B, C categories and the most (54%) in the J, K, L categories than the other major meal pattern groups. There were descending directional differences with the 3,3,3's having the most and the 2,2,2's having the least in the A, B, C categories. An inverse ascending relationship showed for the J, K, L categories from the 2,2,2's to the 3,3,3's. Educational levels demonstrated a similar trend as snacking behaviors (Table 24). The higher the educational level attained by the head of household the larger the A, B, C category percentages and the fewer in the J, K, L categories (and vice versa). These tables indicate that meal and snacking patterns and educational level may have effects on nutrient quality intake. These could be significant factors (regardless of intake factor category group) that may ultimately qualitatively differentiate food consumption patterns. More careful data collection of data on snacking behavior is needed to quantify the differences.

Table 21. Percent Distribution of Respondents By Intake Factor Category Groups and Composite Index Categories (N = 24,362)

Intake Factor Category Groups	Composite Index Categories %												TOTAL
	A	B	C	D	E	F	G	H	I	J	K	L	#
NONE	8.4	26.1	12.6	3.4	8.1	6.3	2.3	5.1	4.1	5.1	10.1	8.3	12,308
NON-MEDICAL	6.5	17.5	9.9	3.1	7.6	6.4	2.5	5.9	5.0	7.9	14.3	13.6	9,620
NON-MEDICAL & MEDICAL	5.9	14.6	10.3	3.2	7.8	7.2	2.9	4.4	5.4	10.4	12.9	15.1	1,454
MEDICAL	8.4	18.8	12.7	4.6	8.6	8.5	2.2	3.8	5.3	6.8	10.2	10.2	980
TOTAL %	7.5	21.7	11.5	3.3	7.9	6.4	2.4	5.3	4.6	6.6	11.9	10.9	24,362

Table 22. Percent Distribution of Respondents by Sex and Race and Composite Index Categories (N = 24,362)

Sex and Race	Composite Index Categories %												TOTAL
	A	B	C	D	E	F	G	H	I	J	K	L	#
Male	8.8	26.8	16.0	3.1	7.7	7.1	2.2	4.6	4.7	4.1	7.7	7.3	10,999
Female	6.4	17.6	7.8	3.5	8.1	5.9	2.6	5.9	4.4	8.7	15.4	13.8	13,363
Black	8.0	17.5	9.4	4.4	6.5	5.5	3.6	4.4	3.9	9.8	13.8	13.0	3,265
White	7.4	22.4	11.8	3.2	8.1	6.6	2.2	5.4	4.7	6.1	11.6	10.5	21,097

Table 23. Percent Distributions of Respondents by Snacking Behavior (N = 17,076)* and Four Most Frequent Meal Patterns (N = 15,209)* and Six Representative Composite Index Categories

	Composite Index Categories %					
	A	B	C	J	K	L
TOTAL	7.5	21.7	11.5	6.6	11.9	10.9
Snacking Behavior						
Snackers	7.9	23.7	11.6	6.2	11.4	9.5
Non-Snackers	6.0	15.4	11.1	7.9	13.8	15.3
Four Most Frequent Meal Patterns						
3,3,3	9.8	28.2	13.1	4.3	8.0	6.6
3,3,2	6.6	16.8	11.2	7.0	14.0	12.3
3,2,2	3.4	11.2	8.5	10.1	20.2	17.1
2,2,2	1.8	7.1	8.5	12.6	19.0	22.2

* The N is less than the 24,362 due to the fact that the table only contains six of the twelve composite index categories and only the 4 major meal patterns are included; the "other" meal pattern is excluded.

Table 24. Percent Distribution of Respondents by Education Levels and Composite Index Categories (N = 24,362)

	Composite Index Categories %												TOTAL	
Education Levels	A	B	C	D	E	F	G	H	I	J	K	L	%	#
None and Some Grade School	6.7	13.0	9.0	4.4	6.5	5.8	4.0	4.9	4.0	10.8	15.9	14.9	8.3	2,033
Grammar School Grad.	6.2	17.0	10.1	4.2	7.9	7.5	2.6	5.7	5.0	8.4	14.8	10.7	8.3	2,020
Some High School	7.1	20.7	11.8	3.3	8.0	5.8	2.2	5.2	4.3	7.5	12.6	11.5	15.4	3,764
High School Grad.	7.0	22.5	11.1	2.8	8.1	6.4	2.5	5.4	4.7	6.1	12.3	11.0	33.6	8,193
Some College	7.5	24.5	12.5	2.8	8.0	6.5	1.8	5.2	4.5	5.9	11.4	9.5	16.6	4,050
College Grad. and Post Grad.	9.7	24.9	12.8	3.9	7.8	6.8	2.1	5.2	4.7	4.6	8.1	9.3	17.5	4,273
TOTAL %	7.5	21.4	11.5	3.3	7.9	6.4	2.4	5.3	4.6	6.6	11.9	10.9	100.0	24,362

Tables with crosstabulated specific marginality micronutrients against marginality score categories showed: vitamin B_6 (37%) and calcium (32%) with the most respondents in the $\leq$ 59.9 percent category and vitamin B_{12} (10%) with the least. The two intake categories with non-medical factors included, NON-MEDICAL and NON-MEDICAL & MEDICAL, consistently had larger percentages of respondents in the $\leq$ 59.9 percent RDA nutrient groups than the NONE and MEDICAL groups. These findings were consistent with findings of Friend and Marston (1975) on the availability of micronutrients in the U.S. food supply in RDA percentages for male and female adults. Vitamin B_6, calcium and magnesium were least available and vitamin B_{12} was most available.

The large percentages of respondents which had either fat outside the specified ranges in the PFC index or fat and carbohydrate outside of the ranges was an expected finding. Page and Friend (1978) discussed the changes in percentage intake of calories from energy yielding nutrients from 1909-13 to 1976 (based on per capita civilian consumption). In the earlier years the ratio was protein (12%)-fat (32%)-carbohydrate (56%). In 1976 the ratio changed to protein (12%)-fat (42%)-carbohydrate (46%).

Nutrition Education Applications

The combination of information from these series of nutrient quality assessment analyses with previous sections of this analyses expands the typologies of factor intake category groups. Although the NONE and the NON-MEDICAL categories were more alike in socio-economic descriptors, it was the MEDICAL and the NONE groups that were more alike in meal and snack patterns and subsequent nutrient quality assessment. The NONE and the MEDICAL groups had more respondents in the 3,3,3 pattern and it was these groups which had greater than 60 percent of these respondents in the one and none categories for marginal nutrient intakes. So, although the two groups reporting non-medical factors had the most respondents snacking, they still had more respondents with marginal nutrient intakes. Crocetti and Guthrie (1982) found the 2,2,2 pattern to have the most individuals with "less desirable" nutrient quality intakes. They also found the 2,2,2's to have the most snackers as compared to the other four major meal patterns.

The nutrition education and marketing strategy implications are numerous. The following is a specific example of how this information may be used. In targeting a nutrition education effort or a product advertisement for households with children and adults (25-55 years), professionals will want to acknowledge that this group will be mixed with three meal a day eaters and two and/or three meal pattern eaters. In addition, this group may have large percentages of snackers. Because of the large percentages that identified "not liking to eat breakfast early in the morning," a mid-morning snack may be promoted. Having identified that calcium and B_6 were the micronutrients most likely to be "marginally" ingested, a mid-morning breakfast/snack for persons who don't like to eat as soon as they get up may be appropriate. Perhaps the snack could be whole grain cereal and milk. Stress given to low fat milks to incorporate the understanding that fat was high in the PFC ratio. From Crocetti and Guthrie (1982) findings it was determined that fat was outside of the specified ranges on the high end of the range and carbohydrate on the low end of the range (see Appendix A-2).

Food Group Intake and Personal Behaviors

This final set of descriptive variables was included to define specific food groups which respondents were eating. Additionally, the eating alone and eating out behaviors were described, as well as food supplement use and weight status (see Chapter II for descriptions of variables). The information obtained from these analyses supplemented findings from previous sections.

The percent distributions of respondents by "total number of mentions" for the Crocetti food groups are presented in Table 25 (food group 32: nutrient supplements, meal extenders and "health foods" was excluded because less than one percent of the respondents even mentioned this group in the three days). The 32 food groups were developed by Crocetti (1982) to reflect use and function of food items in the U.S. diet rather than nutrient content. Table 25 shows a small percent ($\leq$ 25%) of the total population mentioned the following food groups at least once: fruitades; alcohol; poultry mixtures; fish, shellfish, seafood and mixtures; legumes; spoon desserts; candies; and nut butters. This was true for all four of the intake factor category groups. More than 75 percent of the respondents mentioned the following groups at least once: milk, meats, starchy side dishes, vegetables, bread, and garnishes. This also was consistent across the intake factor category groups.

The milk group was differentiated further to show total number of mentions by intake category groups (Table 26). This table showed that the NONE (13%) and MEDICAL (14%) had the fewest respondents in the no mention category and the most in each of the categories three-to-five and more. The persons reporting no problems and only medical problems mentioned more fluid milk items in their three day intake records. This supplements

Table 25. Percent Distribution of Respondents by 31 Crocetti Food Groups and Total Number of Mentions of Food Groups (N =24,362)*

31 Crocetti Food Groups	Total Number of Mentions of Food Groups %			
	0	1-2	3-5	6 or more
Milk	16	19	32	33
Frt/Veg Juice	55	25	19	1
Coffee/Tea	34	14	24	28
Soft Drinks	41	31	22	6
Fruitades	86	11	3	+
Alcohol	87	8	4	1
Soup	70	27	3	+
Eggs	47	43	11	+
Cheese	56	37	8	+
Meats	5	32	51	11
Meat Mixtures	58	38	4	+
Poultry	55	40	4	+
Poultry Mixtures	94	6	+	+
Fish/Seafood	75	24	1	+
Fish/Seafood Mixtures	91	9	+	+
Legumes	78	20	1	+
Starchy Side/Main Dishes	14	53	31	2
Vegetables	8	29	41	23
Starch/Veg/Protein Mixes	63	35	2	+
Bread	3	16	49	33
Cereal	48	34	17	1
Fruits	42	33	20	5
Frozen Desserts	69	26	5	+
Spoon Desserts	82	17	1	+
Cakes, Cookies, Pies	34	38	23	5
Snacky Foods	53	36	10	1
Candies	85	12	2	+
Garnishes	24	40	28	9
Butter & Margarine	32	39	25	4
Sugar Garnishes	33	31	25	11
Nut Butters	82	16	2	+

* N = 24,362 for each of the 31 Food Groups.
+ Less than 1 percent.

Table 26. Percent Distribution of Respondents by Intake Factor Category Groups and Total Number of Mentions of Fluid Milk (N = 24,362)

Intake Factor Category Groups	Total Number of Mentions of Fluid Milk %					TOTAL
	0	1-2	3-5	6-8	9	#
NONE	12.6	17.4	33.4	24.0	12.8	12,308
NON-MEDICAL	18.6	20.9	31.2	19.2	10.1	9,620
NON-MEDICAL & MEDICAL	21.9	21.9	28.2	16.8	11.3	1,454
MEDICAL	13.9	19.6	33.2	19.9	13.5	980
TOTAL %	15.6	19.1	32.1	21.5	11.6	24,362

findings from the nutrient quality assessment analyses. These categories had the fewest respondents in the multiple marginal nutrient intake categories. Calcium was the micronutrient with the largest percentages of respondents with $\leq$ 59.9 percent RDA intake. Milk is an excellent source of calcium.

Other food group consumption trends were obtained from the cross tabulation of intake factor category groups by total number of mentions in the three days recorded for specific food groups. The two categories with medical problems seemed to be more alike in their consumption of foods and the NON-MEDICAL and NONE categories appeared more similar. For example, the categories which reported medical factors, NON-MEDICAL & MEDICAL and MEDICAL had more respondents mention: more fruit and vegetable juice items; more coffee and tea; fewer soft drinks; fewer starch/vegetable/protein mixture combinations; more fruit items; and fewer cakes, cookies, pies, and pastry items. For the aforementioned food groups the opposite held true for the NONE and NON-MEDICAL categories. This may be related to the similarities in socio-economic composition of the categories.

In Tables 27-30 are shown the percent distribution of respondents by intake factor category groups and eating out and eating alone behavior use of vitamin and mineral supplements, and weight status. Tables 27 and 28 illustrate that the respondents who reported some type of medical factor were more similar and the NONE and NON-MEDICAL groups were more alike. The persons reporting medical factors recorded eating alone and eating at home more often. This was expected given the results of the socio-economic descriptor analyses. These groups had the most older respondents living in smaller households with lower incomes. The NONE and NON-MEDICAL had the most working adults in larger households with children and teens.

Table 27. Percent Distribution of Respondents by Eating Out Behavior* and Intake Factor Category Groups (N = 24,362)

	Intake Factor Category Groups %				TOTAL
Eating Out Behavior	NONE	NON-MEDICAL	NON-MEDICAL & MEDICAL	MEDICAL	#
All Meals At Home					
All Snacks at Home	10.9	11.1	17.3	19.5	2,858
Some Snacks Out	3.4	4.1	2.8	2.4	878
All Snacks Out	0.1	0.2	0.1	+	28
No Snacks Reported	11.9	9.5	15.7	18.3	2,785
Incomplete Snacks	13.7	12.6	18.6	18.3	3,345
SUBTOTAL	40.0	37.5	54.5	58.5	9,894
Some Meals At Home					
All Snacks At Home	10.9	9.9	8.7	7.6	2,496
Some Snacks Out	11.5	17.0	10.1	8.2	3,275
All Snacks Out	0.6	0.9	0.4	0.1	163
No Snacks Reported	13.7	9.6	6.7	8.6	2,786
Incomplete Snacks	22.6	23.5	18.3	16.2	5,467
SUBTOTAL	59.2	60.9	44.2	40.6	14,187
All Meals Out	0.4	0.8	0.4	0.4	143
Incomplete Meals	0.4	0.8	0.8	0.5	137
No Answers	+	+	0.1	+	1
TOTAL %	100.0	100.0	100.0	100.0	24,362

* Eating out behavior pertains to food eaten away from home and not from household food supply, (e.g. a brown bag lunch or picnic packed from home food supply would not be considered as having been eaten out.

+ Less than 0.1 percent.

Table 28. Percent Distribution of Respondents by Intake Factor Category Groups and Three Day Patterns of Eating Alone (N = 24,362)

	3-Day Patterns of Eating Alone %				TOTAL
Intake Factor Category Groups	All Meals Alone	Some Meals Alone	No Meals Alone	No Answer	#
NONE	2.4	64.8	31.9	0.9	12,308
NON-MEDICAL	4.0	73.6	21.6	0.7	9,620
NON-MEDICAL & MEDICAL	12.1	71.0	16.1	0.8	1,454
MEDICAL	10.7	65.6	22.1	1.5	980
TOTAL %	3.9	68.7	26.5	0.8	24,362

Table 29. Percent Distribution of Respondents by Intake Factor Category Groups and Reported Use of Vitamin and Mineral Supplements (N = 24,362)

	Reported Use of Vitamin and Mineral Supplements%					TOTAL
	NO and No Answer	Total: YES	Yes, Regular	Yes, Irregular	Yes, NA to Regularity*	#
NONE	71.1	28.9	20.3	7.2	1.4	12,308
NON-MEDICAL	64.4	35.6	23.4	10.0	2.2	9,620
NON-MEDICAL & MEDICAL	55.7	44.3	33.6	8.3	2.4	1,454
MEDICAL	60.0	40.0	30.5	6.6	2.9	980
TOTAL %	67.1	32.9	22.7	8.4	1.8	24,362

* Indicated that the respondent did not indicate regularity of use, but did identify kind of vitamin or mineral supplement.

Table 30. Percent Distribution of Respondents by Intake Factor Category Groups and Weight Status (N = 24,362)

Intake Factor Category Groups	Weight Status %				TOTAL
	Under Weight	Normal	Over Weight	NA*	#
NONE	5.0	72.9	21.3	0.9	12,308
NON-MEDICAL	4.4	71.2	23.3	1.1	9,620
NON-MEDICAL & MEDICAL	3.8	57.8	37.4	0.9	1,454
MEDICAL	3.0	67.6	28.5	1.0	980
TOTAL %	4.6	71.1	23.3	1.0	22,362

* NA = percentage of respondents that had no answers to either height and/or weight and those adults where their height was too extreme and weight status could not be calculated based on charts provided by Food and Nutrition Board (1980).

Therefore, it was expected to find these categories having larger distributions in the non-eating alone categories and eating out categories.

Due to questionnaire wording it is difficult to interpret the reported use of supplements. However, from Table 29 the NONE category had the most (71%) in the no usage and no answer category. The NON-MEDICAL & MEDICAL category had the most respondents (44%) in the reported total usage of supplements category.

The NON-MEDICAL & MEDICAL had the most respondents (37%) in the "overweight" weight status category. The NONE group had the most (73%) in the "normal" weight status category.

From the analyses of food intake and personal behaviors several trends were seen. For example, milk, meats, starchy side and main dishes, vegetables, bread, and condiments or garnishes were used by large percentages of the study population regardless of whether or not they reported a problem or factor affecting their intake. Approximately 99 percent of each of the factor category groups were eating either all meals at home or some meals at home. More than 21 percent of each of the categories fell into the "overweight" weight status category. These findings were consistent with trends in U.S. dietary patterns described by Sanjur (1982) and Pao (1981). Sanjur (1982) summarized findings from various national surveys. The following U.S. consumption trend were reported by Sanjur (1982): increases in milk and meats, decreases in fruits, decreases in potatoes, increases in dark green and yellow vegetables, increases in oils, sugar and other sweetners, and decreases in butter, coffee and tea. Pao (1981) derived estimates of percentages of consumption by NFCS respondents for specific food groups based on nutrient content of foods. The findings from this investigation of persons with self-reported factors affecting their intake were within the ranges for the food groups as Pao (1981) analysed them. Pao's analysis provides a check on the findings of this investigation.

Obesity has increasingly been characterized as a major American health problem. Its prevalance (as much as a third of our population has been reported as being obese), its relation to other medical conditions, and its resistance to treatment have been the reasons for its recognition (Concern, 1979). Although NFCS self-reported weight and height were used to calculate weight status, other investigators have documented accuracy or underreporting in these self-reported measures. Stunkard and Album (1981) found Americans were remarkably accurate in their self-reporting of weights. Pirie et al. (1981) found women's self-reported weight to be frequently low and an under-estimation was found among heavier men. In either case, the large percentages determined to be in the "overweight" categories would not be diminished substantially. Therefore, the NFCS is additional documentation of the prevalence of "overweight" persons in our society based on recommended ranges from the Food and Nutrition Board (NAS, 1980).

Composite Typologies of Intake Factor Category Groups

In Phase I of this investigation, factor intake category groups based on self-reported non-medical and medical factors or problems potentially affecting dietary intakes of NFCS respondents were derived. These groups were analysed in terms of: meal and snack patterns; socio-economic characteristics; nutrient quality assessment; and food intake and personal behaviors. The composite discriminating descriptive characteristics of the intake factor groups is presented in Figure 3.

The NONE and NON-MEDICAL groups included the largest percentages of

FIGURE 3. Discriminating Descriptive Characteristics of Intake Factor Category Groups

Discriminating Descriptive Characterisitcs	NONE	NON-MEDICAL	NON-MEDICAL & MEDICAL	MEDICAL
Identified Factor or Problem	None	Don't like certain foods. Don't like eating breakfast early in morning.	Some foods don't agree with them. On a diet to lose weight. Don't like certain foods. Have a medical problem and/or are on a doctor prescribed diet.	On doctor prescribed diet. Have a medical problem like diabetes or an allergy.
Demographics	Children 18 years Household size ≥3 Family-adults, teens and children Working head(s) of household	Children and adults 25-55 years Family-adults, teens and children Above poverty level incomes Working head(s) of household	Adults 45-75 years Household sized 1-3 Lower educational levels Mixed working and non-working head(s) of household Live in NorthEast and Central	Adults ≥55 years Household sized 1-2 Below poverty level income Female and non-working head of household Lower educational levels Live in NorthEast and Central
Meal Patterns	3,3,3 (63%)	Non-3,3,3 (51%) and 3,3,3 (49%)	3,3,3 (56%) and non-3,3,3 (44%)	3,3,3 (67%)
Nutrient Intake	65% with no or 1 micronutrient "marginal" 81% with PFC ratio outside ranges	50% with 2 or more micronutrients "marginal" 80% with PFC ratio outside ranges	50% with 2 or more micronutrients "marginal" 78% with PFC ratio outside ranges	61% with no or 1 micronutrients "marginal" 78% with PFC ratio outside ranges
Food Related Behaviors	Meals eaten at and away from home Meals not eaten alone	Meals eaten at and away from home Meals not eaten alone	Use supplements Largest percentages "overweight" Eat at home and alone some of the time	Eat alone and at home more often than other groups

respondents less than 18 years living in larger families composed of working adults, children, and teens. The actual specific food group mentions for these two groups were also quite similar. The personal food behaviors such as eating alone and eating out behavior also were more alike for these two groups than the groups identifying some type of medical problem.

The two groups identifying some type of medical problem, NON-MEDICAL & MEDICAL and MEDICAL, were comparable in socio-economic descriptors and specific food group total mentions. These groups had the most: respondents 55 years and older; smaller households; families composed of non-working adults; female headed households; and lower education levels of head of household. These two groups were more similar in intake of specific food groups and eating related behaviors.

The meal and snack patterns were more alike for the NONE and MEDICAL groups and for the two groups identifying some type of non-medical factor affecting intake. This also was true of the nutrient quality assessment indices. All groups showed similar trends in the diet's ratio of protein, fats and carbohydrates. Fat was the macronutrient most apt to be outside the specified ranges in the PFC ratio.

Nutrition Education Implications

The findings from these analyses can be used to target nutrition education messages or strategies in terms of the demographic characteristics, meal and snack patterns, nutrient inadequacies, food eaten or not eaten, and eating behaviors of the study population. This information may aid in nutrition education or message targeting based on iNdividuals' actual reported perceptions of factors or problems affecting intake or special diets. Communication specialists and nutrition educators concur that messages presented in terms familiar and meaningful to target populations will have more impact than terms which have meaning only to the educator/communicator.

The descriptive typologies derived (see Figure 3) to characterize each of the intake factor category groups provide general trends in terms of demographics, food related behaviors, and nutritional problems to aid nutrition educators. For example, a group may be interested in promoting products or developing programs for persons on diets to lose weight. From the typologies derived from the NFCS data, the groups which may be most responsive are women 25-55 years of age. In addition, younger aged females may be a responsive audience. These individuals would likely be: living in households of three or more persons including children, teens and adults; have above poverty level incomes; high school or higher education levels of the head of household; and working male or both female and male heads of household. Large percentages will be eating the three meal a day pattern and snacking. Large percentages will also be inconsistently eating two or three meals a day and snacking. These persons may not like eating breakfast in the early morning, not like certain foods or find that some foods may not agree with them. They will likely ingest greater than 35 percent of their calories from fat and may be marginal in percent RDA intakes of micronutrients, specifically calcium, vitamin B_6 and magnesium. They may eat some meals alone and some meals away from home.

Considering the above typologies nutrition educators or planners may want to promote nutrient dense meal items and/or snacks which have significant levels of calcium, B_6 and/or magnesium. Foods may be promoted which can be eaten at home, at work or "on-the-go." Items to "break-the-fast" from the night until "a little later in the morning than just after getting up" may catch the eye and interest of target populations. Additionally, planners may want to stress that each individual needs to recognize his or her own dietary intake pattern and that no particular foods must specifically be eaten to ensure adequacy. Working around personal dietary patterns or specific food likes and dislikes need not affect the quality of food intake. Stressing these points may decrease target population perception that not eating certain foods or having particular foods that do not agree with them will negatively affect their intakes. The typologies determined in Phase I may provide educators and/or planners with descriptors of specific population segments to be used in information dissemination, teaching, or marketing products.

FOOTNOTE

[1]Contingency coefficient (C) is calculated by taking the square root of chi-square divided by the chi-square plus N. When chi-square (χ^2) is significant, the C is significant. Both measures of association take the N of the sample into consideration. Dividing through by the large sample size (N), all of the χ^2s were significant.

CHAPTER V

RESULTS AND DISCUSSION: PHASE II

> In reviewing the current empirical evidence, no single factor appears to be responsible for the development of dietary patterns ... . Rather, a constellation of factors ... behaving in a synergistic fashion appear to be more significant than any single factor working independently. Needless to note, we must continue efforts to unravel these interactive mechanisms, which may prove more important than the sum of individual determinants (Sanjur, 1981:xiii)

In an effort to continue to "unravel" the factors which simultaneously interact in food related behaviors, Phase II of this study was conducted. The model illustrated in Chapter II was estimated and the results are given in this chapter. Data obtained in the Nationwide Food Consumption Survey (NFCS) provided a unique opportunity to apply multivariate analysis techniques to organize further understandings of food behaviors. The large sample size and availability of respondent data on demographics, food intake (and calculated nutrient intake) and related behaviors made the NFCS a viable data base for this investigation. The first task in Phase II was to determine the study population and specific variables to represent the four variable sets in the model. The dependent variable, problem versus no problem, and the three independent variable sets (1. demographic characteristics; 2. respondents' nutrient intakes; and 3. food and personal related behaviors) are statistically described. Factor analysis, discriminant analysis and canonical correlation analysis were used to estimate relationships between the four variable sets. The results are presented and discussed in the following sections.

When appropriate chi-squares and F-ratios and significance levels are reported as statistical tests to assess systematic relationships existing between categories. As in Phase I, due to the large sample size and the incorporation of N in the tests of association, these calculations were given minimal consideration by the researchers in discussing results and determining implications.

Sample and Variable Descriptions

The sample selected for use in Phase I (see Chapter IV) was also used as the study population for Phase II (N = 24,362). For selection and description of variables to be incorporated in the model, a 10 percent random subsample was generated from the study population. The 10 percent subsample was used to check for assumptions of linearity among the variables. In Chapter III descriptions are given of the methodology used to transform and/or select variables which met with assumptions of multivariate analysis techniques used to estimate the model.

The construction and description of the dependent variable, problem group and the three sets of independent variables are given in Appendix A-4. The dependent variable was a dichotomous variable called "problem versus no problem". Fifty-one percent of the sample identified some type of factor affecting the way they ate or drank and/or being on a special diet. (See page 1 for the specific NFCS questions used to identify problem variable.)

Descriptive statistics on the total 10 percent random subsample for each of the indicators of the three sets of independent variables are given in Tables 31 and 32-34. Table 31 lists the means, standard deviations, skewness, and minimum and maximum scores for each of the

TABLE 31. Descriptive Statistics For All Indicators of the Independent Variable Sets (N=2,406)*

	Indicator	Mean+	Standard Deviation	Skew	Minimum/Maximum Score		Max/Min Variance
X_{D1}	Age	31.4	22.0	0.7	4.0	95.0	1.1
X_{D2}	Sex	1.5	0.5	≠	1.0	2.0	≠
X_{D3}	Race	1.1	0.3	≠	1.0	2.0	≠
X_{D4}	Education Male	13.0	3.8	-0.5	0.0	19.0	1.1
X_{D5}	Education Female	12.1	3.0	-0.5	0.0	19.0	1.0
X_{D6}	Poverty Level	2.7	1.9	1.6	0.0	13.1	1.4
X_{D7}	Central City	0.3	0.4	≠	0.0	1.0	≠
X_{D8}	Suburban	0.4	0.5	≠	0.0	1.0	≠
X_{N1}	% Calories Fat	39.7	6.9	-0.2	0.0	76.1	1.3
X_{N2}	% Calories CHO	43.6	8.9	-0.1	0.0	99.4	1.3
X_{N3}	% RDA Protein	166.6	61.2	0.8	4.2	535.7	0.8

* N = 10% random subsample of the total study population from Phase I (N=24,362).

+ The units of measure for each of the indicators are listed in Appendix A-4.

≠ Measurements not applicable to dichotomous variables.

TABLE 31. (con't)

	Indicator	Mean[+]	Standard Deviation	Skew	Minimum/Maximum Score		Max/Min Variance
X_{N4}	% RDA Calcium	87.2	45.9	1.3	1.2	387.8	1.2
X_{N5}	% RDA Iron	102.1	52.6	1.3	1.2	491.0	1.0
X_{N6}	% RDA Magnesium	81.0	30.4	0.9	3.0	236.3	1.0
X_{N7}	% RDA Phosphorous	134.5	54.9	1.1	3.7	445.8	1.1
X_{N8}	Log % RDA Vitamin A	4.5	0.7	-0.2	0.5	6.8	1.3
X_{N9}	% RDA Thiamin	111.6	46.1	1.4	0.0	556.0	1.1
X_{N10}	% RDA Riboflavin	130.4	59.1	1.5	0.0	625.0	1.1
X_{N11}	% RDA Vitamin B_6	74.5	33.1	1.1	0.0	258.7	1.0
X_{N12}	Log % RDA Vitamin B_{12}	4.8	0.6	-0.3	0.5	6.9	1.4
X_{N13}	% RDA Vitamin C	148.6	105.6	1.5	0.0	991.6	1.5
X_{N14}	% Recommended Energy Intake	83.1	27.2	0.7	8.4	201.6	1.0
X_{F1}	Weight Status	1.1	0.2	0.4	0.0	2.3	1.2
X_{F2}	# Mentions Milk	4.4	3.5	1.1	0.0	32.0	1.1

[+]The units of measure for each of the indicators are listed in Appendix A-4.

TABLE 31. (con't)

	Indicator	Mean+	Standard Deviation	Skew	Minimum/Maximum Score		Min/Max Variance
X_{F3}	# Mentions Coffee/Tea	1.7	2.1	1.4	0.0	29.0	1.3
X_{F4}	# Mentions Meat	3.2	1.9	0.6	0.0	11.0	1.0
X_{F5}	# Mentions Legumes	0.3	0.7	3.0	0.0	6.0	1.1
X_{F6}	# Mentions Starch Dishes	2.0	1.4	0.8	0.0	8.0	1.0
X_{F7}	# Mentions Vegetables	3.7	2.8	1.2	0.0	18.0	1.1
X_{F8}	# Mentions Bread	4.5	2.2	0.2	0.0	14.0	1.0
X_{F9}	# Mentions Cereal	1.2	1.4	1.5	0.0	14.0	1.2
X_{F10}	# Mentions Frozen Desserts	0.5	0.9	2.2	0.0	6.0	1.1
X_{F11}	# Mentions Cakes, Pies	1.8	1.9	1.4	0.0	12.0	1.1
X_{F12}	# Mentions Butter & Margerine	1.8	1.8	1.2	0.0	10.0	1.2
X_{F13}	# Mentions Nut Butter	0.3	0.7	3.0	0.0	5.0	1.3
X_{F14}	Ate Alone - Day 2	0.8	0.3	≠	0.0	1.0	≠

+ The units of measure for each of the indicators are listed in Appendix A-4.

≠ Measurements not applicable to dichotomous variables.

TABLE 31. (con't)

	Indicator	Mean+	Standard Deviation	Skew	Maximum/Minimum Score		Max/Min Variance
X_{F15}	# Days Ate Breakfast	2.6	0.8	-2.3	0.0	3.0	1.6
X_{F16}	# Days Ate Lunch	2.4	1.0	-1.5	0.0	3.0	1.2
X_{F17}	# Days Ate Supper	1.8	1.3	-0.5	0.0	3.0	1.0

+ The units of measure for each of the indicators are listed in Appendix A-4.

TABLE 32. Group Means and Tests for Group Differences For Indicators of Demographic Characteristics by the Dependent Variable, Problem Group (N=1,809)*

	Demographic Indicators	Problem Group $\bar{x}$ + Problem	No Problem	F Ratio	p
X_{D1}	Age	34.8	28.1	56.1	.01 ≠
X_{D2}	Sex	1.6	1.4	18.3	.01 ≠
X_{D3}	Race	1.1	1.1	44.3	.37
X_{D4}	Education Male	13.2	12.9	2.9	.08
X_{D5}	Education Female	12.2	12.0	1.7	.18
X_{D6}	Poverty Level	2.8	2.8	2.5	.11
X_{D7}	City C 1 - Central City	0.2	0.3	53.3	.10
X_{D8}	City C 2 - Suburban	0.4	0.3	47.8	.08

* The N reflects the sample which had no missing values for each of the indicators of demographic characteristics of the 10% random subsample generated from the total study population (N=2406).

\+ The units of measure for each of the indicator variables are listed in Appendix A-4.

≠ $p \leq .01$.

TABLE 33. Group Means and Tests for Group Differences For Indicators of Nutrient Quality By the Dependent Variable, Problem Groups (N=2,256)*

	Demographic Indicators	Problem Groups $\bar{x}$ + Problem	No Problem	F Ratio	p
X_{N1}	% Calories Fat	39.6	39.8	0.4	0.5
X_{N2}	% Calories CHO	43.3	43.9	3.0	0.1
X_{N3}	% RDA Protein	156.6	176.7	66.4	0.01≠
X_{N4}	% RDA Calcium	82.4	92.1	27.0	0.01≠
X_{N5}	% RDA Iron	95.9	108.6	34.9	0.01≠
X_{N6}	% RDA Magnesium	77.8	84.2	27.0	0.01≠
X_{N7}	% RDA Phosphorous	129.3	139.8	22.2	0.01≠
X_{N8}	Log % RDA Vitamin A	4.5	4.6	15.2	0.01≠
X_{N9}	% RDA Thiamin	105.7	117.5	39.8	0.01≠
X_{N10}	% RDA Riboflavin	122.1	139.0	50.1	0.01≠
X_{N11}	% RDA Vitamin B_6	68.9	80.0	50.1	0.01≠
X_{N12}	Log % RDA Vitamin B_{12}	2.3	2.4	20.3	0.01≠
X_{N13}	% RDA Vitamin C	139.4	157.6	18.1	0.01≠
X_{N14}	% Recommended Energy Intake	80.2	86.1	28.3	0.01≠

* The N reflects the sample which had no missing values for each of the indicators of demographic characteristics of the 10% random subsample generated from the total study population (N=2406).

\+ The units of measure for each indicator are listed in Appendix A-4.

≠ $p \leq .01$.

TABLE 34. Group Means and Tests for Group Differences For Indicators of Food Related Behaviors by the Dependent Variable, Problem Group (N=2,385)

Food Related Behavior Indicators		Problem Groups $\bar{x}$+ Problem	No Problem	F Ratio	p
X_{F1}	Weight Status	1.1	1.1	5.5	.05[≠]
X_{F2}	# Mentions Milk	4.2	4.7	11.7	.01[δ]
X_{F3}	# Mentions Coffee/Tea	3.9	3.0	30.5	.01[δ]
X_{F4}	# Mentions Meat	3.1	3.4	15.7	.01[δ]
X_{F5}	# Mentions Legumes	0.3	0.3	8.7	.01[δ]
X_{F6}	# Mentions Starch	1.9	2.2	27.2	.01[δ]
X_{F7}	# Mentions Vegetables	3.6	3.8	4.7	.05[≠]
X_{F8}	# Mentions Bread	4.3	4.7	17.5	.01[δ]
X_{F9}	# Mentions Cereal	1.0	1.3	25.6	.01[δ]
X_{F10}	# Mentions Frozen Desserts	0.4	0.5	7.0	.01[δ]
X_{F11}	# Mentions Cakes, Pies	1.7	1.8	4.0	.05[≠]
X_{F12}	# Mentions Butter/Margarine	1.7	1.9	5.8	.05[≠]
X_{F13}	# Mentions Nut Butter	0.2	0.3	12.4	.01[δ]
X_{F14}	# Ate Alone-Day 2	0.1	0.1	13.4	.01[δ]
X_{F15}	# Days Ate Breakfast	2.5	2.7	31.2	.01[δ]
X_{F16}	# Days Ate Lunch	2.3	2.5	11.7	.01[δ]
X_{F17}	# Days Ate Supper	1.7	1.9	8.5	.01[δ]

* The N reflects the sample which had no missing values for each of the indicators of food related behaviors of the 10% random sub-sample generated from the total study population (N=2406).

+ The units of measure for each indicator are listed in Appendix A-4.

≠ $p \leq .05$.

δ $p \leq .01$.

indicators included in the model. The column labeled maximum/minimum variance is the ratio of maximum to minimum variance determined from ANOVA's (analyses of within group variances). In the ANOVA's each of the indicators was the dependent variable and the problem versus no problem variable was the independent variable. Tables 32-34 list the group means and results of tests for group differences (F ratio) for each of the three sets of independent variables. Each of the independent variable sets will be discussed separately combining the results from Tables 31-34.

Demographic Descriptors

Demographic characteristics have consistently been demonstrated to significantly affect nutrient intakes or food behaviors (Lund and Burk, 1969; Eppright et al., 1970; Sims, 1972; Yetley, 1974; and Adrian and Daniels, 1976). Age (X D1), sex (X D2), race (X D3), education levels of male (X D4) and female (X D5) heads of households, poverty level (X D6) and city characteristics of respondents place of residence (City C_1 = central city X D7 and City C_2 = suburban X D8) were used as indicators of demographic characteristics in the model.

The mean age of the sample was 31 years (see Table 31). The mean age was 35 years for the problem group and 28 years for the no problem group ($p \leq .01$). This result was expected given the findings concluded in Phase I. The none category had more children than any of the other intake factor categories. There were more women in the problem category and more men in the no problem category ($p \leq .01$). Both groups had more whites than blacks, but this was reflected in the total NFCS sample population. In education level of male and female heads of households the problem and no problem groups were similar. In both cases the females had a total sample average ($\bar{x}$ = 12.1 years of schooling) of approximately one year less of education than the males ($\bar{x}$ = 13.0 years of schooling). Poverty level and city characteristics were similar for the problem groups.

Nutrient Intake

The means for the total sample and each of the problem groups for the percent of calories from the macronutrients fats ($\bar{x}$ = approximately 40%) and carbohydrates ($\bar{x}$ = approximately 44%) were similar. This was expected given the results from Phase I for the PFC index and composite index (see Chapter IV). The factor intake groups had similar proportions in the PFC categories. By subtracting the mean total percent calories of fats and carbohydrates from 100 percent, the mean total percent calories from protein was calculated ($\bar{x}$ = approximately 16%). In 1976, Page and Friend estimated the ratio of the macronutrients in the U.S. diets to be approximately: protein (12%), fats (42%), and carbohydrates (46%). Our mean intakes estimated from a random subsample of the NFCS were slightly different: protein (14%), fats (40%), and carbohydrates (44%). Our findings were comparable to the estimates Hegsted (1979) reported from the NFCS. Hegsted (1979) reported percent of calories from fats to be decreasing to 39-42 percent as estimated from the NFCS compared to the 1965 National Food Consumption Survey data estimate of 42-45 percent. Our findings supported the trend Hegsted noted by saying "the message promoted by the federal government to reduce fat intake has reached segments of the U.S. population." The Legislative Branch has promoted the decreased intake of fat in "Dietary Goals I and II" (U.S. Senate Select Committee on Nutrition and Human Needs, 1977 a. and 1977 b.). The Executuve Branch has been responsible for developing and distributing several publications suggesting the U.S. population decrease intake of fat. Examples of these publications include: "Healthy People" (Surgeon General U.S. Department of Health, Education and Welfare, 1979) and "Dietary Guidelines for Americans" (USDA and Department of Health, Education and Welfare (1980).

Protein has repeatedly been reported as comprising 10-12 percent of the calories ingested (Hegsted, 1979). Protein intake has been reported to be increasing and our data supported this trend.

The total intake of calories has been reported as decreasing (Hegsted, 1979). The mean total intake from the sample was estimated as 83 percent of the REI, Recommended Energy Intakes (NAS, Food and Nutrition Board, 1980). The mean for the problem group ($\bar{x}$ = 80%) was lower than the no problem group ($\bar{x}$ = 86%) ($P \leq .10$) (see Tables 31 and 33). Tables 31 and 33 further illustrate that the mean intakes for all indicator nutrients were higher for the no problem category ($p \leq .01$). This may be due to the fact that they are just eating more than the problem category on the average as illustrated by the REI.

The mean values obtained from three day average percentages of the RDA for nutrient intakes were used to determine a rank order for average percent intakes of nutrients. The rank order (largest to smallest) derived was: protein ($\bar{x}$ = 167%), vitamin B_{12} ($\bar{x}$ = 158%), vitamin C ($\bar{x}$ = 149%), phosphorous ($\bar{x}$ = 135%), riboflavin ($\bar{x}$ = 131%), thiamin ($\bar{x}$ = 112%), iron ($\bar{x}$ = 102%), calcium ($\bar{x}$ = 87%), magnesium ($\bar{x}$ = 81%), and vitamin B_6 ($\bar{x}$ = 74%). From these data, no nutrients on the average fell below the 59.9 percent of the RDA used in deriving the marginal nutrients. Averages or means masked the ranges and numbers of individuals which fell in the low end of the percent of RDA intakes for specific nutrients. From these data, calcium, magnesium and vitamin B_6 had the lowest mean values for the percentages of RDA which was similar to the findings of Phase I (see Chapter IV).

To use these averages for any kind of policy or nutrition education programs would not be recommended. To determine accurately specific nutrients which are marginal in terms of the RDA for the U.S. population, intakes would need to be determined for the same age/sex groups as are the RDA.

Food Related Behaviors

Table 31 and 34 show the total group and problem group means for indicators of food related behaviors. Weight status averaged at 10 percent above the NAS, Food and Nutrition Board (1980) recommended weight ranges. See Chapter III for description of variable constructed to represent weight status. Given the results of Phase I regarding weight status (see Chapter IV) the findings in Phase II were expected. For all food group total number of mentions for three days (expect coffee and tea), the no problem category had larger average numbers. This was expected since the no problem group had larger percentage intakes of the REI (see Table 33). From these data based on mean ($\bar{x}$) total number of mentions for the three days, bread ($\bar{x}$ = 4.5), milk ($\bar{x}$ = 4.4), vegetables ($\bar{x}$ = 3.7), and meat ($\bar{x}$ = 3.2) had the most mentions by respondents. In investigating the number of days specific meals were eaten (X_{F15} - X_{F17}), the no problem group had more meals eaten than the problem group. These data supplement the findings from Phase I on specific meals eaten to contribute to the derived meal patterns. Supper ($\bar{x}$ = 1.8) and lunch ($\bar{x}$ = 2.4) were the meals most often skipped based on the average total number of days mentioned. Breakfast ($\bar{x}$ = 2.6) was the meal which had the largest mean for total number of days eaten in both groups.

Tests for Multicollinearity

For purposes of assessment and clarification in interpretation of results, tests for multicollinearity were applied for indicators of the independent variable sets. Linear independence is assumed among variables in general linear model (GLM) analysis techniques. It should be stated that estimates may be derived and statistical tests performed on data sets where multicollinearity exists. However, the results of estimates and statistical tests where perfect linearity exists are not readily interpretable or stable.

To determine the extent of multicollinearity (for description see Chapter III) within each of the independent variable sets the determinant of the correlation matrices was derived and principal component factor analyses were conducted (see Appendix B, Tables B1-B6). SPSS Subprogram Factor (Nie et al., 1975) was used to conduct tests for multicollinearity. The 10 percent random subsample (N = 2,406) originally selected from the study population was randomly split into two 50 percent subsamples (N = 1,203) to cross-validate results obtained.

In Tables B1-B3 (see Appendix B) the correlation matrices and calculated determinants (det.) for each of the independent variable set indicators are shown: demographic characteristics (det. = .4); nutrient quality (det. = .1); and food related behaviors (det. = .2). A determinant larger than zero indicated some linear independence among variables. The nutrient quality indicators had the highest level of multicollinearity (closest to zero) which was expected given the high correlations ($r = \geq .7$) between many of the variables and the fact that many foods contain similar sets of nutrients. Pennington (1976) and Jenkins (1982) investigated the correlations between nutrients. Beyond the criteria specified in Chapter III non-perfect multicollinearity (a non-zero determinant) was the only criterion used for incorporating a particular set of indicators in our independent variable sets. Each of the three sets met this criterion.

None of the indicators of demographic characteristics and food related behaviors were highly correlated. Moderate correlations existed between the demographic characteristics: race and central city ($r = .4$); female head of households educational level and poverty level ($r = .4$); and central city and suburban ($r = -.5$). The only indicators of food related behaviors that were moderately correlated ($r = .4 -.6$) were the meat and bread food groups ($r = .4$). As was indicated from the determinant of the correlation matrix several of the indicators of nutrient quality were highly correlated ($r = \geq .7$). The indicators which were highly correlated are listed in Table 35.

The second set of analyses to determine linear independency among indicators of the independent variable sets were principal component factor analyses. The principal component solution was derived from standardizing the variance-covariance matrix resulting in a correlation matrix (Tables B4-B6, Appendix B). This correlation matrix was a "matrix of cosines where each entry θij represented the cosine of the angle between the variable vectors $\bar{i}$ and $\bar{j}$"[1] (Woelfel et al., 1980). This correlation matrix was then orthogonally decomposed and rotated to yield eigenvectors and eigenvalues. For each analysis, a set of reference coordinates or axes were placed upon the sets of variables and projections were measured (loadings $= \lambda$) for each variable on the axes.

Tables B4-B6, Appendix B illustrate the results of the principal component analyses in terms of the rotated (transformed) factor structures presented. These tables showed that each of the major factors or axes determined in the factor eigenanalyses of the three sets of

TABLE 35.
Identification of Highly Correlated ($R_c \geq .7$) Indicators of Nutrient Quality (N=1177)*

Indicators of Nutrient Quality	R_c
% Calories from Fats - % Calories from Carbohydrates	.81
% RDA Protein - % RDA Calcium	.68
% RDA Protein - % RDA Magnesium	.70
% RDA Protein - % RDA Vitamin A	.75
% RDA Protein - % RDA Riboflavin	.72
% RDA Protein - % RDA Vitamin B_6	.76
% RDA Protein - % Recommended Energy Intake	.73
% RDA Calcium - % RDA Magnesium	.70
% RDA Calcium - % RDA Phosphorous	.85
% RDA Calcium - % RDA Riboflavin	.79
% RDA Iron - % RDA Phosphorous	.72
% RDA Magnesium - % RDA Phosphorous	.77
% RDA Magnesium - % RDA Riboflavin	.71
% RDA Magnesium - % RDA Vitamin B_6	.69
% RDA Magnesium - % Recommended Energy Intake	.71
% RDA Phosphorous - % RDA Riboflavin	.68
% RDA Phosphorous - % Recommended Energy Intake	.71
% RDA Thiamin - % RDA Riboflavin	.68
% RDA Thiamin - % RDA Vitamin B_6	.69
% RDA Thiamin - % Recommended Energy Intake	.70
% RDA Riboflavin - % RDA Vitamin B_6	.74
% RDA Riboflavin - % RDA Vitamin B_{12}	.71
% RDA Riboflavin - % Recommended Energy Intake	.68

* Sample size reflects results of case elimination due to missing data from a 5% subsample of total study population (N=24,362, 5%=1203). Two 5% subsamples were determined and cross validated.

independent variables were primarily explained by one of the indicators in the set. For example, in the principal component analyses of the demographic characteristics Factor 1, race (λ = .99) explained the largest proportion of the variance. For Factor 2, suburban (λ = .96) explained the largest proportion of variance and in Factor 3 it was educational level of the male head of household (λ = .97). This pattern was consistent across each of the three sets of indicators. Factor analyses were used to identify relative linear independency among indicator variables. In this sense, factor analyses were used for exploratory purposes (exploring and detecting patterns in variables) (Nie et al., 1975:17) and not for purposes of estimation or statistical testing.

Based on the findings from the determinants of the correlation matrices and the principal component analyses, the researchers were satisfied that the indicators as represented in Figure 4 (see descriptions in Appendix A-4) were relatively linear independent.

Once the indicators for the three sets of independent variables had been determined, correlation matrices were derived for each of the three independent variable sets with one another (see Appendix B, Tables B7-B9). Most correlation coefficients were low, however, a moderate, negative relationship existed between sex and iron (r = -.5) in the matrix of demographic characteristics and nutrient quality indicators. Given the higher RDA standard for women and the lower percentage of women meeting the standard, this was an expected result. In the matrix determined between nutrient quality and food related behaviors, several moderate correlations were determined. The milk food group was moderately, positively correlated with percent RDA calcium and percent RDA riboflavin (r = .6, each), percent RDA magnesium (r = .5), percent RDA phosphorous,

FIGURE 4. Model Estimated To Assess Interrelationships Between Sets of Variables Affecting Food Related Behaviors. Appendix A-4 Defines Variables Included in the Model.

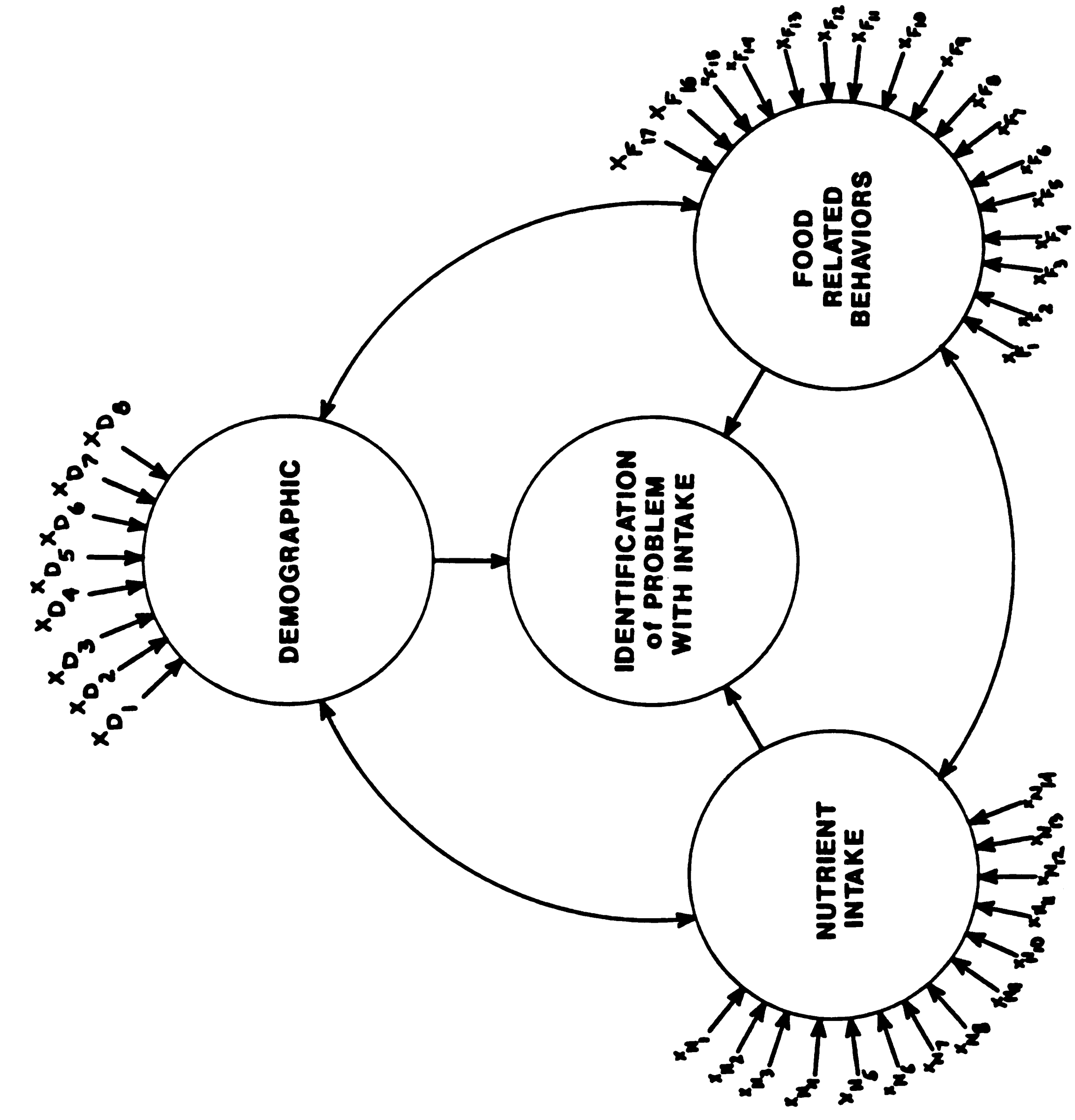

DEMOGRAPHIC
IDENTIFICATION of PROBLEM WITH INTAKE
FOOD RELATED BEHAVIORS
NUTRIENT INTAKE

FIGURE 4.

percent RDA vitamin B_6 and percent RDA vitamin B_{12} (r = .4, each). The RDA percent for vitamin A was moderately, positively correlated to the total number of mentions of the vegetable food group (r = .4). The food group representing total number of mentions of cereal was moderately, positively correlated to percent RDA riboflavin and percent RDA vitamin B_6 (r = .4, each).

Discriminant Analyses

With the indicators determined for the three sets of independent variables, discriminant analyses were computed to: (1) produce a check on homogeneity in the covariance matrices for each of the independent variable sets and (2) determine the relationship between each of the three sets and the dependent variable, identification of problem with intake. These results are presented separately.

As a final quantitative check on multicollinearity and to assess an underlying assumption of discriminant analysis (see Chapter III), the log determinants of the covariance matrices were derived for each of the discriminant analyses run (see Table 36). The rank and log determinants were calculated for the problem versus no problem dependent variable groups within each of the three sets of independent variables. Each of the covariance matrices were full in rank (see Chapter III).

The rank of a matrix is the order of the largest square submatrix whose determinant does not equal zero. To meet full rank no column vector can be linearly dependent upon another column (the same holds true for rows) and the number of columns must exceed the number of rows. When linear dependency exists (as when multicollinearity exists) the dimensionality of space needed to represent the variable vectors is deficient (geometric definition of rank). In this situation one or more of the variable vectors is highly correlated and in the case of perfect multicollinearity the vectors are colinear.

The log determinants were obtained to check for two criterion regarding the covariance matrices: (1) non-singular results and (2) similar determinants for each of the problem groups within each of the independent sets. The SPSS Subprogram Discriminant (Nie et al., 1975) actually prints the message "singular further analyses can not be conducted" when singular results are obtained. Given the two criterion (full rank and non-singular determinants), the data were determined to satisfy the assumptions of discriminant analyses. Subsequently, discriminant analyses were performed to determine canonical discriminant functions for the dependent variable and each of the independent variable sets.

Discriminant analyses were used to determine the relationship between each of the independent variable sets and the dependent variable. The output from these analyses was a canonical correlation coefficient (R_c) which represented the correlation between the dependent variable and the set of independent variables being assessed. The square of the canonical correlation (or the eigenvalue, R_c^2) represents the amount of variance shared by the two sets. The results of these analyses are presented in Table 37. The canonical correlations derived for each of the groups were quite similar: demographic (R_c = .25), nutrient quality (R_c = .23), and food related behaviors (R_c = .27). These were low correlations. These canonical correlations summarized the strength of association between the variable sets and also provided a means for comparing the association across groups. The eigenvalues (R_c^2's) were a measure of the proportion of variance shared by variable sets. The R_c^2's were small, demographic and nutrient quality (R_c^2 = .06) and food related behaviors

TABLE 36.

Tests For the Equality of Group Covariance Matrices For Each of the 3 Independent Variable Sets and the Dependent Variable (N=2406)*

Independent Variable Set	Dependent Problem Group	Rank	Log Determinant
Demographic	Yes	8	4.5
	No	8	4.6
Nutrient Quality	Yes	14	70.5
	No	14	70.6
Food Related Behaviors	Yes	17	4.4
	No	17	3.3

* The sample size included in each of the analyses varied as a result of case elimination due to missing data. These analyses were run on two 5% subsamples of the 10% (N=2406) and the results were cross validated.

TABLE 37.

Canonical Discriminant Functions For the Dependent Variable By the 3 Sets of Independent Variables (N=2406)*

Independent Variable Set	N*	Eigenvalue (R_c^2)	Canonical Correlation (R_c)	Chi Square (x^2)	df	p
Demographic	1809	.06	.25	59	8	.000
Nutrient Quality	2356	.06	.23	63	14	.000
Food Related Behaviors	2385	.08	.27	89	17	.000

* Sample size varies as a result of case elimination due to missing data. These analyses were run on two separate 5% subsamples of the 10% random subsample generated from the total study population (24,362).

(R_c^2 = .08). In each case over 90 percent of the variation in the discriminant space remained unaccounted by the between group differences. These results may mean several things: (1) the problem versus no problem groups were very similar in composition or patterned variation and differentiation or explanation may have been difficult; (2) the indicators used to represent each of the independent variable groups were not appropriate to differentiate accurately the problem groups; (3) non-linear relationships and/or interaction affects existed between variables; and/or (4) gross unreliability existed in the data set.

Canonical Analyses

The final task in Phase II determined the quantitative relationships between the three sets of independent variables by deriving canonical correlations (R_c's) and canonical variate loadings (λ 's) (see Chapter III). From the eigenanalyses, Tables 38-40 were produced which list each of the canonical variates derived with the calculated canonical correlations (R_c's) and eigenvalues (R_c^2's). Figure 5 represents the model estimated based on the <u>first</u> canonical variates derived for each group and the discriminant canonical analyses from the previous section in this chapter. Tables 41-43 list the canonical variate loadings (λ 's) showing which variables accounted for the most variation in the underlying canonical variates. For example, the first reference axis derived, canonical variate 1, for each set accounted for the greatest proportion of variance between the two sets. Between each of the sets the R_c^2's (eigenvalues) were moderate: demographic-nutrient quality (R_c^2 = .5), demographic-food related behaviors (R_c^2 = .5) and nutrient quality-food behaviors (R_c^2 = .6). These can be interpreted to mean that 50-60 percent of the variation between the two groups was explained by the specified

TABLE 38.

Canonical Correlations Among the Indicators of Demographic Characteristics With the Indicators of Nutrient Quality (N=2406)*

Canonical Variate	Eigenvalue (R_c^2)	Canonical Correlation (R_c)	Wilk's Lambda (Λ)	Chi Square (χ^2)	df	p
1	.54	.74	.21	1375	112	$.00^+$
2	.37	.61	.46	684	91	$.00^+$
3	.13	.36	.73	274	72	$.00^+$
4	.08	.29	.84	150	55	$.00^+$
5	.04	.19	.92	75	40	$.01^+$
6	.02	.16	.95	42	27	.07
7	.02	.12	.98	20	16	.22
8	.01	.08	.99	6	7	.51

TABLE 39.

Canonical Correlations Among the Indicators of Demographic Characteristics With the Indicators of Food Behaviors (N=2406)*

Canonical Variate	Eigenvalue (R_c^2)	Canonical Correlation (R_c)	Wilk's Lambda (Λ)	Chi Square (χ^2)	df	p
1	.47	.68	.29	1096	136	.00+
2	.22	.47	.55	534	112	.00+
3	.14	.38	.70	313	90	.00+
4	.08	.28	.82	175	70	.00+
5	.06	.25	.89	101	52	.00+
6	.03	.17	.95	46	36	.13
7	.01	.12	.98	20	22	.61
8	.01	.09	.99	7	10	.74

* The sample size varies as a result of case elimination due to missing data. These analyses were run on two separate 5% subsamples of the 10% random subsample generated from the study population (N=24,362).

+ $p \leq .01$.

TABLE 40.

Canonical Correlations Among the Indicators of Nutrient Quality With The Indicators of Food Behaviors (N=2406)*

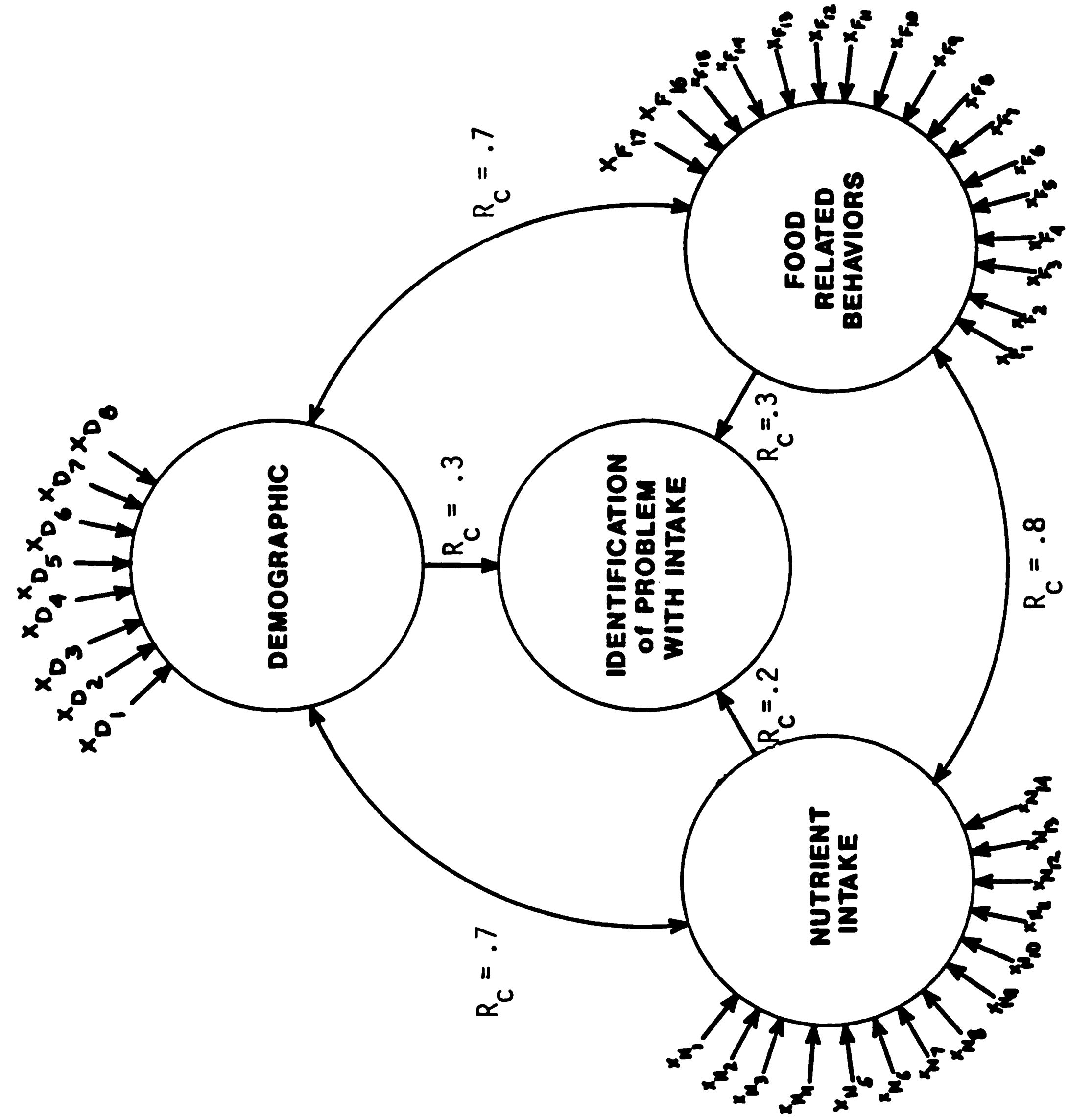
Canonical Variate	Eigenvalue (R_c^2)	Canonical Correlation (R_c)	Wilk's Lambda (Λ)	Chi Square (χ^2)	df	p
1	.64	.80	.04	3776	238	.00+
2	.43	.65	.11	2593	208	.00+
3	.36	.60	.19	1947	180	.00+
4	.30	.55	.29	1428	154	.00+
5	.27	.52	.42	1013	130	.00+
6	.20	.45	.57	653	108	.00+
7	.12	.35	.72	388	88	.00+
8	.09	.29	.81	241	70	.00+
9	.05	.22	.89	135	54	.00+
10	.03	.18	.94	76	40	.00+
11	.02	.13	.97	37	28	.05≠
12	.01	.11	.98	18	18	.48
13	.00	.06	1.00	5	10	.91
14	.00	.03	1.00	1	4	.91

* The sample size varies as a result of case elimination due to missing data. These analyses were run on two separate 5% subsamples of the 10% random subsample generated from the study population (N=24,362).

+ $p \leq .01$.

≠ $p \leq .05$.

FIGURE 5. Estimated Model Based on First Canonical Variate Analyses. Estimates Presented are Canonical Correlations Between the Variable Sets. Tables 41 - 43 List the Canonical Variate Loadings for Indicators of Independent Variable Sets.



DEMOGRAPHIC
IDENTIFICATION of PROBLEM WITH INTAKE
FOOD RELATED BEHAVIORS
NUTRIENT INTAKE
R_C = .7
R_C = .3
R_C = .3
R_C = .2
R_C = .8
R_C = .7

FIGURE 5.

TABLE 41.

Canonical Variate Loadings For the First 5 Canonical Variates Determined Between the Indicators of Demographic Characteristics and Nutrient Quality (N=1782)*

Indicator		Canonical Variate Loadings (λ)				
		1	2	3	4	5
X_{D1}	Age	.89	.43	.06	-.11	.05
X_{D2}	Sex	-.36	.91	-.14	.01	-.11
X_{D3}	Race	-.14	.05	.78	.36	.03
X_{D4}	Education Male	-.11	.19	-.29	.39	.77
X_{D5}	Education Female	.12	-.14	-.71	.42	.09
X_{D6}	Poverty Level	.18	.00	-.41	.68	-.39
	Living Locale:					
X_{D7}	Central City	.03	.03	.31	.53	.22
X_{D8}	Suburban	-.01	-.13	-.32	-.21	-.21
X_{N1}	% Calories Fats	.13	-.13	-.06	-.04	.10
X_{N2}	% Calories CHO	-.25	.06	-.11	-.21	.31
X_{N3}	RDA Protein	-.32	-.52	.08	.23	.02
X_{N4}	RDA Calcium	-.08	-.52	-.43	.01	.11
X_{N5}	RDA Iron	.51	-.57	.17	-.09	.13
X_{N6}	RDA Magnesium	-.04	-.33	-.29	-.03	.02
X_{N7}	RDA Phosphorous	.23	-.54	-.27	.13	-.03
X_{N8}	RDA Vitamin A	-.02	-.04	-.05	.32	.30
X_{N9}	RDA Thiamin	-.12	-.24	.24	.06	.29
X_{N10}	RDA Riboflavin	-.26	-.32	-.15	.03	.05
X_{N11}	RDA Vitamin B_6	-.18	-.58	.13	.23	.06
X_{N12}	RDA Vitamin B_{12}	-.12	-.59	-.17	.32	-.21
X_{N13}	RDA Vitamin C	-.08	-.17	-.13	.53	.52
X_{N14}	Recommended Energy Intakes	.04	-.20	-.11	.19	.22

* The sample size varied due to the missing values for each of the sets. These analyses were conducted on two 5% subsamples of the 10% random subsample.

TABLE 42.

Canonical Variate Loadings For the First 5 Canonical Variates Determined Between the Indicators of Demographic Characteristics and Food Related Behaviors (N=1807)*

Indicator		Canonical Variate Loadings (λ) 1	2	3	4	5
X_{D1}	Age	.97	-.17	-.03	.07	-.02
X_{D2}	Sex	.19	.24	.60	-.31	-.61
X_{D3}	Race	-.17	-.45	.53	.59	.02
X_{D4}	Education Male	.09	.54	.44	-.11	.64
X_{D5}	Education Female	-.09	.65	-.24	-.10	.15
X_{D6}	Poverty Level	.16	.48	-.41	.38	-.12
	Living Locale:					
X_{D7}	C1 - Central City	-.02	-.01	.50	.29	.04
X_{D8}	C2 - Suburban	-.07	.53	-.22	.33	-.14
X_{F1}	Weight Status	.22	-.16	.10	.04	-.37
X_{F2}	Milk	-.30	.18	-.17	-.23	.35
X_{F3}	Coffee/Tea	.80	.04	-.38	-.03	-.13
X_{F4}	Meat	.02	-.07	-.41	.51	.23
X_{F5}	Legume	-.09	-.37	-.08	-.04	.02
X_{F6}	Starchy Dishes	-.11	-.44	-.06	.47	.29
X_{F7}	Vegetables	.39	.12	-.17	.12	.27
X_{F8}	Bread	.05	-.32	-.44	.10	.29
X_{F9}	Cereal	-.01	-.03	-.13	-.22	.48
X_{F10}	Frozen Desserts	-.18	.41	-.20	-.23	.28
X_{F11}	Cakes, Cookies	-.16	.39	-.35	-.23	.41
X_{F12}	Butter & Margarine	.16	.03	-.34	.14	.01
X_{F13}	Nut Butters	-.29	.07	-.16	-.07	.24
X_{F14}	Ate Alone	.43	.02	.67	-.17	.43
X_{F15}	# Days Breakfast	.10	-.09	-.13	.06	.26
X_{F16}	# Days Lunch	.10	-.50	-.22	-.33	.11
X_{F17}	# Days Supper	-.03	-.50	-.12	-.56	.01

* The sample size varied from 2406 as a result of case elimination due to missing data. These analyses were run on two separate 5% subsamples of the 10% random subsample generated from the total study population (N=24,362).

TABLE 43.

Canonical Variate Loadings for the First 5 Canonical Variates Determined Between the Indicators of Nutrient Quality and Food Related Behaviors (N=2357)*

	Canonical Variate Loadings (λ)				
Indicator	1	2	3	4	5
X N1 % Calories Fat	-.22	.43	-.34	-.18	.30
X N2 % Calories CHO	.35	-.17	.37	.16	-.37
X N3 RDA Protein	.49	.55	-.10	-.12	.05
X N4 RDA Calcium	.73	.35	.06	.06	.19
X N5 RDA Iron	.10	.60	.32	-.13	-.06
X N6 RDA Magnesium	.45	.52	.54	.05	.12
X N7 RDA Phosphorous	.37	.55	.12	.01	.14
X N8 RDA Vitamin A	.36	.34	.34	-.28	.25
X N9 RDA Thiamin	.42	.58	.17	-.24	-.10
X N10 Riboflavin	.76	.40	.11	-.12	.03
X N11 RDA Vitamin B 6	.55	.37	.19	-.31	-.08
X N12 RDA Vitamin B 12	.50	.41	-.16	-.15	.12
X N13 RDA Vitamin C	.29	.23	.15	-.26	.05
X N14 Recommended Energy Intakes	.30	.82	.05	.00	.02
X F1 Weight Status	-.10	.00	.02	.01	.03
X F2 Milk	.83	.12	.14	.08	.18
X F3 Coffee/Tea	-.56	.22	.54	.17	.20
X F4 Meat	-.12	.69	-.04	-.23	.05
X F5 Legume	.00	.07	.26	.06	-.14
X F6 Starchy Dishes	-.05	.36	-.08	-.10	-.15
X F7 Vegetables	-.02	.37	.29	-.27	.33
X F8 Bread	.10	.62	-.03	.10	-.01
X F9 Cereal	.53	-.05	.52	-.24	-.17
X F10 Frozen Desserts	.29	.24	-.04	.02	.08
X F11 Cakes, Cookies	.28	.47	.12	.16	-.09
X F12 Butter & Margarine	-.02	.51	.08	.00	.19
X F13 Nut Butters	.25	.06	.24	.25	.01
X F14 Ate Alone	-.14	-.09	.05	.01	.01
X F15 # Days Ate Breakfast	.24	.25	.19	-.10	.01
X F16 # Days Ate Lunch	-.05	.08	.02	-.02	-.04
X F17 # Days Ate Supper	.07	.08	.07	.09	-.13

* Sample size varied for the 2406 as a result of case elimination due to missing data. These analyses were run in two separate 5% subsamples of the 10% random subsample generated from the total study population (N=24,362).

indicators. In the demographic-nutrient quality analysis, age (λ = .97) of the demographic indicators and iron (λ = .51) in the nutrient quality indicators were the specific variables primarily accounting for the variance explained by the first reference axis (see Table 41). In the demographic-food related behaviors, age (λ = .97) as the demographic indicator and coffee/tea (λ = .80) as the food related behavior indicator were the indicators which primarily accounted for the proportion of variance explained by the two sets of indicators (see Table 42). The average three day percent RDA for riboflavin (λ = .76) and calcium (λ = .73) of the nutrient quality indicators and the total number of mentions of the milk group (λ = .83) in the food related behavior indicators were the variables which primarily accounted for the variance explained by the first canonical variate between the groups (see Table 43).

From the Tables 41-43, the specific indicators which accounted for the variance explained by the canonical variates determined between groups can be determined. Many of these results were expected. For instance, in the analyses between the nutrient quality and food related behaviors group, percent RDA riboflavin and calcium and milk were the indicators with the highest loadings. Milk is a good source and provides large portions of the RDA requirements for riboflavin and calcium. In the second orthogonal canonical variate derived between those groups, REI and bread and meat were the primary indicators accounting for the explained variance between the groups. Bread and meat had among the highest average number of mentions for the three days and were two food groups eaten by the most respondents, which would explain the relationship. In the analyses between demographic characteristics and nutrient quality and food related behaviors, age was the indicator which accounted for the primary variance explained by the first canonical variates in both cases. This was expected because eating behaviors and RDA vary significantly between age categories (Crocetti and Guthrie, 1982).

Summary

Phase II of this investigation was designed to investigate and quantify the relationships between sets of independent variables representing demographic characteristics, nutrient intake, and food related behaviors and the dependent variable, problem versus no problem group. Multivariate analyses were used to investigate factors interacting in food related behaviors.

The no problem group was younger, ate more in terms of total number of mentions of specific food groups, and ate more (in number) of specific meals than the group that identified some type of factor affecting or problem with their intake. Many of the other findings as the no problem group having all average percent RDA intakes higher than the problem group were expected given the larger intakes in terms of calories and specific food groups of the no problem group over the problem group.

Discriminant analyses were used to quantify the relationship between each of the sets of independent variables and the dependent variable. Low correlation coefficients were determined ($R_c \leq .3$). These results may have meant that the problem no problem groups were very similar in composition or patterned variation and subsequently differentiation or explanation may have been difficult. It may also have meant that the indicators used in the model to represent each of the sets of independent variables were not appropriate, not measured well, and/or misspecified in functional form .

Canonical analyses were conducted to determine the relationships between each of the sets of indicators representing independent variables. The correlations obtained from canonical variate analyses (see Figure 5 and Tables 38-40) were moderately high ($R_c \geq .7-.8$) and the amount of patterned variation accounted for by the sets of variables moderate (50 to 60% in the first canonical variates). Age was the indicator explaining the largest proportion of the variation between sets when demographic characteristics were included. Relationships between specific nutrient average percent RDA intake and food groups were documented (such as calcium and riboflavin and the milk group).

This investigation further "unraveled" specific relationships between <u>sets</u> of variables affecting food related behaviors. It built upon previous findings which identified relationships between these independent variable sets. It went a step beyond traditional econometric techniques, in that the correlations were derived between sets rather than individual indicators. The findings may be used to further refine and direct future analyses to unfold a better set of measured indicators for each of the independent variable sets. Analyses to derive explanatory variables are critical steps in groundng understandings of conceptual schemes which facilitate eventual theory development in applied nutrition.

FOOTNOTES

[1]As Woelfel et al., 1980 point out, the diagonal entries of the standardized correlation matirx are 1 or unity. This is due to the fact that where $\bar{i} = \bar{j}$ the angle is 0 and the cosine of 0 = 1.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The Department of Agriculture (USDA) staff included two questions in the 1977-78 Nationwide Food Consumption Survey (NFCS) on the U.S. population's behavior that could affect food and nutrient intake patterns. First, individuals participating in the NFCS reported if they were on a doctor prescribed diet, on a group, or an individual diet regimen. They then responded to a list of nine items that might affect food consumption. These nine items were: being on a diet to lose weight; being on a diet to gain weight; having a chewing problem; having a medical problem like diabetes or an allergy; foods not agreeing with them; not liking to eat breakfast early in the morning; having no interest in cooking for one person; not liking to eat certain foods; and other.

Almost 50 percent (49.5%) of the NFCS respondents were on a diet listed in the first question or checked at least one item in the second question (Crocetti and Guthrie, 1982). Thus a large sample identified themselves as having at least one behavior that potentially could affect dietary intake.

This secondary analysis of NFCS data was conducted in two phases. In Phase I the entire study population (N = 24,362) was divided into four groups based upon whether answers to the two questions were medically or nonmedically related: MEDICAL (4.0%), NON-MEDICAL (39.5%), NON-MEDICAL & MEDICAL (6.0%), and NONE (50.5%). The MEDICAL group reported either a doctor prescribed diet and/or a medical problem like diabetes or an allergy. The NON-MEDICAL group reported being on a group or individual diet regimen and/or any one of the other eight factors affecting intake (excluding the one medical problem). The NON-MEDICAL & MEDICAL group reported a medical problem(s) and a non-medical factor(s). The NONE group did not report any of the medical problems or non-medical factors. Sets of descriptive characteristics were derived for each of the four groups. The statistically determined descriptions included: demographic characteristics; meal and snack patterns; nutrient quality assessment; and food related behaviors.

The NON-MEDICAL & MEDICAL and MEDICAL groups had the most respondents over 55 years of age and were comparable in socio-economic characteristics. As expected, they lived in smaller households with more: non-working adults, female only headed households, and lower education levels for head of households. These groups also were similar in frequency of dietary intake from food groups and in eating out and eating alone behaviors.

The NONE and NON-MEDICAL had the most respondents under 18 years of age, living in larger households, and with employed head(s) of household. Personal food behaviors such as intake frequency for food groups, eating alone, and eating out were alike for these two groups.

The NONE and MEDICAL groups had the most respondents eating three-meal-a-day patterns. The NON-MEDICAL and NON-MEDICAL & MEDICAL had the most respondents reporting patterns of two and/or three meals a day. All groups reported snacking ($\geq$73%) with groups not varying considerably from one another.

The NON-MEDICAL and NON-MEDICAL & MEDICAL had more respondents ingesting foods meeting less than 60 percent of their Recommended Dietary

Allowances (RDA) for seven nutrients: calcium, iron, magnesium, vitamin A, vitamin B_6, vitamin B_{12}, and vitamin C (marginality index). Conversely, the NONE and MEDICAL groups had the most respondents ingesting foods with more than 59.9 percent of the RDA for the seven nutrients.

Therefore, meal patterns and total number of mentions of food groups were the characteristics which differentiated nutrient quality assessment between the four groups. A descriptive composite for each groups is presented. The application of these descriptive composites is discussed.

Phase II was a theoretical treatment of the data set to: 1) demonstrate that if adequate data sets are available they could be used to study factors affecting food behavior and 2) assess factors potentially affecting food intake. The sample was divided into two groups, PROBLEM versus NO PROBLEM affecting dietary intake. The respondents reporting any one of the items in the two NFCS questions were in the PROBLEM group (49.5%). A model was derived and estimated using multivariate techniques. The dependent variable was the PROBLEM versus NO PROBLEM group. The three independent variable sets represented demographic characteristics, food related behaviors, and nutrient intakes. Correlational relationships were determined between each of the variable sets.

Two five percent random subsamples (N = 1,200) of the total study population used in Phase I were used to estimate the model and cross-validate results. The preliminary tasks of Phase II consisted of determining specific variables, indicator variables, from the NFCS data set to define the independent variable sets in the model. For example, the indicator variables determined to represent demographic characteristics were: age, sex, race, education of male and female head(s) of household, poverty level, and central city and suburban location of household residence. Also in the preliminary tasks was the investigation of the underlying assumptions of the multivariate statistical techniques used in analyses.

Descriptive statistics were generated for the PROBLEM versus NO PROBLEM groups. The NO PROBLEM group was younger, ate more , and reported more meals than the PROBLEM group. The NO PROBLEM group had higher mean percent RDA nutrient intakes and mean caloric intakes than the PROBLEM group.

These findings agreed with the findings of Phase I. On the average, the respondents in the PROBLEM group reported fewer mentions of food groups than the respondents in the NO PROBLEM group. They were also not eating as many meals and had lower mean percentages for nutrient intakes based on their RDA. Snacks did not contribute food groups or nutrients needed for the PROBLEM group to equal food group or nutrient intake of the NO PROBLEM group.

Once the indicator variables to be used in the model were described, the model was estimated. Discriminant analyses were used to compute correlation coefficients between the dependent variable, PROBLEM versus NO PROBLEM, and each of the independent variable sets: demographic characteristics, food related behaviors, and nutrient intake. Correlation coefficients summarized the strength of association between the variable sets and also provided a means for comparing association across groups. Low correlations ($R_c \leq .3$) were determined between the groups. The use of other indicators or more precise measurements of the independent variable sets might explain more of the patterned variation in the PROBLEM versus NO PROBLEM groups.

In addition, the relationships between the sets of independent variables were determined using canonical correlation analyses to determine general strength of association between the sets and which indicator variable(s) in the variable sets accounted for the most patterned variation between sets. The correlations obtained for the first canonical variate analyses were moderately high (R_c's of .7 to .8). The R_c^2 represented the amount of patterned variation accounted for by the sets of variables. The R_c^2's were moderate (approximately 50 to 60%) by the first canonical variates.

Age, sex, race, and poverty level were the characteristics accounting for the largest proportions of patterned variation in the analyses between demographic and nutrient quality indicators. Between demographic and food related indicators age accounted for the most patterned variation in the first canonical variate. A combination of variables accounted for the patterned variation between nutrient quality and food related indicators. In the first canonical variate, number of mentions of the food group milk, percent RDA intake of riboflavin, and percent RDA intake of calcium explained the most variation. This makes sense since milk is a good source of riboflavin and calcium.

Findings from Phase II may be used to identify appropriate variables to use as indicators for each of the independent variable sets. Also shown was that with precise measurements of appropriate variables, multivariate analyses can be used to study factors affecting food intake.

Limitations of the Study

Limitations of conducting a secondary analysis of the NFCS are discussed in detail in Chapter II. Considerations included: sampling techniques, dietary data collection methodology, question selection and wording, sample completion rates and variable construction. These considerations and financial constraints were viewed as the primary limitations of this study.

Strengths of the study

The NFCS had approximately 25,000 respondents and data were collected on demographics, food intake, and selected personal factors or behaviors which may affect food habits. Descriptive composites were derived based on respondents reported factors affecting dietary intakes.

The strengths of Phase II were the appropriate use of methodologies to determine the relationships between sets of variables affecting or interrelated in food behaviors and PROBLEM versus NO PROBLEM groups. Estimation techniques used derived correlational/mathematical relationships between sets of variables. Phase II was designed to have theory building application.

Conclusions/Implications

Almost 50 percent of the NFCS sample responded "yes" to one or more behaviors they had which could affect their dietary intake. Meal patterns and food group intakes were the distinguishing characteristics in nutrient quality assessment analyses among the four subgroups. Mathematical relationships between sets of variables representing food related behaviors were estimated in Phase II.

Phase I

Descriptive characteristics were determined for four population segments based upon their response to two dietary problem questions. The medical problem groups have been and continue to be evaluated in other national sample surveys, for example by the National Center for Health Statistics (1978). The population segments which reported non-medical factors had not been evaluated in these specific terms in a national sample prior to the NFCS. Expanded analyses and refinement of measurements might provide researchers clearer understandings about general public perceptions of factors affecting (positively or negatively) their dietary intake. Communication specialists and nutrition educators concur that messages presented in terms familiar and meaningful to target populations should have greatest impact.

Phase I results complemented the findings of Crocetti and Guthrie (1982). Meal patterns and total number of mentions of food groups were the characteristics which differentiated nutrient quality assessment. The two groups which had the largest percentages of respondents eating three meals a day (the NONE and MEDICAL groups) had the smallest percentages in the marginal ($\leq$ 59.9% RDA) intake categories for seven nutrients. The two groups identifying some type of non-medical factors (NON-MEDICAL and NON-MEDICAL & MEDICAL) had the most respondents in the nonregular three-meal-a-day patterns. These non-medical groups also had the most respondents in the marginal intake categories for seven nutrients.

In summary, the descriptive characteristics derived in Phase I can be used to target nutrition education messages or strategies. For example, the findings related to meal and snack patterns may alert nutritionists and health educators to stress more nutrient dense food items since total average caloric intake appears to be decreasing as determined by other analyses of NFCS data.

The findings may also be used to define questions for future surveys which seek to assess problems or factors affecting dietary intake. An example of this would be redefining data collection on factors affecting intakes and/or snacking behavior to improve possibilities for detailed investigation.

Phase II

In Phase II multivariate techniques were explored in the estimation of a model representing food related behaviors. Phase II results defined the mathematical relationships between sets of variables interrelated in food intake patterns.

The findings lead us to believe that multivariate analysis techniques may be used to describe statistical associations between variables affecting food intake. Several demographic variables as age, sex, and race explained patterned variation between indicators of demographics and nutrient intake and food related behaviors. The significance of these specific variables has been documented in previous investigations of food consumption data. However, the relationship of these variables to the total model had not been investigated before. Predictive understandings of food related behaviors may be furthered by more precise measurement of variables and refinement in the process of developing models. Use of analytical methods and theories from such disciplines as sociology, anthropology, and psychology hold promise for advancement in modeling of food related behaviors.

APPENDIX A
VARIABLE CONSTRUCTION AND DESCRIPTIONS

APPENDIX A-1

CALCULATIONS USED IN DEVELOPING THE "MARGINALITY SCORE" FOR SEVEN NUTRIENTS

Seven Nutrients	"Weight" Assigned	Percent RDA for 3 Day Average
Calcium	1	$\geq$ 80.0 (desirable)
Iron	2	$\geq$ 60.0-79.9 (acceptable)
Magnesium	9	$\leq$ 59.9 (marginal)
Vitamin A		
Vitamin B_6		
Vitamin B_{12}		
Vitamin C		

Patterns	Raw Score	# Nutrients Marginal
1 1 1 1 1 1 1	7	None
1 1 1 1 1 1 2	8	
1 1 1 1 1 2 2	9	
1 1 1 1 2 2 2	10	
1 1 1 2 2 2 2	11	
1 1 2 2 2 2 2	12	
1 2 2 2 2 2 2	13	
2 2 2 2 2 2 2	14	
1 1 1 1 1 1 9	15	One
1 1 1 1 1 2 9	16	
1 1 1 1 2 2 9	17	
1 1 1 2 2 2 9	18	
1 1 2 2 2 2 9	19	
1 2 2 2 2 2 9	20	
2 2 2 2 2 2 9	21	
1 1 1 1 1 9 9	23	Two
1 1 1 1 2 9 9	24	
1 1 1 2 2 9 9	25	
1 1 2 2 2 9 9	26	
1 2 2 2 2 9 9	27	
2 2 2 2 2 9 9	28	
1 1 1 1 9 9 9	31	Three
1 1 1 2 9 9 9	32	
1 1 2 2 9 9 9	33	
1 2 2 2 9 9 9	34	
2 2 2 2 9 9 9	35	
1 1 1 9 9 9 9	39	Four
1 1 2 9 9 9 9	40	
1 2 2 9 9 9 9	41	
2 2 2 9 9 9 9	42	
1 1 9 9 9 9 9	47	Five
1 2 9 9 9 9 9	48	
2 2 9 9 9 9 9	49	
1 9 9 9 9 9 9	55	Six
2 9 9 9 9 9 9	56	
9 9 9 9 9 9 9	63	Seven

APPENDIX A-2

CALCULATIONS USED IN DEVELOPING THE "PFC SCORE"

	Cut Points and Weights		
	Weight: 2	Weight: 1	Weight: 2
	%	%	%
Protein (P)	≤ 9.9	10.0-25.0	≥ 25.1
Fat (F)	≤19.9	20.0-35.0	≥ 35.1
Carbohydrates (C)	≥70.1	70.0-40.0	≤ 40.1

Patterns

P	F	C	Score	"Meaning"
1	1	1	1	All three adequate
				Two adequate, one inadequate when:
1	1	2	2	P & F adequate, C inadequate
1	2	1	3	P & C adequate, F inadequate
2	1	1	4	F & C adequate, P inadequate
				One adequate, two inadequate when:
1	2	2	5	P adequate, F & C inadequate
2	1	2	6	F adequate, P & C inadequate
2	2	1	7	C adequate, P & F inadequate
2	2	2	8	All three inadequate

APPENDIX A-3

CROCETTI 32 FOOD GROUPS

BEVERAGES

1. Milk
2. Fruit and Vegetable Juices
3. Coffee and Tea
4. Soft Drinks
5. Fruitades and Drinks
6. Alcoholic Beverages
7.

OTHER FOODS

7. Soup
8. Eggs
9. Cheese
10. Meats
11. Meat Mixtures
12. Poultry
13. Poultry Mixtures
14. Fish, Shellfish, Seafood
15. Fish, Shellfish, Seafood Mixtures
16. Legumes
17. Plain Starchy Side and Main Dishes
18. Vegetables
19. Starch, Vegetable and Protein Mixtures
20. Bread
21. Hot and Cold Cereals
22. Fruits
23. Frozen Desserts
24. Non-frozen, "Spoon" Desserts
25. Cakes, Cookies, Pies, Pastries, etc.
26. "Snacky" Foods
27. Candies, Sweets, Chocolates
28. Garnishes
29. Butter and Margarine
30. Sugar Garnishes
31. Nut Butters
32. Nutrient Supplements, Meal Extenders, "Health Foods"

APPENDIX A-4

SELECTION OF VARIABLES TO BE INCLUDED IN PHASE II

Glossary of Indicators:

A cleared data tape was copied from Crocetti and Guthrie (1982) secondary analysis of the NFCS. It contained data on variables that were actually coded as they had been by USDA on the household and individual questionnaires. It also contained variables that were constructed for usage as in Phase I. (See Chapter III., Section 2.). In this appendix, a listing is presented which identifies variables as they were found on the data tape and/or how they were combined or categorized for usage in Phase II. The list serves as a glossary of indicators for the model. It is organized in four categories based on the sets of variables used in estimating the model: (1) problem affecting intake; (2) demographic characteristics; (3) personal and food related behaviors; and (4) nutrient intake. The list only includes those variables that were used in the model.

Variable Name	Unit of Measure or Categories of Variable	Discussion of Variable Construction
(1) <u>Problem Group-</u>		
Dependent Variable		Yes - respondents who identified any non-medical or medical factor
Problem	Yes (1)	
No Problem	No (2)	No - respondents who identified no problems or factors affecting intake

Variable Name		Unit of Measure or Categories of Variable	Discussion of Variable Construction
(2) Demographic Characteristics-			
Set of independent variables includes:			
X_{D_1}	Age	Number of years	Calculated from date of birth given on questionnaire
X_{D_2}	Sex	Male (1) Female (2)	*
X_{D_3}	Race	White (1) Black (2)	*
X_{D_4}	Education of Male Head of Household	Number of Years	*
X_{D_5}	Education of Female Head of Household	Number of Years	*
X_{D_6}	Poverty	Poverty index (U.S. Bureau of the Census, 1971)	*
X_{D_7} and X_{D_8}	City Characteristic	(1) Central City (2) Suburban (3) Non-Metro	* Dummy coded (X_{D_7} - City C_1 - Central City X_{D_8} - City C_2 - Suburban)

Variable Name		Unit of Measure or Categories of Variable	Discussion of Variable Construction
(3) Nutrient Intake -			
Set of independent variables includes:			
X_{N_1}	3 Day Average % Calories from Fat	percent	+
X_{N_2}	3 Day Average % Calories from Carbohydrates	percent	+
X_{N_3}	3 Day Average % RDA Protein	percent	+
X_{N_4}	3 Day Average % RDA Calcium	percent	+
X_{N_5}	3 Day Average % RDA Iron	percent	+
X_{N_6}	3 Day Average % RDA Magnesium	percent	+
X_{N_7}	3 Day Average % RDA Phosphorus	percent	+
X_{N_8}	Log of 3 Day Average % RDA Vitamin A	percent	Log Transformation of calculated value
X_{N_9}	3 Day Average % RDA Thiamin	percent	+
$X_{N_{10}}$	3 Day Average % RDA Riboflavin	percent	+
$X_{N_{11}}$	3 Day Average % RDA Vitamin B_6	percent	+
$X_{N_{12}}$	Log of 3 Day Average % RDA Vitamin B_{12}	percent	Log transformation of calculated value
$X_{N_{13}}$	3 Day Average % RDA Vitamin C	percent	+
$X_{N_{14}}$	3 Day Average % Recommended Energy Intake (REI)	percent	+

Variable Name		Unit of Measure or Categories of Variable	Discussion of Variable Construction
(4) Personal and Food Related Behaviors-			
Set of independent variables includes:			
X_{F_1}	Weight Status	percent (1.00 equal within normal range (+ .10 equal 10% over normal range).	Discussed in Chapter III.
X_{F_2}	Milk Food Group (#1)	# of times mentioned food group: 3 days total	+
X_{F_3}	Coffee/Tea Food Group (#3)	"	+
X_{F_4}	Meat Food Group (#10)	"	+
X_{F_5}	Legume Food Group (#16)	"	+
X_{F_6}	Starchy Side and Main Dish Food Group (#17)	"	+
X_{F_7}	Vegetables (#18)	"	+
X_{F_8}	Bread Food Group (#20)	"	+
X_{F_9}	Cereal Food Group (#21)	"	+
$X_{F_{10}}$	Frozen Dessert Food Group (#23)	"	+
$X_{F_{11}}$	Cakes, Cookies and Pies Food Group (#25)	"	+
$X_{F_{12}}$	Butter and Margarine Food Group (#29)	"	+

Variable Name		Unit of Measure or Categories of Variable	Discussion of Variable Construction
(4)	Personal and Food Related Behaviors (Continued)		
$X_{F_{13}}$	Nut Butter Food Group (#31)	# of times mentioned food group: total of 3 days	+
$X_{F_{14}}$	Ate Alone-Some Meals Day 2	(1) Yes (2) No	Dummy coded from Ate Alone Day 2 category: ate alone >1 meal, but less than all meals.
$X_{F_{15}}$	Number of Days Ate Breakfast	# of Days	Crocetti, A.F. and Guthrie, H.A. (1981)
$X_{F_{16}}$	Number of Days Ate Lunch or Brunch	"	"
$X_{F_{17}}$	Number of Days Ate Dinner	"	"

* Identified as was coded on NFCS questionnaire or as USDA transformed respondent's answers and coded on NFCS tapes provided to contractees.

+ Crocetti, A.F. and Guthrie, H.A. Final Report: A secondary analysis of the NFCS to Study Food Consumption Patterns of the U.S. Washington, D.C.: U.S.D.A., 1982 (U.S.D.A.-CNC Contract No. 53-53-32U4-9-192).

APPENDIX A-5

"COMPOSITE INDEX" CATEGORIES

Marginality Index- 7*	'PFC Index' All "okay"	One Outside Range	Two or More Outside Ranges
NONE	A	B	C
ONE	D	E	F
TWO	G	H	I
THREE-SEVEN	J	K	L

* Marginality Index represents the number of nutrients ingested at less than or equal to 59.9 percent of the RDA. The seven nutrients in Marginality Index: calcium, iron, magnesium, vitamin A, vitamin B_6, vitamin B_{12}, and vitamin C.

A - All macronutrients within ranges weight '1' and no micronutrients less than or equal to 59.9% RDA.

B - One macronutrient outside of specified range and no micronutrient less than or equal to 59.9% RDA.

C - Two or more macronutrients outside of specified ranges and no micronutrient less than or equal to 59.9% RDA.

D - All macronutrients within ranges weight '1' and one micronutrient less than or equal to 59.9% RDA.

E - One macronutrient outside of specified range and one micronutrient less than or equal to 59.9% RDA.

F - Two or more macronutrients outside of specified ranges and one micronutrient less than or equal to 59.9% RDA.

G - All macronutrients within ranges weight '1' and two micronutrients less than or equal to 59.9% RDA.

H - One macronutrient outside of specified range and two micronutrients less than or equal to 59.9% RDA.

I - Two or more macronutrients outside of specified ranges and two micronutrients less than or equal to 59.9% RDA.

J - All macronutrients within ranges weight '1' and three-seven micronutrients less than or equal to 59.9% RDA.

K - One macronutrient outside of specified range and three-seven micronutrients less than or equal to 59.9% RDA.

L - Two or more macronutrients outside of specified ranges and three-seven micronutrients less than or equal to 59.9% RDA.

APPENDIX B

PHASE II:

PRINCIPAL COMPONENT ANALYSES AND CORRELATION TABLES

TABLE B-1.

Correlation Matrix: Indicators of Demographic Characteristics (N=951*)

	AGE	SEX	RACE	EDUCM	EDUCF	POVERTY	CITYC1	CITYC2
AGE	1.00000	.05039	-.09074	-.02888	-.04855	.04675	.01672	-.04301
SEX	.05039	1.00000	-.01059	.16772	-.06121	.01740	-.00221	-.01874
RACE	-.09074	-.01059	1.00000	-.01911	-.17152	-.23728	.37431	-.24565
EDUCM	-.02889	.16772	-.01911	1.00000	.54521	.14827	.11107	.10311
EDUCF	-.04855	-.06121	-.17152	.54521	1.00000	.39896	-.00441	.07222
POVERTY	.04675	.01740	-.23729	.14827	.39896	1.00000	-.04669	.16468
CITYC1	.01672	-.00221	.37431	.11167	-.00441	-.04669	1.00000	-.47699
CITYC2	-.04301	-.01874	-.24565	.10311	.07222	.16468	-.47699	1.00000

DETERMINANT OF CORRELATION MATRIX = .39654611 .39654607+000)

* N= Half of the 10% random subsample of the study population in Phase II (N=2,406). The N's reflect the sample size with no missing values for each of the respective independent variable indicators.

TABLE B-2.

Correlation Matrix: Indicators of Nutrient Quality (N=1,177*)

	CALOFAT	CALOCHO	RDAPRO	RDACALC	RDAFE	RDAMAG	RDAPHOSP	LRDAVITA	RDATHIA	RDARIBO
CALOFAT	1.00000	-.81378	.17764	.06869	.06732	-.04818	.14028	-.02296	-.01564	-.01067
CALOCHO	-.81378	1.00000	-.16741	-.06396	-.06868	.09551	-.16824	.09158	.11813	.08296
RDAPRO	.17764	-.16741	1.00000	.66396	.52777	.76108	.74931	.40461	.61916	.72023
RDACALC	.06869	-.06396	.66396	1.00000	.48106	.70405	.85341	.43676	.51627	.78868
RDAFE	.06732	-.06868	.52777	.48106	1.00000	.61203	.71588	.35223	.54102	.46630
RDAMAG	-.04818	.09551	.76108	.70405	.61203	1.00000	.77305	.47642	.64870	.70713
RDAPHOSP	.14028	-.16824	.74931	.85341	.71588	.77305	1.00000	.38115	.56855	.68122
LRDAVITA	-.02296	.09158	.40461	.43676	.35223	.47642	.38115	1.00000	.43062	.55769
RDATHIA	-.01564	.11813	.61916	.51627	.54102	.64870	.56855	.43062	1.00000	.75570
RDARIBO	-.01067	.08296	.72023	.78868	.46630	.70713	.68122	.55769	.75570	1.00000
RDAB6	-.00573	.01098	.76255	.55581	.56045	.68510	.61206	.46481	.68993	.73739
LRDA12	.19751	-.16626	.62051	.57429	.42836	.44983	.56705	.41964	.43580	.71015
RDAVITC	-.13601	.14998	.34207	.25126	.25472	.38938	.24836	.39483	.40443	.29974
REI	.12520	-.01469	.73071	.57569	.56067	.70589	.70936	.41581	.69948	.67710

	RDAB6	LRDA12	RDAVITC	REI
CALOFAT	-.00573	.19751	-.13601	.12520
CALOCHO	.01098	-.16626	.14998	-.01469
RDAPRO	.76255	.62051	.34207	.73071
RDACALC	.55581	.57429	.25126	.57569
RDAFE	.56045	.42836	.25472	.56067
RDAMAG	.68510	.44983	.38938	.70589
RDAPHOSP	.61206	.56705	.24836	.70936
LRDAVITA	.46481	.41964	.39483	.41581
RDATHIA	.68993	.43580	.40443	.69948
RDARIBO	.73739	.71015	.29974	.67710
RDAB6	1.00000	.58830	.41938	.60624
LRDA12	.58830	1.00000	.20082	.50038
RDAVITC	.41938	.20082	1.00000	.30550
REI	.60624	.50038	.30550	1.00000

DETERMINANT OF CORRELATION MATRIX = .0000040(.40071009-005)

* N = Half of the 10% random subsample of the study population in Phase II (N=2,406). The N's reflect the sample size with no missing values for each of the respective independent variable indicators.

TABLE B-3.

Correlation Matrix: Indicators of Food Related Behaviors (N=1,194*)

	WTSTAT	FDGP1	FDGP3	FDGP10	FDGP16	FDGP17	FDGP18	FDGP20	FDGP21	FDGP23
WTSTAT	1.00000	-.05267	.03675	.03429	-.01150	-.00643	.06179	-.01749	-.07275	-.01403
FDGP1	-.05267	1.00000	-.10156	-.01319	-.02421	.00561	.04409	.10605	.37605	.12775
FDGP3	.03675	-.10156	1.00000	.07426	-.01769	.01820	.21632	.07173	-.09614	-.07785
FDGP10	.03429	-.01319	.07426	1.00000	.03525	.20026	.20392	.41782	-.08023	.04450
FDGP16	-.01150	-.02421	-.01769	.03525	1.00000	.17872	.02905	.09529	-.03497	-.01776
FDGP17	-.00643	.00561	.01820	.20026	.17872	1.00000	.07567	.06438	-.02704	-.00894
FDGP18	.06179	.04409	.21632	.20392	.02905	.07567	1.00000	.13902	.03559	.03528
FDGP20	-.01749	.10605	.07173	.41782	.09529	.06438	.13902	1.00000	-.03656	.06776
FDGP21	-.07275	.37605	-.09614	-.08023	-.03497	-.02704	.03559	-.03656	1.00000	.09404
SFDGP23	-.01403	.12775	-.07785	.04450	-.01776	-.00894	.03528	.06776	.09404	1.00000
FDGP25	-.03999	.20345	.01960	.08174	-.05007	-.01050	.02765	.13496	.14424	.23530
FDGP29	-.06291	.14723	.13560	.15301	.01927	.07915	.14753	.42382	-.05340	.09256
FDGP31	-.07587	.17207	-.14330	-.04477	-.01603	-.09626	-.04755	.11215	.09368	.14230
EAT22	.02467	-.05131	.02293	-.10191	-.07761	-.14469	-.06319	-.06416	.03656	-.08120
DAYSNO1	-.01160	.23129	.09907	.12266	.00764	.04781	.07311	.23103	.20412	.07192
DAYSNO2	-.06171	.15003	-.02228	.04865	-.04358	-.00407	.07260	.11510	.06118	.06565
DAYSNO5	.05464	.01969	.04717	.00970	.09606	.09927	-.05898	.13086	.05239	-.01401

	FDGP25	FDGP29	FDGP31	EAT22	DAYSNO1	DAYSNO2	DAYSNO5
WTSTAT	-.03999	-.06291	-.07587	.02467	-.01160	-.06171	.05464
FDGP1	.20345	.14723	.17207	-.05131	.23129	.15003	.01969
FDGP3	.01960	.13560	-.14330	.02293	.09907	-.02228	.04717
FDGP10	.08174	.15301	-.04477	-.10191	.12266	.04865	.00970
FDGP16	-.05007	.01927	-.01603	-.07761	.00764	-.04358	.09606
FDGP17	-.01050	.07915	-.09626	-.14469	.04781	-.00407	.09927
FDGP18	.02765	.14753	-.04755	-.06319	.07311	.07260	-.05898
FDGP20	.13496	.42382	.11215	-.06416	.23103	.11510	.13086
FDGP21	.14424	-.05340	.09368	.03656	.20412	.06118	.05239
SFDGP23	.23530	.09256	.14230	-.08120	.07192	.06565	-.01401
FDGP25	1.00000	.09728	.14122	-.07535	.13536	.10156	-.00718
FDGP29	.09728	1.00000	-.00329	-.05398	.16574	.02543	.04076
FDGP31	.14122	-.00329	1.00000	-.04051	.05777	.10567	-.01352
EAT22	-.07535	-.05398	-.04051	1.00000	-.05356	-.06110	.02088
DAYSNO1	.13536	.16574	.05777	-.05356	1.00000	.02473	.02247
DAYSNO2	.10156	.02543	.10567	-.06110	.02473	1.00000	-.10292
DAYSNO5	-.00718	.04076	-.01352	.02088	.02247	-.10292	1.00000

DETERMINANT OF CORRELATION MATRIX = .2254486(.22544857+000)

* N = Half of the 10% random subsample of the study population in Phase II (N=2,406). The N's reflect the sample size with no missing values for each of the respective independent variable indicators.

TABLE B-3.

Correlation Matrix: Indicators of Food Related Behaviors (N=1,194*)

	WTSTAT	FDGP1	FDGP3	FDGP10	FDGP16	FDGP17	FDGP18	FDGP20	FDGP21	FDGP23
WTSTAT	1.00000	-.05267	.03475	.01829	-.01850	-.02643	.06179	-.01769	-.07275	-.01603
FDGP1	-.05267	1.00000	-.10156	-.01319	-.02421	.00541	.04408	.10665	.37605	.16775
FDGP3	.03475	-.10156	1.00000	.07426	-.01769	.01820	.21632	.07173	-.09614	-.07785
FDGP10	.01829	-.01319	.07426	1.00000	.03525	.20024	.20192	.41782	-.08023	.04450
FDGP16	-.01850	-.02421	-.01769	.03525	1.00000	.17872	.05905	.09529	-.03987	-.01776
FDGP17	-.02643	.00541	.01820	.20024	.17872	1.00000	.07567	.06438	-.02704	-.00894
FDGP18	.06179	.04408	.21632	.20192	.05905	.07567	1.00000	.13902	.05559	.03528
FDGP20	-.01769	.10665	.07173	.41782	.09529	.06438	.13902	1.00000	-.03656	.06776
FDGP21	-.07275	.37605	-.09614	-.08023	-.03497	-.02704	.05559	-.03656	1.00000	.09404
SFDGP23	-.01603	.16775	-.07785	.04450	-.01776	-.00894	.03528	.06776	.09404	1.00000
FDGP25	-.03999	.28345	.01960	.08174	-.05107	-.01050	.02765	.13496	.14424	.23530
FDGP29	-.06391	.14723	.13560	.15301	.01927	.07915	.14753	.42382	-.05340	.09356
FDGP31	-.07587	.17207	-.14330	-.06477	-.06603	-.09626	-.04755	.11215	.09368	.14238
EAT22	.02467	-.05133	.02293	-.10191	-.07741	-.14469	-.06319	-.06416	.03656	-.08120
DAYSN01	-.01160	.23129	.09907	.12266	.00764	.04781	.07511	.23103	.26412	.07192
DAYSN02	-.00171	.15003	-.02248	.04865	-.04358	-.00407	.07260	.11510	.06118	.06563
DAYSN05	.05464	.01969	.04717	.00970	.09606	.09927	-.05848	.13086	.05239	-.01401

	FDGP25	FDGP29	FDGP31	EAT22	DAYSN01	DAYSN02	DAYSN05
WTSTAT	-.03999	-.06391	-.07587	.02467	-.01160	-.00171	.05464
FDGP1	.28345	.14723	.17267	-.05133	.23129	.15003	.01969
FDGP3	.01960	.13560	-.14330	.02293	.09907	-.02248	.04717
FDGP10	.08174	.15301	-.06477	-.10191	.12266	.04865	.00970
FDGP16	-.05007	.01927	-.06603	-.07741	.00764	-.04358	.09606
FDGP17	-.01050	.07915	-.09626	-.14469	.04781	-.00407	.09927
FDGP18	.02765	.14753	-.04755	-.06319	.07511	.07260	-.05848
FDGP20	.13496	.42382	.11215	-.06416	.23103	.11510	.13086
FDGP21	.14424	-.05340	.09368	.03656	.26412	.06118	.05239
SFDGP23	.23530	.09356	.14238	-.08120	.07192	.06563	-.01601
FDGP25	1.00000	.09728	.14122	-.07535	.13536	.10156	-.00718
FDGP29	.09728	1.00000	-.00329	-.05398	.16574	.02543	.04076
FDGP31	.14122	-.00329	1.00000	-.04051	.05777	.10567	-.01352
EAT22	-.07535	-.05398	-.04051	1.00000	-.05358	-.06110	.02088
DAYSN01	.13536	.16574	.05777	-.05358	1.00000	.02473	.02247
DAYSN02	.10156	.02543	.10567	-.06110	.02473	1.00000	-.10292
DAYSN05	-.00718	.04076	-.01352	.02088	.02247	-.10292	1.00000

DETERMINANT OF CORRELATION MATRIX = .2254486E .22544857+000)

* N = Half of the 10% random subsample of the study population in Phase II (N=2,406). The N's reflect the sample size with no missing values for each of the respective independent variable indicators.

TABLE B-4.

Principal Component Analysis on the Indicators of Demographic Characteristics: The Rotated (Transformed) Factor Structure (N=951*)

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8
AGE	-.14555	-.02185	-.01374	.02363	.02501	.99706	-.02534	.01009
SEX	-.00569	-.01162	.08566	.00921	.99515	.02510	-.03739	-.00469
RACE	.90856	-.10819	-.30162	-.11010	-.00376	-.04996	-.07645	.17716
EDUCM	-.00233	.05521	.97606	.05682	.08144	-.01438	.16894	.06205
EDUCF	-.17604	.01918	.17823	.20052	-.04721	-.02871	.95802	.00162
POVERTY	-.10846	.07424	.05734	.97008	.01050	.08605	.19351	-.00702
CITYC1	.12787	-.74609	.06831	-.00593	-.00566	.01164	.00261	.96813
CITYC2	-.10185	.66061	.05910	.07643	-.01356	-.02447	.01991	-.23655

* N = Half of the 10% random subsample of the study population in Phase II (N=2,406). The N reflects the sample size with no missing values for each of the respective independent variable sets.

TABLE B-5.

Principal Component Analysis on the Indicators of Nutrient Quality: The Rotated (Transformed) Factor Structure (N=1,177*)

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8	FACTOR 9	FACTOR 10
CALOFAT	.08141	.95937	.01580	.01932	.07168	.00559	-.04434	.08461	-.01815	-.00261
CALOCHO	.01157	-.94549	.03918	-.06915	-.05952	.06752	.09490	.04957	-.02445	.01979
RDAPRO	.37849	.19118	.27323	.20629	.55136	.06436	.10671	.90361	.28318	.16963
RDACALC	.80437	-.01923	.14190	.16472	.20417	.15128	.10118	.11965	.08687	.13033
RDAFE	.71862	.03792	.11249	.49215	.16818	.18145	.09228	.13756	.11852	.12691
RDAMAG	.43603	-.05732	.33901	.27246	.90457	.21417	.10560	.24353	.18046	.69626
RDAPHOSP	.67605	.11277	.22061	.43806	.19658	.06067	.07461	.85160	.10777	.21457
LRDAVITA	.16403	-.01802	.14685	.10036	.14148	.91818	.22176	.06512	.09327	.10242
RDATHIA	.79718	-.04655	.83929	.22216	.11031	.13595	.15776	.19978	.15923	.11757
RDARIBO	.47926	-.05106	.58131	.06536	.15422	.17215	.16601	.16006	.26132	.14238
RDAB6	.20566	-.08119	.35517	.27118	.25499	.17865	.20552	.15483	.70519	.17172
LRDA12	.26546	.10046	.17140	.19947	.85409	.10541	.09173	.12217	.14738	.06081
RDAVITC	.13396	-.12931	.13576	.00516	.87631	.32618	.93524	.92337	.09678	.07677
NII	.31716	.05489	.34942	.24095	.17538	.14075	.12623	.74272	.13591	.19907

	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
CALOFAT	-.02547	.24725	.70456	-.03017
CALOCHO	-.11259	.20522	.01038	-.04085
RDAPRO	.65066	-.01299	.01656	.01561
RDACALC	.10040	.02196	.02369	-.06762
RDAFE	.08689	.00306	.01226	-.00487
RDAMAG	.14416	.02190	.01932	.01356
RDAPHOSP	.14699	-.05439	-.05256	.27245
LRDAVITA	.04768	.01129	.01267	.02482
RDATHIA	.11691	.00767	-.04256	.02187
RDARIBO	.10458	.00727	.31906	-.03332
RDAB6	.03691	-.00460	.02106	.01152
LRDA12	.12605	-.02070	.01705	.01209
RDAVITC	.04743	.00243	.20785	.03148
NII	.19829	.01136	.02036	.01189

* N = Half of the 10% random subsample of the study population in Phase II (N=2,406). The N reflects the sample size with no missing values for each of the respective independent variable indicators.

Table B-6.

Principal Component Analysis on the Indicators of Food Realted Behaviors: The Rotated (Transformed) Factor Structure (N=1,194*)

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR 8	FACTOR 9	FACTOR 10
WTSTAT	-.03175	.01805	-.00103	-.03306	-.02772	-.01652	.02831	-.00292	.03139	.02901
FDGP1	.07091	-.01363	.10312	.07787	.07070	.13261	.00998	.07076	.01890	-.05360
FDGP3	.06121	.02419	.05092	-.06779	-.00947	.01528	.02476	-.03858	.10632	.98413
FDGP10	.05091	.96452	.05151	-.04776	.01968	.03668	-.00202	.01944	.09591	.02549
FDGP16	.00369	.00648	.00247	-.00048	-.02160	-.02437	.04536	-.00789	.01364	-.01134
FDGP17	.03216	.09227	.01960	-.04701	-.00153	-.00468	.04916	-.00548	.03199	.00748
FDGP18	.06210	.09093	.02364	-.02145	.05418	.00570	-.03478	.01572	.98306	.10686
FDGP20	.21783	.21134	.10886	.06480	.05921	.05478	.07367	.02198	.03618	.02575
FDGP21	-.13695	-.04034	.13081	.03514	.06427	.05803	.01097	.03744	.03348	-.04772
SFDGP23	.04013	.01838	.02478	.06334	.02516	.10796	-.00852	.98596	.01556	-.03836
FDGP25	.03533	.03529	.05161	.06150	.06308	.97640	-.00437	.11111	.00580	.01579
FDGP29	.96670	.05050	.06912	-.00868	.00337	.03600	.01536	.04242	.06489	.06445
FDGP31	-.00756	-.04430	.02214	.98479	.02752	.06012	-.00562	.86302	-.02144	-.06769
EAT22	-.01921	-.04706	-.02216	-.01858	-.02751	-.03215	.01194	-.03639	-.01712	.01261
DAYSNC1	.06641	.05090	.97431	.02269	.00365	.05191	.00539	.02560	.02423	.05262
DAYSNC2	.00371	.01868	.00267	.04663	.99110	.06039	-.05210	.02482	.03335	-.00924
DAYSNC3	.01486	-.00123	.00523	-.00550	-.05186	-.00415	.99260	-.00640	-.03376	.02408

	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14	FACTOR 15	FACTOR 16	FACTOR 17
WTSTAT	-.00997	.01064	.79541	-.03207	-.01580	-.03989	-.20596
FDGP1	-.01136	-.02187	-.04505	.14405	.00372	.95375	.03563
FDGP3	-.01165	.01297	.02997	-.04550	.00346	-.04901	.02267
FDGP10	.00876	-.04565	.01992	-.04058	.09969	-.01371	.19005
FDGP16	.59281	-.33620	-.01009	-.01698	.08470	-.20998	.04201
FDGP17	.06760	-.07016	-.01329	-.01107	.94556	.00333	.01356
FDGP18	.01407	-.01764	.03255	.03213	.03225	.01758	.04916
FDGP20	.05343	-.02190	-.00709	-.02733	.01497	.03749	.93265
FDGP21	-.01632	.02356	-.03470	.96692	-.01185	.17642	-.02590
SFDGP23	-.00802	-.03712	-.01297	.05569	-.00546	.06437	.01913
FDGP25	-.02559	-.03371	-.01527	.05742	-.00235	.12390	.05014
FDGP29	.00349	-.02059	-.35402	-.03615	.03390	.06771	.19415
FDGP31	-.00051	-.01100	-.03411	.03371	-.04717	.09916	.05476
EAT22	-.03620	.94297	.01072	.02156	-.06463	-.01936	-.01873
DAYSNC1	.00261	-.02147	-.00096	.12932	.02034	.09719	.09665
DAYSNC2	-.02172	-.02766	-.02807	.02294	-.00149	.06325	.04963
DAYSNC3	.04541	.01199	.02856	.02371	.04413	.00901	.06130

* N = Half of the random subsample of the study population in Phase II (N=2,406). The N reflects the sample size with no missing values for each of the respective independent variable indicators.

TABLE B-7.

Correlations Among the Indicators of Demographic Characteristics and Nutrient Quality (N=2406)

	X_{D1}	X_{D2}	X_{D3}	X_{D4}	X_{D5}	X_{D6}	X_{D7}	X_{D8}	X_{N1}	X_{N2}	X_{N3}	X_{N4}	X_{N5}
X D1	1.000												
X D2	.048	1.000											
X D3	-.039	-.002	1.000										
X D4	-.028	.168	-.029	1.000									
X D5	-.047	-.058	-.133	.348	1.000								
X D6	.050	.013	-.245	.150	.401	1.000							
X D7	.014	.000	.361	.103	-.010	-.051	1.000						
X D8	-.345	-.025	-.241	.108	.076	.165	-.477	1.000					
X N1	.053	-.105	-.036	-.010	.042	.019	-.030	.000	1.000				
X N2	-.144	.098	-.038	.049	-.026	-.089	-.017	.008	-.807	1.000			
X N3	-.343	-.202	.044	-.001	-.013	.019	.021	.032	.172	-.163	1.000		
X N4	-.190	-.238	-.143	.022	.149	.071	-.078	.103	.025	.021	.655	1.000	
X N5	.198	-.453	-.047	-.107	.003	.030	.016	.043	.062	-.046	.508	.436	1.000
X N6	-.116	-.153	-.119	.016	.070	.054	-.049	.108	-.065	.112	.687	.689	.593
X N7	.031	-.340	-.123	-.025	.135	.127	-.036	.079	.134	-.161	.736	.842	.702
X N8	-.031	-.021	.002	.094	.033	.078	.047	-.008	-.049	.114	.411	.438	.339
X N9	-.151	-.119	.086	.006	-.050	-.058	.044	-.019	-.015	.119	.616	.484	.515
X N10	-.256	-.094	-.045	.017	.027	.006	-.023	.048	-.028	.099	.705	.777	.432
X N11	-.257	-.270	.047	-.024	-.002	.014	.055	.029	-.011	.013	.765	.536	.548
X N12	-.245	-.270	-.032	-.032	.116	.102	.020	.032	.193	-.162	.606	.555	.416
X N13	-.110	-.071	.025	.155	.113	.096	.093	.029	-.150	.207	.349	.261	.273
X N14	-.033	-.119	-.054	.037	.046	.066	.035	-.010	.125	-.011	.722	.548	.553

	X_{N6}	X_{N7}	X_{N8}	X_{N9}	X_{N10}	X_{N11}	X_{N12}	X_{N13}	X_{N14}
X N6	1.000								
X N7	.763	1.000							
X N8	.497	.382	1.000						
X N9	.630	.540	.442	1.000					
X N10	.693	.660	.566	.742	1.000				
X N11	.677	.604	.481	.685	.719	1.000			
X N12	.421	.561	.421	.421	.694	.574	1.000		
X N13	.417	.271	.387	.420	.304	.451	.203	1.000	
X N14	.700	.704	.413	.683	.649	.607	.474	.323	1.000

TABLE B-8.

Correlations Among the Indicators of Demographic Characteristics and Food Related Behaviors (N=2406)

	x_{D1}	x_{D2}	x_{D3}	x_{D4}	x_{D5}	x_{D6}	x_{D7}	x_{D8}	x_{F1}	x_{F2}	x_{F3}	x_{F4}	x_{F5}
x D1	1.000												
x D2	.095	1.000											
x D3	-.061	.026	1.000										
x D4	-.057	.136	-.034	1.000									
x D5	-.163	-.048	-.224	.360	1.000								
x D6	.044	-.028	-.252	.063	.317	1.000							
x D7	.025	.021	.345	.007	-.073	-.124	1.000						
x D8	-.114	-.032	-.160	.095	.153	.170	-.429	1.000					
x F1	.155	.090	.035	-.060	-.059	.013	.018	-.062	1.000				
x F2	-.205	-.107	-.087	.032	.110	-.020	.028	.002	-.096	1.000			
x F3	.516	.041	-.195	-.023	-.022	.160	-.077	-.003	.069	-.133	1.000		
x F4	.034	-.168	.017	-.073	.007	.090	.002	.046	.022	-.011	.060	1.000	
x F5	-.025	-.074	.058	-.110	-.101	-.093	-.006	-.075	-.001	-.027	-.020	.029	1.000
x F6	-.039	-.149	.167	-.086	-.132	-.014	.030	-.080	-.030	.012	.016	.206	.149
x F7	.242	-.014	-.057	.075	.063	.113	-.042	.015	.056	.068	.204	.179	.036
x F8	.071	-.187	.003	-.114	-.036	-.039	-.076	-.011	-.021	.094	.043	.410	.087
x F9	-.006	-.085	-.059	.046	.026	-.022	-.019	-.044	-.075	.365	-.112	-.077	-.036
x F10	-.153	-.026	-.129	.122	.170	.094	-.089	.095	-.041	.156	-.109	.046	-.026
x F11	-.137	-.090	-.171	.093	.154	.098	-.077	.080	-.059	.288	-.020	.066	-.044
x F12	.113	-.084	-.074	-.057	.016	.043	-.038	.071	-.070	.140	.119	.164	.023
x F13	-.176	-.086	-.017	.023	.061	-.019	-.073	.064	-.072	.156	-.144	-.084	.006
x F14	.265	.145	.044	.196	-.067	-.104	.124	-.091	.029	-.039	.030	-.091	-.077
x F15	.073	-.074	-.011	-.005	-.019	-.003	-.015	-.007	-.025	.230	.098	.116	-.000
x F16	.093	-.068	-.009	-.116	-.111	-.077	-.061	-.167	.033	-.016	.070	.096	.103
x F17	.007	-.037	-.025	-.124	-.129	-.160	-.067	-.153	.042	.032	.044	.012	.107

	x_{F6}	x_{F7}	x_{F8}	x_{F9}	x_{F10}	x_{F11}	x_{F12}	x_{F13}	x_{F14}	x_{F15}	x_{F16}	x_{F17}
x F6	1.000											
x F7	.090	1.000										
x F8	.051	.123	1.000									
x F9	-.063	.069	-.069	1.000								
x F10	-.011	.049	.048	.098	1.000							
x F11	-.010	.041	.123	.142	.267	1.000						
x F12	.106	.124	.411	-.070	.077	.080	1.000					
x F13	-.095	-.035	.112	.068	.136	.154	-.021	1.000				
x F14	-.155	-.024	-.053	.066	-.062	-.083	-.059	-.035	1.000			
x F15	.061	.079	.196	.259	.060	.130	.171	.047	-.043	1.000		
x F16	.103	.033	.060	.054	-.005	.001	.055	-.045	.007	.033	1.000	
x F17	.094	-.039	.128	.079	-.036	-.001	.026	.000	.044	.055	.266	1.000

TABLE B-9.

Correlations Among the Indicators of Nutrient Quality and Food Related Behaviors (N=2406)

	X_{N1}	X_{N2}	X_{N3}	X_{N4}	X_{N5}	X_{N6}	X_{N7}	X_{N8}	X_{N9}	X_{N10}	X_{N11}	X_{N12}	X_{N13}
X N1	1.000												
X N2	-.313	1.000											
X N3	.174	-.184	1.000										
X N4	.047	-.002	.684	1.000									
X N5	.063	-.043	.525	.482	1.000								
X N6	-.050	.098	.701	.704	.614	1.000							
X N7	.136	-.164	.748	.855	.714	.774	1.000						
X N8	-.023	.092	.408	.439	.755	.479	.385	1.000					
X N9	-.017	.120	.619	.513	.543	.648	.569	.432	1.000				
X N10	-.012	.085	.721	.785	.667	.707	.683	.560	.755	1.000			
X N11	-.038	.014	.762	.556	.559	.685	.611	.466	.690	.738	1.000		
X N12	.175	-.164	.619	.573	.426	.448	.565	.422	.435	.710	.587	1.000	
X N13	-.137	.202	.322	.251	.255	.389	.248	.396	.404	.300	.419	.200	1.000
X N14	.121	-.010	.739	.575	.558	.706	.707	.420	.700	.678	.606	.498	.305
X F1	.017	-.055	-.002	-.022	.062	-.001	.010	-.017	-.008	-.021	-.022	-.046	-.017
X F2	-.065	.101	.428	.638	.161	.452	.408	.312	.329	.606	.393	.433	.151
X F3	.100	-.159	-.226	-.196	.142	.067	.005	-.058	-.085	-.246	-.220	-.206	-.135
X F4	.332	-.330	.255	.086	.245	.064	.203	.027	.258	.115	.163	.254	.004
X F5	-.090	.091	.091	.007	.104	.154	.067	-.059	.129	.018	.104	-.066	-.055
X F6	.120	-.065	.221	.005	.100	.086	.110	.007	.153	.062	.176	.117	.032
X F7	.127	-.112	.178	.117	.143	.212	.175	.409	.155	.146	.193	.130	.252
X F8	.072	-.008	.272	.204	.257	.243	.250	.155	.302	.216	.145	.174	.056
X F9	-.262	.315	.148	.233	.207	.281	.113	.310	.308	.381	.386	.191	.218
X F10	.031	.096	.120	.136	.041	.112	.072	.112	.085	.162	.129	.150	.114
X F11	-.015	.193	.198	.209	.147	.229	.176	.162	.180	.234	.136	.113	.084
X F12	.158	-.044	.121	.133	.146	.169	.172	.176	.124	.118	.049	.074	.069
X F13	-.059	.138	.097	.160	.020	.217	.094	.052	.058	.121	.077	.067	.114
X F14	-.008	-.010	-.153	-.070	.011	-.091	-.052	-.038	-.065	-.122	-.140	-.171	-.033
X F15	-.054	.124	.194	.171	.182	.211	.130	.224	.250	.229	.185	.153	.220
X F16	.001	.012	-.014	-.013	.021	-.006	.001	.046	.060	.019	-.019	-.034	-.046
X F17	-.001	.051	.064	.059	.054	.080	.043	.052	.098	.100	.041	.021	-.026

TABLE B-9.(con't)

	x_{N14}	x_{F1}	x_{F2}	x_{F3}	x_{F4}	x_{F5}	x_{F6}	x_{F7}	x_{F8}	x_{F9}	x_{F10}	x_{F11}	x_{F12}
X N14	1.000												
X F1	-.028	1.000											
X F2	.292	-.041	1.000										
X F3	.005	.106	-.153	1.000									
X F4	.257	.012	-.020	.037	1.000								
X F5	.050	-.030	-.021	-.033	.078	1.000							
X F6	.190	-.045	.006	-.058	.253	.181	1.000						
X F7	.209	-.015	.071	.113	.124	-.046	.147	1.000					
X F8	.378	-.011	.109	.075	.356	.115	.071	.095	1.000				
X F9	.054	-.043	.377	-.145	-.152	-.041	-.096	.062	-.070	1.000			
X F10	.171	-.018	.122	-.069	.013	-.048	.061	.067	-.007	.070	1.000		
X F11	.335	-.056	.229	.003	-.011	-.065	-.018	.119	.042	.082	.198	1.000	
X F12	.303	-.020	.117	.139	.048	-.093	.073	.136	.488	-.026	.046	.110	1.000
X F13	.074	-.036	.159	-.111	-.129	-.061	-.071	-.050	.111	.163	.043	.090	.027
X F14	-.054	.024	-.101	.095	-.102	-.038	-.122	.017	-.014	-.034	-.072	-.048	.049
X F15	.157	-.034	.208	.026	.043	.044	.059	.089	.252	.263	.054	.104	.174
X F16	.013	.035	-.042	.012	.077	.066	.112	-.004	.066	.010	-.031	-.061	.036
X F17	.063	.030	.074	.001	.065	.075	.039	-.048	.126	.011	-.003	-.023	.059

	x_{F13}	x_{F14}	x_{F15}	x_{F16}	x_{F17}
X F13	1.000				
X F14	-.055	1.000			
X F15	.071	.003	1.000		
X F16	-.063	.012	.030	1.000	
X F17	.009	-.065	.028	.235	1.000

LIST OF REFERENCES

REFERENCES

Adrian, J, Daniel, R. Impact of socioeconomic factors in consumption of selected food nutrients in the United States. American Journal of Agricultural Economics, 1976; 58(1):31-38.

ANAREM Systems Research Corporation. Secondary analysis of the 1977-78 national food consumption survey: A research proposal submitted to the Institute of Human Nutrition. Washington, D.C.: U.S. Department of Agriculture, 1980.

Aquwa, OC. An investigation of the nutritional implications of the definitions and measurements of food consumption patterns for developed and developing countries. Washington, D.C.: Howard University, 1980. (Unpublished doctoral dissertation.)

Bass,A, Wakefield, L, Kolasa, K. Community nutrition and individual food behavior. Minneapolis: Burgess Publishing Company, 1979.

Beaton, GH, Milner, BA, Corey, P et al. Sources of variance in 24-hour dietary recall data: Implications for nutrition study design and interpretation. American Journal of Clinical Nutrition, 1979; 32:2546-2559.

Blalock, HM. Theory construction: From verbal to mathematical formulations. Englewood Cliffs: Prentice-Hall, Inc., 1969.

Burk,MC, Pao, EM. Methodology for large-scale surveys of household and individual diets. Washington, D.C.: U.S. Government Printing Office, 1976. (Home Economics Research Report No. 40.)

Caliendo, MA. Nutrition and the world food crisis. New York: Macmillan Publishers, 1980.

Cambridge Computer Associates, Inc. The crosstabs system (Release 400 ed.) Cambridge: Cambridge Computer Association, 1967. (For exclusive use by City University of New York Computer Center.)

Carter, RL, Sharbough, CO, Stapell, CA. Reliability and validity of the 24-hour recall, Journal of American Dietetic Association, 1981; 79:542-546.

Clark, F. Recent food consumption surveys and their uses. Federation Proceedings, 1974; 33(11):2270-2274.

Committee on Food Habits. Manual for the study of food habits. Washington, D.C.: National Research Council, NAS, 1945 (NCR Bulletin #111).

Concern, Inc. Overfed and Undernourished? Points of view: A nutrition report, 1979; 1(1):1-4.

Crocetti, AF, Guthrie HA. Report on Step II for the study of food consumption patterns in the United States., Washington, D.C.: U.S. Department of Agriculture, 1980. (USDA, CNC Contract No. 53-32U4-9-192.)

Crocetti, AF, Guthrie, HA. Report on Step III for the study of food consumption patterns in the United States. Washington, D.C.: U.S. Department of Agriculture, 1981(a) (USDA, CNC Contract No. 53-32U4-9-192).

Crocetti, AF, Guthrie, HA. Report #5 for the study of food consumption patterns of the United States. Washington D.C.: U.S. Department of Agriculture, 1981(b) (USDA, CNC Contract No. 53-32U4-9-192).

Crocetti, AF, Guthrie, HA. Food consumption patterns and nutritional quality of United States diets: A preliminary report. Food Technology, 1981(c); 35(9):40-49.

Crocetti, AF, Guthrie, HA. Final Report: Food consumption patterns and nutritional quality of United States diets. Washington, D.C.: U.S. Department of Agriculture (1982, in press) (USDA, CNC Contract No. 53-32U4-9-192).

Cronin, FJ. Personal Communication. Washington, D.C.: U.S. Department of Agriculture, 1980.

Cronin, FJ, Krebs-Smith, SM, Wyse, BW, Light, L. Characterizing food usage patterns by demographic variables. Washington, DC: U.S. Department of Agriculture, (1981, in press.).

Dixon, WJ, Brom, MB. BMDP biomedical computer programs, 2nd ed. Los Angeles: UCLA, 1979.

Dodds, JM. The handy five food guide. Journal of Nutrition Education, 1981; 13(2):50-52.

Dwyer, J. Executive summary: National conference on nutrition education: Directions for the 1980's. Journal of Nutrion Education, 1980; 12(5):79-88.

Eppright, E, Fox, H, Fryer, B, Lamkin, G, Vivian, V. The North Central regional study of diets of preschool children, nutritional knowledge and attitudes of mothers. Journal of Home Economics, 1970; 61:407-413.

Fink,EL. Personal Communication. East Lansing, Michigan: Michigan State University, 1979.

Friend, B, Marston, R. Nutritional review. Hyattsville, Maryland: Consumer and Food Economics Institute, ARS, 1975 (National Food Situation).

Green, PE, Carroll, DJ. Mathematical tools for applied multivariate analysis. New York: Academic Press, 1976.

Guthrie, HA, Scheer, JC. Nutritional adequacy of self-selected diets that satisfy the four food groups guide. Journal of Nutrition Education, 1981; 13(2):46-49.

Hanushek, EA, Jackson, JE. Statistical methods for social scientists. New York: Academic Press, 1977.

Hegsted, DM. What Americans are eating now: Preliminary results of USDA Food Consumption survey. Paper presented at: Washington, D.C.: Third Conference on nutrition and the American food system, 1979.

Hill,MM, Cleveland, M. Food guides: Their development and use. Nutrition Program News, 1970; 1-5.

Hyman, MM et al. Drinkers, drinking and alcohol-related mortality and hospitalizations: A statistical compendium. New Brunswick: Rutgers University, 1980.

Jenkins, M. Dietary relationships existing between macronutrient and micronutrient intakes. University Park: Pennsylvania State University, 1982 (Unpublished doctoral dissertation).

Karvetti, RL, Knuts, LR. Agreement between dietary interviews. Journal of American Dietetic Association, 1981; 79:654-660.

Knapp, TR. Canonical correlation analysis: A general parametric significance testing system. Psychology Bulletin, 1978; 85(2):410-416.

Kolasa, KM, Lackey, CJ, Slonim, AS. Factors affecting food selection: The roles of food science and of nutrition. Washington, D.C.: National Academy of Science (In press, 1982).

Lachance, PA. A suggestion on food guides and dietary guidelines. Journal of Nutrition Education, 1981; 13(2):56.

Learner, RM, Kivett, VR. Discriminators of perceived dietary adequacy among the rural elderly. Journal of American Dietetic Association, 1981; 78:330-337.

Light, L. Changes in the food guide. Washington, D.C.: National Extension Workshop on Nutrition and Food Preservation, 1977.

Light, L, Cronin, FJ. Food guidance revisted. Journal of Nutrition Education, 1981; 13(2):57-62.

Lund,LA and Burk, MC. A multidisciplinary analysis of children's food consumption behavior. St. Paul: University of Minnesota, 1969 (Agriculture Experiment Station Bulletin #265).

Marr,JW. Individual dietary surveys: purposes and methods. World Review of Nutrition and Dietetics, 1971; 13:105-164.

Marston, R, Page, L. Nutrient content of the national food supply. National Food Review (USDA), 1978:41.

McLaughlin, MS. Discriminant analysis in communication research. In: Monge, PR, Cappella, JN, eds. Multivariate techniques in human communication research. New York: Academic Press, 1980:175-204.

Mead,M. Food habit research: Problems of the 1960's. Washington, D.C.: National Research Council, NAS, 1964 (NRC Bulletin #1225).

Monge, PR. Multivariate multiple regression. In: Monge, PR, Cappella, JN, eds. Multivariate techniques in human communication research. New York: Academic Press, 1980:11-56.

Murray, J. Household food consumption surveys of the United States Department of Agriculture: A historical review of data collection methods, 1894-1969. Hyattsville, Maryland: Consumer and Food Research Division, ARS, USDA, 1975.

National Academy of Sciences, NRC, Food and Nutrition Board: Recommended dietary allowances, 9th edition, Washington, D.C.: National Academy of Sciences, 1980.

National Center for Health Statistics. Health-United States 1976-77, Hyattsville, Maryland: U.S. Department of Health, Education, and Welfare, 1977 (DHEW Publication No. (HRA) 77-1232).

National Center for Health Statistics. Health-United States, 1978. Hyattsville, Maryland: U.S. Department of Health, Education and Welfare (DHEW Publication No. (PHS) 78-1232).

National Research Council, NAS, Committee on Food Habits. Manual for the study of food habits. Washington, D.C.: National Research Council NAS, 1945 (Bulletin of the National Research Council no. 111).

Neter, J, Wasserman, W. Applied linear statistical models. Homewood, Illinois: Richard D. Irwin, Inc., 1974.

Nie, NH, Hull, GH, Jenkins, JG, Steinbrenner, K, Brent, DH. SPSS: Statisical package for the social sciences, 2nd edition, New York: McGraw-Hill, 1975.

Olson, CM, Gillespie, AH. Highlights of the discussions: Workshop on nutrition education research applying principles from the behavioral sciences. Journal of Nutrition Education, 1980; 13(1):576-579.

Page,L, Friend, B. The changing United States diet. Biological Science, 1976; 28(3):196.

Pao, EM. Food and nutrient intakes of individuals within families in the south. Columbus: Ohio State University, 1977 (Unpublished doctoral dissertation).

Pao, EM. Changes in American food consumption patterns and their nutritional significance. Food Technology, 1981; 35(2):43-53.

Pennington, JT. Dietary nutrient guide. Westport, Connecticut: AVI Publishing Company, 1976.

Pennington, JAT. Considerations for a new food guide. Journal of Nutrition Education, 1981; 13(2):53-55.

Pirie, P, Jacobs, D, Jeffrey, R, Hannan, P. Distortion in self-reported height and weight data. Journal of American Dietetic Association, 1981; 78:601-606.

Sanjur, D. Social and cultural perspectives in nutrition. Englewood Cliffs: Prentice-Hall, 1982.

Sims,LS, Paolucci, B, Morris, PM. A theoretical model for the study of nutritional status. Ecology of Food and Nutrition, 1972; 1(3):197-205.

Sims,L. Personal Communication, University Park, Pennsylvania: Pennsylvania State University, 1980.

Stoyanoff, NF. An examination of the relationship between social structural factors, complexity of the information environment, individuals' processing style, and cognitive structure. East Lansing: Michigan State University, 1981 (Unpublished doctoral dissertation).

Stunkard, AJ, Albaum, JM. The accuracy of self-reported weights. American Journal of Clinical Nutrition, 1981; 34:1593-1599.

Stunkard, AJ, Waxman, M. Accuracy of self-reports of food intake. Journal of American Dietetic Association, 1981; 79:547-551.

Todhunter, EN. Lifetyle and nutrient intake in the elderly. In: Winick, M, ed. Nutrition on Aging, New York: John Wiley, 1976.

United States Bureau of the Census. Poverty increases by 1.2 million in 1970. Washington, D.C.: U.S. Government Printing Office, 1971 (Current Population Reports Series P-60, No. 77).

United States Department of Agriculture, Consumer and Food Economics Institute. Review of commentaries and critiques on the subject of food selection guidance tools. Washington, D.C.: USDA, 1976. (Background paper for 1976 food selection guidance discussions.)

United States Department's of Agriculture and of Health, Education and Welfare. Nutrition and your health: Dietary guidelines for Americans. Washington, D.C.: U.S. Government Printing Office, 1980.

United States Department of Health, Education and Welfare, United States Department of Agriculture, White House Office of Science and Technology Policy, Federal Trade Commission, Society for Nutrition Education. National conference on nutrition education: Directions for the 1980's. 1980; 12(2) Supplement 1.

United States Department of Labor, Employment and Training Administration. Dictionary of occupational titles, 4th edition. Washington, D.C.: U.S. Government Printing Office, 1977.

United States General Accounting Office. Nationwide food consumption survey: Need for improvement and expansion. Washington, D.C.: General Accounting Office, 1977 (CED-77-56).

United States Senate Select Committee on Nutrition and Human Needs. Dietary goals for the United States, 1st ed. Washington, D.C.: U.S. Government Printing Office, 1977(a).

United States Senate Select Committee on Nutrition and Human Needs. Dietary goals for the United States, 2nd ed. Washington, D.C.: U.S. Government Printing Office, 1977(b).

United States Surgeon General. Healthy people: Report on health promotion and disease prevention. Washington, D.C.: Government Printing Office, 1979 (DHEW Publication No. (PHS) 79-55071).

Woelfel, J, Fink, EL. The measurement of communication processes: Galileo theory and method. New York: Academic Press, 1980.

Woelfel, JC, Woelfel, JD, Woelfel, ML. Standardized versus unstandardized data matrices: Which type is more appropriate for factor analysis. Quality and Quantity, 1980; 14(6):699-710.

Yetley, E. A causal model analysis of food behavior. Ames: Iowa State University, 1974 (Unpublished doctoral dissertation).