NUTRITION KNOWLEDGE AND DIETARY PRACTICES OF A SELECT GROUP OF ADULT MALES WITH EMPHASIS ON THE DEVELOPMENT AND VALIDATION OF THE KNOWLEDGE TEST INSTRUMENT

by

MARLENE ELIZABETH BATT

A THESIS

PRESENTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

DEPARTMENT OF FOODS AND NUTRITION

UNIVERSITY OF MANITOBA

WINNIPEG, MANITOBA SEPTEMBER, 1979

NUTRITION KNOWLEDGE AND DIETARY PRACTICES OF A SELECT GROUP OF ADULT MALES WITH EMPHASIS ON THE DEVELOPMENT AND VALIDATION OF THE KNOWLEDGE TEST INSTRUMENT

BY

MARLENE ELIZABETH BATT

A dissertation submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF SCIENCE

ACKNOWLEDGEMENTS

The author would like to extend special thanks to her advisors, Professor R. Diamant, Department of Foods and Nutrition, Professor M. Campbell, Department of Foods and Nutrition, and Dr. K. Mount, Department of Statistics for their professional assistance and guidance throughout the project. The assistance and encouragement of other faculty members, especially Dr. V. Bruce, and fellow graduate students has also been appreciated.

Thanks are expressed to Beverly Vane, Effie Henry and Karen Jack for their assistance in collecting the data, to Mathilde Schneider for her technical expertise, and to Gary Wilton, Joanne Holowec, and the 38 employees of the Great West Life Assurance Company, whose co-operation made this study possible.

Appreciation is extended to the University of Manitoba Graduate Fellowship Committee for the financial support throughout the author's postgraduate years.

The author also wishes to express sincere appreciation to her family for the encouragement and support throughout her university years. Special consideration is extended to Harvey and Susan Batt.

ABSTRACT

Thirty-eight adult males, 25 to 35 years and employed in a local insurance company, participated in a study designed to test the relationships between nutrition knowledge, dietary practices, and other attribute variables. Extensive work was done on the development and validation of the nutrition knowledge test. The research instruments included a 30-item multiple-choice nutrition knowledge test, a three-day food record, a 23-item forced-choice test to measure internal-external locus of personality control, and a 13-item biographical and food habit questionnaire. The nutrition knowledge score was based on a 26-item version of the test (KR20 = 0.69) and the dietary practice score was based on the intake of 9 nutrients and two levels of energy and in relation to the Canadian Dietary Standard (revised 1975). The level of nutrition knowledge of the group was low. The mean score on the nutrition test was 38 percent. Misconceptions about balanced food selection existed and there was a low level of knowledge in the area of food composition and nutrient sources and weight control. In the area of cardiovascular health, the group answered more correctly about vegetable oils and good health than about hydrogenated forms of these oils. As a group, the intake of nutrients and energy generally met or exceeded the recommended Canadian levels and the distribution of kilocalories in the diet was close to the recommended proportions. At least one-third of the nutrients were consumed away from home. The majority of the adult males were classified as internally-controlled, most of the subjects consulted newspapers or magazines for their nutrition information and shared the responsibilities for meal planning and/or preparation with someone else. Nutrition knowledge was significantly and negatively related to dietary practices ($p < 0.043$) and there was a significant difference ($p < 0.013$) between the nutrition knowledge scores of the sole planner and/or preparer of meals on a regular basis and the sole planner on an occasional basis.

TABLE OF CONTENTS

SECTION PAGE

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

Extensive research has been devoted to discovering what factors influence food habits and why food habits are difficult to change. The difficulty of this task is apparent if one considers the powerful social and cultural dimensions of food as described by Todhunter (1973):

> Food is prestige, status and wealth -- a mark of what one can afford to buy...It is a means of communication and interpersonal relations, such as an 'apple for the teacher,' or an expression of hospitality, friendship, affection, neighborliness, comfort and sympathy in time of sadness or disaster. It symbolizes strength, athleticism, health and success. It is a means of pleasure and self-gratification and a relief from stress. It is feasts, ceremony, rituals, special days and nostalgia for home, family and the 'good old days.' It is an expression of individuality and sophistication, a means of self-expression and a way of revolt. Most of all, it is tradition, custom and security.

Thus the same author writes, it is "...easier to talk about man's food habits today and how they originated than it is to understand the complex interacting physical, economic, political, social and psychological, emotional and technological factors that have produced them and that permit or prevent change" (Todhunter, 1973).

Efforts to uncover the cultural, social, personal and situational factors that influence food choices have proceeded from descriptive papers in the 1940's to the 1960's (Mead, 1943; Eppright, 1947; Pumpian-Mindlin, 1954; Lee, 1957; Moore, 1957; Fathauer, 1960) to more recent research with or without the statistical correlation of isolated

demographic factors and/or attitudes and values to dietary quality (Wilhelmy et al., 1950; Boek, 1956; Fox et al., 1970; Steelman, 1976; AuCoin et al., 1972; Coughenour, 1972; Walter, 1973; Suter and Barbour, 1975; Cosper and Wakefield, 1975; Hertzler and Owen, 1976; Schafer, 1978). Finally, the complex interactions of both external and internal influences on food habits have been recognized and various hypothetical models have been constructed in recent years (Sims and Morris, 1974; Caliendo and Sanjur, 1978; Krondl and Lau, 1978) in attempts to explain the reasons underlying food behaviors so that nutrition education endeavors would be more profitable. Statistical analyses applied to segments of the model have been undertaken in order to strengthen the predictive nature of the models.

Nutrition knowledge, an internal influence on food habits, plays a part in the hypothetical models described by Krondl and Lau (1978) and in the path model constructed by Caliendo and Sanjur (1978). Earlier than this, however, the importance of nutrition knowledge had been recognized, and several studies had been conducted to assess the level of nutrition knowledge of different groups. The application of research of this type to the understanding of food habits is evident when nutrition knowledge has been correlated with dietary practices. This corresponds to the general viewpoint held that nutrition information is useful only to the extent that it is applied.

A more rigorous approach to interpreting the relationship between knowledge and food practices involves an evaluation of the methods to assess these variables, in particular, nutrition knowledge. Confidence in the outcomes of the research follows from using instruments that yield reasonably valid and reliable results. Nutrition knowledge

has been measured in the literature in various ways and it is only recently that emphasis has been placed on the research methodology. Similarly, in the following review, the methodology used to assess nutrition knowledge, an internal influence on food habits, will be emphasized.

II. REVIEW OF LITERATURE

A. DEVELOPMENT AND VALIDATION OF TESTS

In any research project in which data are collected, not only the adequacy of the research design, but also the quality of the measurement procedures must be considered in order to have a research project of recognizable quality. Few instruments employed in the social sciences meet all the criteria of an ideal measuring instrument: relevance, reliability, validity, and sensitivity (Selltiz *et al.*, 1976). A variety of factors, some relatively stable, some transitory, affect the scores obtained on any measuring instrument. These factors contribute to either constant (systematic or biasing) errors or random (variable) errors. Two stable characteristics of individuals which are of immediate concern to researchers are: the tendency to give a favorable picture of oneself (social desirability influence) and the tendency to agree or disagree with statements regardless of their context (acquiescent response set). Nevertheless it is possible to increase the validity and reliability of a test instrument by reducing the errors of measurement.

A test administered with the purpose of obtaining an assessment of an individual's nutrition knowledge is subject to errors which can be reduced to a minimum if specific procedures are used. The assessment of validity and reliability become important in this instance. Validity, that is, the accuracy with which an instrument measures what it is

supposed to measure can be investigated by either a practical or pragmatic approach or indirectly by construct validation procedures. In the former case, validity is judged in terms of accuracy of predictions of the criterion based on the test results. For example, a scholastic achievement test may be validated by comparing scores on the test with grade point averages (GPA's), the criterion. If there is no correlation, the test may not be valid in predicting GPA's. It should also be considered that validity pertains to the results of a test, is a matter of degree -- not all or none, and is specific to some particular use and group (Gronlund, 1976). In addition, "...validity depends on the purpose for which a test is used, the group with which it is used, and the skill with which it is used; and test validity may deteriorate as the test is used repeatedly" (Ebel, 1965).

Next to validity, reliability is the most important characteristic of evaluation results (Gronlund, 1976). Thus, in order to be valid, a test must be reliable, that is, a test must be consistent in whatever it measures. It has been stated that "reliability is a necessary, but not a sufficient condition for validity" (Kerlinger, 1973; Gronlund, 1976). A detailed explanation of how to estimate, interpret, and improve test reliability is provided by Ebel (1965). Similar to the discussion of validity, the properties of reliability should not be overlooked. Reliability refers to the results obtained; test scores are not reliable in general, rather they are reliable or generalizable over different periods of time, over different samples of questions, over different raters etc.; is necessary but not sufficient; and reliability is primarily statistical in nature (Gronlund, 1976).

An explanation of some of the research terminology is important for the interpretation of nutrition knowledge studies. "Validation" refers to the total process of determining the validity and the reliability of test instruments, since reliability goes "hand-in-hand" with validity. Content validity is described as "the representativeness or sampling adequacy of the content--the substance, the matter, the topics--of a measuring instrument" (Kerlinger, 1973). Content validity differs from "face validity" in that the former requires subject matter expertise, while the latter refers to the appearance of the test to the layman (Martuza, 1977). "A test that appears to be a relevant measure based on superficial examination is said to have face validity" (Gronlund, 1976). The assessment of content validity is generally a subjective process, but requires individuals knowledgeable in the subject matter.

Construct validation is the next step in validation. Kerlinger (1973) places his greatest emphasis on construct validity since "it is probably the most important form of validity from the scientific research point of view." Construct validation concerns the "extent to which test performance can be interpreted in terms of certain psychological constructs" (Gronlund, 1976). According to Gronlund (1976) there is no adequate single method of establishing construct validity. It is simply a matter of accumulating evidence from many different sources. In the "known groups" method, groups of people with "known" characteristics, for example, nutrition knowledge, would have an instrument administered to them following the prediction of the direction of differences (Kerlinger, 1973; Martuza, 1977). Gronlund (1976) has outlined the process of construct validation. First of all, the constructs

presumed to account for test performance should be identified. Secondly, hypotheses regarding test performance from the theory underlying the construct should be set up. Finally, the hypotheses are tested by logical and empirical means and then each hypothesis is tested with each test score. Another method of assessing construct validity which is linked to reliability programs is the use of the corrected item--total correlation. In this method, each test item is correlated with the total test score; however, one major difference in this approach is that the total score is assumed to be valid. Then the extent that an item measures the same thing as the total score does, to that extent the item is valid (Kerlinger, 1973).

Coinciding with validity is the necessary, but not sufficient condition of reliability. Test reliability has been operationally defined as the coefficient of correlation between scores on two equivalent forms of a test for a specified group of examiners or subjects (Ebel, 1965). The higher the coefficient, the more consistently the test measures what it is supposed to measure. Formula approaches to the assessment of test reliability have been employed to overcome some of the limitations involving test-retest methods or methods requiring the construction of equivalent forms of the test. The Kuder-Richardson formulae provide estimates of the reliability of a single test from a single administration and are employed when single unit weight-rights only scoring is used (Kuder and Richardson, 1937). These are measures of internal consistency, assuming that all items in the test are homogeneous. Information on the difficulty (proportion of correct response) of each item in the test, the variability of the test scores, and the numbers of items in the test are required for this

analysis.

A sophisticated approach to improving test quality is through a six step systematic process of item analysis described by Ebel (1965) and others (Gronlund, 1976; Martuza, 1977). Item analysis is the analysis of subject response to objective test items to yield the two indices of discrimination and difficulty. The index of discrimination is based on the difference between the upper and lower 27 percent of the test group in proportion of correct response and is biased in favor of items of middle difficulty. The index of difficulty expresses the percent of correct responses so that the higher the numerical value of this index, the easier the item. Higher reliability of the test scores occurs when items are concentrated near the midpoint of difficulty. Following item analysis, the next step in constructing a test that yields reliable results is the selection of the best (ie. most discriminating) items for the improved version of the test. According to Ebel (1965), a test containing higher discrimination indices, that is, 0.40 and over is more reliable than a similar test composed of items with lower discrimination indices. Martuza (1977) indicated that the prevailing practice in norm-referenced test construction is to attempt to have items in the 0.30 - 0.70 range. However, on the practical side he stated that there are reasons for including items which are weak discriminators. In addition, Gronlund (1976) also considers the practical viewpoint in saying that "the tentative nature of item analysis should discourage us from making fine distinctions on the basis of indices of difficulty and discriminating power." Preferably items with low indices can be revised to improve their discrimination indices and subsequently be re-analyzed by item analysis.

B. NUTRITION KNOWLEDGE STUDIES

Knowledge of nutrition has been measured, according to the literature, to meet either one or all of three major research objectives. First of all, the level of awareness of the subject matter by several different groups has been examined. Also considered have been food fallacies or misconceptions about foods and nutrition. The assessment of nutrition knowledge in these cases has assisted in the design of effective nutrition education programs. Secondly, nutrition knowledge has been measured in studies termed ex post facto research (Kerlinger, 1973) in which the relationships between nutrition knowledge and other attribute variables such as attitudes, personality, and dietary practices have been investigated. As indicated earlier, these studies usually formed the basis for discussions on factors influencing food habits. Finally, nutrition knowledge has been measured in true experimental research designs employing the pre-post test pattern as an indication of change following nutrition education programs.

Studies assessing nutrition knowledge alone or with demographic characteristics such as age, occupation, and education and those investigating the relationships between nutrition knowledge, dietary practices and other attribute variables in ex post facto research designs will be considered in the following review of literature. Emphasis will be placed on the validity and reliability of the instruments designed to measure nutrition knowledge.

C. THE ASSESSMENT OF NUTRITION KNOWLEDGE AND BELIEFS

Traditionally females have been more involved than males in the buying of food and the preparation of meals. For this major reason

studies have been conducted on the nutrition knowledge of homemakers under the assumption that those homemakers with better nutrition knowledge would plan more nutritious meals. The first studies used open-ended questioning approaches and had limited content of subject matter, while later surveys have employed more sophisticated test instruments and validation procedures.

One of the earliest surveys of nutrition knowledge was undertaken by Young et al.(1956a). Nutrition knowledge of 645 homemakers in Rochester and Syracuse, New York,was assessed by responses to open-ended questions which were related to foods to be included in the daily menu, the definition of a "balanced" meal, and the meaning of the "basic 7", for example. A general assessment of knowledge was based on the number of food groups for which the homemaker could give a nutritionally correct reason for including in the family's meals. Nineteen to thirty percent of the homemakers had minimal knowledge (ie. gave correct responses for 3 or more food groups), while one-third to one-half displayed no evidence of nutrition knowledge (ie. gave no reasons or erroneous ones). Only one quarter could provide a nutritionally meaningful and adequate definition of a balanced diet. To summarize, the younger, better educated, and higher income homemakers had the greatest knowledge. Formal education seemed the most important single factor related to nutrition knowledge. No statistical analyses were conducted on the results or test instruments.

In 1963, Brown et al. (1963) investigated the nutrition knowledge of 81 British housewives by a questionnaire survey in which the respondents were required to suggest two foods which were good sources of the five nutrients: protein, iron, carbohydrate, calcium, and

vitamin C. In addition, they were asked to respond "true" or "false" to 11 sayings on food misconceptions. Acknowledging the limited techniques for assessing knowledge, the authors concluded that, in general, whether their knowledge of nutrition was right or wrong, it had little bearing on the actual choice of foods purchased and consumed.

The nutrition knowledge of 238 mothers of 264 junior high children in Vermont was tested in a study by Morse et al. (1967) using the Kilander Information Test comprising 33 multiple-choice questions covering a wide range of practical information on nutrition and diet. Few details of this test were disclosed except that it had been revised in 1946 and 1957. Knowledge was later related to their education, occupation, and the nutritional status of their children. Those mothers with higher education had higher test scores.

Following this early emphasis on the nutrition knowledge of the homemaker, the importance of assessing the knowledge of other groups has been recognized. Certain individuals, especially those in teaching and health-related professions hold positions whereby the dissemination of nutrition information, whether correct or incorrect is inevitable. Therefore, the nutrition knowledge of nurses, medical students and physicians, physical education majors, and elementary school teachers has been investigated in later research.

A 67 true or false item test including 4 categories of knowledge and deemed appropriate for nurses to know about was used by Harrison et al. (1969). It was pretested on nurses and two control groups; one having no connection with nutrition or medicine, the other consisting of graduate students in nutrition in order to check the ambiguity of

the items and whether or not the test discriminated between the two control groups. Although not stated directly, the procedure resembled methods used in construct validation.

Phillips (1971) reported on a study concerned with the development of a nutrition knowledge test for 254 second year medical students of four New England medical schools. The multiple-choice test focusing on the practical application of normal and therapeutic nutrition was tested for content validity by a panel of experts, pretested on a group of third year students, subjected to item analyses, and revised and re-evaluated by experts. The Kuder-Richardson reliability coefficient was determined to be 0.65. Therefore, more effort was made to develop the test instrument.

The 39 multiple-choice item nutrition test administered to a self-selected group of practising physicians and medical students in a study by Podell et al. (1975) had been revised and validated prior to its use. No details as to how this was done were provided. This test was, however, pilot tested for clarity and clinical relevance. No reliability coefficients were reported either for this study or for the one conducted by Cho and Fryer (1974) to determine the knowledge and source of information of 138 physical education majors and a group of 81 students completing a basic nutrition course for non-majors at Kansas State University. In the latter study no details of the test construction were provided. Construct validation would have helped to explain the low scores of the group completing the basic nutrition course. "...it was surprising that the scores were not higher for the BN (basic nutrition) group since most of this material had been covered in their basic nutrition course" (Cho and Fryer, 1974). The test, itself,

may not have been a valid indicator of knowledge.

Seven questions were selected from a larger questionnaire by Dugdale et al. (1979) in order to test the levels and accuracy of the nutritional knowledge of 33 medical practitioners, 63 medical students, 25 student nurses, and 39 theology students. Although these authors emphasized the format of the test and whether or not a "don't know" category was included to eliminate guessing, no information on the validity and the reliability of the instrument was provided. This is surprising due to the recent nature of the publication. Regarding the contents of the shorter test, the 7 questions were chosen because they dealt with currently "fashionable" nutritional topics which were often considered by patients.

More recently, the results of a nutrition knowledge test designed to assess the knowledge of preservice and inservice elementary school teachers have been published (Carver and Lewis, 1979). This two part test included 24 true-false questions in 7 areas of nutrition knowledge adapted and modified from McCarthy and Sabry (1973) and true-false answers related to five short paragraphs. Content and construct validation procedures were used to assess the validity of the test and whether or not it discriminated between those already knowledgeable in nutrition and those who were not. The Kuder-Richardson formula, KR 20, was applied in order to assess the internal consistency of the true-false and paragraph sections. Correlation coefficients between scores of the two parts of the test were determined in order to ascertain whether each section tested a different level of knowledge. Not only was this well-designed and validated test used to measure the level of knowledge of elementary teachers, the authors concluded that it would serve also

as a "useful tool in diagnosis of needs for preservice and inservice teacher-training programs in nutrition."

The nutrition knowledge of other groups besides homemakers and those relating to teaching and health professions has been investigated in order to determine the necessity of nutrition education programs. Dwyer et al. (1970) developed a multiple-choice knowledge questionnaire for a study on the nutrition knowledge and attitudes toward nutrition of 1338 high school students in Massachusetts. Validation of the test by both content and construct validation procedures was done. Item analysis was performed on the test in order to maximize reliability. Reliability was determined by re-administering the test to two groups of adolescent females two weeks after the first testing. This test-retest method to assess stability over time yielded high Pearsonian correlation coefficients of 0.777 and 0.950. Seventy-three junior and senior high school students from the Tennessee School for the Deaf and 93 normal hearing students completed a 53 item true-false test (Garton and Bass, 1974). The details of test construction were not disclosed and no reliability coefficients were reported. Similarly no details of the test length, the validation procedures or the reliability determination were provided in an abstract outlining a mail survey on college nonvegetarians and vegetarians at San Diego State University by Lindamood and Gunning (1977). Therefore, the methods used to develop and validate the test instruments have varied along with the differences in the target populations.

Coinciding with the interest in assessing the extent of nutrition knowledge, the prevalence of misconceptions about food was apparent even in Canada (MacDiarmid, 1957). In 1956, Hueneman (1956) stressed

the need for strong nutrition education programs to "combat food misinformation and quackery in the field of nutrition." Almost twenty years later McBean and Speckman (1974) presented a review of food faddism and problems arising from adherence to these dietary regimes. Presently, there is still concern about misinformation about nutrition (Brown et al., 1978). Some of the studies purporting to measure the extent of food fallacies are listed below.

Similar to the studies measuring nutrition knowledge, the early studies on food fallacies have concentrated on the homemaker as the target population. By a mail questionnaire approach Schulte (1963) investigated the relationship between general and nutrition education and belief in selected food fallacies of 302 upper-class homemakers in New York City. Content validity of the 130 fallacies was determined by a panel of experts and it was stated that the questionnaire had been tested in a personal interview and was found reliable and valid in three studies. No details of the reliability and validity assessment were outlined in this abstract. The correlation between the educational attainment and belief in food fallacies was reported as not being substantial -- whatever slight relationship existed, it was more related to general education than nutrition education.

Wilson and Lamb (1968) used a self-administered questionnaire to determine the relationship between the food beliefs as assessed by 58 true-false items and ecological factors of 119 professional and civic-minded women. Although food beliefs were clustered under certain factors according to factor loadings, there was no information regarding the reliability or even content validity of the test. The largest group of subjects who accepted false beliefs were college graduates and even

a few misconceptions were held by those educated in home economics and nutrition.

Comparable to studies on affluent population groups, nutritional misbeliefs were found to exist among a low income urban population near Washington, D.C. in a study by Cornely et al. (1963). General knowledge of food was tested by a series of 10 common food fallacies. No details of validity and reliability were indicated. Based on the categorization of the data, acceptance of food fallacies was said to be influenced by personal characteristics such as age, education, and prior residence.

Wang (1971) investigated more than one socioeconomic group in a survey which differentiated 97 low and 1050 middle income homemakers and 259 teenage youths residing in Maryland with respect to their beliefs in food fallacies. The 40 item Food Knowledge Inventory included 8 categories of statements regarding facts and fallacies or misconceptions about food and had been pretested prior to use. No details regarding the reliability or validity were provided.

More precise methods regarding the development of the test instrument have been reported by McCarthy and Sabry (1973) in a study designed to measure the nutrition misconceptions among 274 first year students in Guelph, Ontario. The 70 - item true-false questionnaire in 10 subject areas had been subjected to extensive content validation prior to use. Item analyses had been performed and difficulty indices calculated following a pretest. The KR reliability coefficient for the study group was 0.59. This was stated as being "an acceptable value for group evaluation." Other variables, two indicative of dietary practices, were statistically analyzed in relation to the nutrition scores

attained. Regarding the 28 percent of the sample who reported taking a vitamin-mineral supplement, there was no correlation between this characteristic and misconception scores. There was a low significant correlation ($r = 0.21$, $p < 0.01$) between higher misconception scores and shopping at health food stores. However, the authors stated that this coefficient was too low to be used to predict further relationships between nutrition knowledge and practices.

Methods to assess the nutrition knowledge and/or beliefs of various groups have progressed from the less structured open-ended techniques to the more controlled multiple-choice or true-false formats. with or without the attempt to improve the validity or reliability of the instruments. In addition, there has been a trend to relate nutrition knowledge to age, socioeconomic level, and other demographic variables besides using nutrition knowledge as a focal point for designing nutrition education programs. The extent of the impact of nutrition knowledge on food habits has been of interest to those attempting to understand the many factors which influence one's food choices. In the next section research concerning the relationship between nutrition knowledge and dietary practices will be reviewed.

D. THE RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE AND DIETARY PRACTICES

A question that arose in the literature at an early date was, "Is better knowledge of nutrition associated with better eating practices?" (Young et al., 1956b). Since that time research on the relationship between nutrition knowledge and dietary practices has attempted to answer this query. The early focus has again been on the homemaker and as time progressed, the methods used to assess knowledge

and dietary practices have become refined.

As previously cited, Young et al. (1956a) studied the nutrition knowledge of 645 homemakers in Rochester and Syracuse, New York, and in a later paper (Young et al., 1956b), nutrition knowledge was compared to nutritional practices. The latter was explored qualitatively by questions relating to foods served to the family in the previous 24 hours, whether or not the foods were typical and how they differed, and the usual beverages drunk by both adults and children at each meal. Questions on the amounts of certain key foods either purchased or used in the previous week yielded quantitative data on nutritional practices. Following a comparison of knowledge with practices of those with little or no nutrition knowledge and of those with minimal knowledge, it was concluded that on a qualitative basis nutritional practices were considerably better than theoretical knowledge. Those food groups which were least well known were also the least used. In addition, a higher percentage of homemakers with minimal knowledge of nutrition had adequate feeding practices than those with some or no knowledge.

Almost twenty years after the question posed by Young et al. (1956b), Emmons and Hayes (1973) assessed the nutrition knowledge of 486 mothers of 783 children in Upstate New York by their responses to the two questions: "What foods or types of foods do you try to include in your child's diet each day?" and "Why do you feel each of these foods should be included?" In addition, the children were asked similar questions. This method of knowledge assessment differed greatly from other research of the early 1970's which used the fixed-alternative approach. A 24-hour recall of the child's diet was provided by both the mothers and their children in order to evaluate the nutritional

practices of the children. The nutrition knowledge data of both groups were compared to the diet of the child as reported by both mother and child to note any relationship between knowledge and practice. In general, and based on the non-statistical analyses of the data, nutrition practices seemed much better than nutrition knowledge since more mothers served foods from the different food groups than reported the food groups as being important in their child's diet.

In a study which investigated the relationship between formal education of 60 mothers in a suburb near Beirut, Lebanon, and their nutritional knowledge, nutritional practices, and the growth pattern of their children, Al-Isi et al. (1975) attempted to increase the reliability of the results by determining the reliability of their 50-item yes - no test instrument. The reliability coefficient of this test was high (Spearman-Brown coefficient 0.86), however questions on the construct validity of the test were left unanswered. Knowledge test scores were later compared to nutritional practices as evaluated by 25 questions on sources of food, food budgetting, selection and preparation, and infant feeding. The Pearson correlation coefficient ($r = 0.68$, $p < 0.001$) marked a strong relationship between the two variables. The majority of all mothers, grouped according to years of formal education, scored poorly on both the knowledge test and the practice questionnaire.

A recent paper by Phillips et al. (1978) concerned the relationship of food and nutrition knowledge to one specific food-related practice, the use of presweetened cereals. Thirty upper middle-class mothers of preschool children in Knoxville, Tennessee were interviewed regarding their food and nutrition knowledge as determined by a test instrument which sought information on their perception of their child's preference

for presweetened cereals, the percentage of cereals in the home that were presweetened, and other demographic variables. No information was provided on the details of the knowledge test except that it was "designed to measure application of food and nutrition knowledge to food practices." The sample was subdivided into two groups to see the effect of experience with older children on the mother's application of knowledge. The significance level was set at the 0.10 level "because the exploratory nature of this investigation involved finding possible existing relationships." A low significant negative relationship ($r = -0.35$, $p < 0.10$) existed between the mother's food and nutrition knowledge and percentage of presweetened cereals purchased when there were children older than the preschool subjects in the family. The authors concluded that family composition should be considered when designing nutrition education programs.

In unpublished work exploring the relationship between nutrition knowledge and dietary practices, Woolcott (1971) studied 129 homemakers residing in an isolated northern Manitoba mining community. The interview schedule consisted of 16 multiple-choice items and 9 agree-disagree statements. Content validity was established by a panel of nutrition experts; the reliability and construct validity were not determined. A 24-hour recall and a plan of a one day's menu (also a reflection of knowledge) were used to study the nutritional practices of these homemakers. A significant positive relationship ($p < 0.05$) existed between knowledge and practice as measured by the dietary recall. There was also a non-significant trend for respondents who scored high on the knowledge test to have high scores on the meal plan.

Woolcott (1971) emphasized the gap between nutrition knowledge and practice since the homemakers planned better meals than they actually consumed.

The relationship between the acquisition of nutrition knowledge and its application in eventual practice has also been examined following nutrition education intervention programs designed with the intention of improving eating practices. A review of the literature regarding this topic will not be considered, however, remarks made by Fruin and Davison (1978) are appropriate to future analyses of this type of research. Caution has been expressed by these authors when "change" is assessed by subtracting pre-test scores from post-test scores. Some tests are not as carefully prepared as far as reliability is concerned and are likely to contain considerable measurement error. Therefore, any change occurring may be due to errors of measurement, rather than actual changes in behavior. In addition, the length of time following the intervention method must also be considered when evaluating change in dietary behavior.

Few studies have investigated nutrition knowledge and dietary practices alone or with certain demographic variables. Only four have been mentioned in this review. At the same time and in the early 1970's emphasis was also being placed on the influence of attitudes on food habits. Towards the end of the decade, more rigorous methodology was being employed in exploring the relationships among nutrition knowledge, attitudes, and dietary practices. Personality variables have also been included in research of this type. The next section of this review, therefore, concerns research investigating nutrition knowledge, attitudes or personality, and dietary practices.

E. THE RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE AND ATTRIBUTE VARIABLES SUCH AS ATTITUDES AND PERSONALITY

A pioneer study in 1970 by Eppright et al.(1970) on the nutrition knowledge and attitudes of mothers and the effect on the diets of their children made the way for studies that started to appear in the literature five years later regarding nutrition knowledge, attitudes and dietary practices of various target groups of current interest. Two thousand mothers of preschool children in 12 North Central States were surveyed in a study designed to investigate the effect of a number of variables on the food energy and nutrient intake of preschool children. Content validity of the true-false nutrition test was established by a group of nutritionists and a pretest on 150 lay people was conducted prior to the survey. It was reported that the 35 most highly intercorrelated items were retained, however, no details on the reliability coefficient were mentioned. Simple linear correlations were computed between food energy and intake of individual nutrients as determined from 3-day food records. The nutrition knowledge scores were significantly related at the one percent level to kilocalories ($r = 0.058$), protein ($r = 0.077$), calcium ($r = 0.062$), phosphorus ($r = 0.082$), riboflavin ($r = 0.069$), niacin equivalents ($r = 0.085$), and ascorbic acid ($r = 0.107$). Therefore, seven out of twelve nutrient variables were significantly related to nutrition knowledge at a low value of error probability. Nutrition knowledge was also significantly correlated to an overall nutrition score ($r = 0.070$, $p < 0.01$). Mothers of the children that were classified in the lowest 10 percent with respect to total intake of each nutrient except protein and phosphorus had a relatively low level of nutrition knowledge. The relationship between nu-

trition knowledge and dietary practices, as measured by these researchers, is therefore evident.

Schwartz (1975) investigated the nutrition knowledge, attitudes, and practices of 313 female high school graduates in Ohio. The knowledge test comprised 30 true-false statements related to general knowledge of nutritional concepts, food composition, misconceptions about food, and the application of basic nutritional principles. No details of the validation procedures were provided except that the test was "developed, validated in previous research, and described by Eppright and co-workers." It had been revised, however, for this study. Dietary practices were assessed qualitatively by the frequency of intake during a three day period of foods in 17 food groups as compared with the Basic Four Food Group pattern. It was reported that significant correlation coefficients were found between nutrition knowledge and attitudes and between attitudes and practices. The correlation between nutritional knowledge and practices was non-significant. No values for the correlation coefficients were reported. It was concluded that attitudes serve as a mediator between knowledge and practices.

In a later paper, the nutrition knowledge, attitudes, and practices of 352 Canadian public health nurses was studied by this author (Schwartz, 1976). The 40 true-false statement nutrition test had been developed and validated in previous research by Harrison and co-workers (1969). No reliability determinations had been conducted. Contents of the test included common tools in planning and evaluation of diets; cultural, economic, psychological and physiological factors which influence food intake; and nutrients in foods. Professional and personal dietary practices of the nurses were assessed by 20 statements. It was

reported that significant and direct positive relationships were found between nutrition knowledge and attitudes (the strongest relationship) and knowledge and practices (the weakest relationship) and attitudes and practices. Again the results were vague since no correlation coefficients were reported.

In a similar study, Thompson and Schwartz (1977) studied these three variables with 366 grade 8 high school students of different socioeconomic areas in Vancouver. The 20 true-false item knowledge test concerned general knowledge of basic nutrition principles and concepts. Construct validity was determined by a pretest on nutrition experts who obtained higher mean scores than a group of grade 8 students. Item analysis was performed to determine the difficulty of the test items, however, "the reliability of the items was assumed." Nutrition practices were assessed by using the 24-hour recall of all food consumed which was a part of a self-administered questionnaire and were scored qualitatively in relation to the four food groups. It was reported that significant positive correlations at the 5 percent level were found for nutrition knowledge and attitudes ($r = 0.50$) and attitudes and practices ($r = 0.21$). The correlation between nutrition knowledge and practices was reported as being very low and non-significant.

Evidence of more rigorous methodology is provided in more recent papers. Grotkowski and Sims (1978) studied the nutrition knowledge, attitudes, and dietary practices of 64 non-institutionalized elderly persons of a wide range of socioeconomic levels. Nutrition knowledge was measured by an instrument containing 25 true-false and multiple-choice items from the research of Eppright _et al_. (1970), Harrison _et al_. (1969), Dwyer _et al_., (1970), and Wang (1971). The internal

consistency reliability coefficient, Cronbach Alpha, was reported as 0.80 for a more reliable 20-item test. Quantitative data on the nutrient intakes were obtained from 3-day food records and were compared to the appropriate recommended dietary allowances. The association between knowledge and nutrient intake was not statistically significant at the 5 percent level, although the one between knowledge scores and kilocalories was significant at the 6 percent level. Another measure of knowledge, scored on a 10 point rating scale, "self-evaluation of nutrition knowledge," was significantly related to energy ($r = 0.35$, $p < 0.05$), protein ($r = 0.30$, $p < 0.05$), and fat ($r = 0.44$, $p < 0.01$). Based on a schematic representation of the relationships among the variables studied, the authors concluded that socioeconomic status and nutritional knowledge were the key independent variables with personal attributes and beliefs acting as intervening or control variables between these and certain nutrient intakes.

The relationship of nutrition knowledge, attitudes, and nutrient intake of 61 lactating women of university communities in Indiana and Pennsylvania was studied by Sims (1978). The knowledge test consisted of 36 true-false and multiple-choice items and was originally used by Eppright _et al_. (1970), modified later by Sims (1976), and again by Grotkowski and Sims (1978). The internal reliability of the more reliable 20-item test (Cronbach Alpha) was 0.77. Three one-day food records were used to obtain quantitative data on the nutrient intakes. More complex statistical or mathematical procedures such as path analysis and factor analysis were employed in exploring the relationships among the dependent and independent variables. Nutrition knowledge was

significantly related to dietary practices as described by four food group indices through factor analysis. Cronbach reliability coefficients were 0.85, 0.83, and 0.87 for the protein, energy, and dairy group indices, respectively. The relationships between knowledge and the indices were: protein group index ($r = 0.41$, $p < 0.01$), energy index ($r = 0.35$, $p < 0.01$), dairy group index ($r = 0.32$, $p < 0.01$), and ascorbic acid ($r = 0.25$, $p < 0.05$). The first three factors accounted for the majority of the variance in the data. Whether or not the authors were justified in using the technique of factor analysis will be discussed later.

The preceding two papers attempted to increase the validity and reliability of the results through more sophisticated methodology, however, in a more recent paper by Werblow et al. (1978), validation and reliability procedures were not reported. Certain core questions had been taken from other questionnaires for this study on the nutrition knowledge, attitudes, and food patterns of 94 women athletes at the University of Nebraska. The 31 true-false nutrition knowledge questions were reviewed by experts in nutrition and test construction, revised, pretested, and further revised. No other details on the methodology were given. A qualitative assessment of food patterns was based on a list of 50 food or food supplement items and four eating situations. Low significant positive correlations at the 5 percent level existed between nutrition knowledge and training-weight control diet similarity scores ($r = 0.24$) and pre-event weight control diet similarity scores ($r = 0.25$). The authors concluded that "as knowledge increased, these athletes were more likely to eat, avoid and/or feel indifferent about some of the same types of foods for training, weight-

control, and pre-event meals." Also as knowledge increased, the weight control food pattern served as a basis for other eating situations. These conclusions support the relationship between nutrition knowledge and dietary practices.

Evidence contrary to the above conclusion is provided in unpublished work by MacFadyen (1977) on 101 top level competitive swimmers in Winnipeg. Nutrition knowledge was assessed by 22 multiple choice questions and dietary practices were assessed by using a three-day food record and written responses to 6 open-ended questions. The reliability of the test instrument was not determined. The relationship between the nutrition knowledge score and dietary practices assessed by the three-day food record was not significant whereas the relationship between knowledge and dietary practices before and during competition was significant at the 5 percent level for only the question concerning vitamin supplementation during training. This author concluded that nutrition knowledge and dietary practices were not closely related.

Similar to the more recent research on the preceding topic, in a much earlier paper Jalso et al., (1965) studied the relationship between nutritional beliefs of 340 members varying in age, income, and formal education of community organizations and their dietary practices. However, personality rigidity rather than attitudes was the attribute variable studied in addition to these and other demographic variables. Fifty-three "faddists" and 48 "non-faddists" were selected from this group on the basis of a 30 statement nutritional opinion questionnaire having a reliability coefficient of 0.75. Details of the methods were reported in the original source of the data. Nutritional practices were

evaluated by answers to 20 questions regarding the use of food supplements and special "health" foods, weight control techniques, special diets, and avoidance of certain foods. A highly positive correlation ($r = 0.63$, $p < 0.01$) between opinion scores and practice scores was said to be indicative of a strong relationship between belief in food fallacies and actual practice. Personality rigidity determined by a 39-item test designed by another researcher and the opinion score were correlated ($r = 0.50$, $p < 0.01$). That is, the more rigid the personality the more misconceptions held.

Separate components of the knowledge, attitudes, and dietary practices interrelationship have also been examined. In particular, the relationship between nutrition knowledge and attitudes of different groups has been studied by several authors concurrently with the above research. Emphasis will be placed only on the construction of the knowledge test instrument.

The testing instrument used by Petersen and Kies (1972) in a mail survey of 910 elementary teachers in Nebraska included true-false nutrition knowledge questions regarding general knowledge of nutrition, food composition, application of nutrition principles and food misconceptions. This instrument was evaluated and pretested by a small group of teachers and a professional statistician. New items were included "as deemed appropriate for the current group". No other details of the test construction were provided.

A limited way of assessing knowledge of nutrition was used by Bremer and Weatherholtz (1975) in a survey on the nutrition attitudes of 670 individuals of a university community. Based on answers to the two factual questions about nutrition which concerned the best source of polyunsaturated fatty acids and factors which might affect a person's

nutritional status it was concluded, "It is surprising (and less flattering to their educational backgrounds) that their performance was less than average on the factual questions about nutrition." One can question whether the authors had enough evidence from two questions to justify a statement such as this one.

Vickstrom and Fox (1976) used true-false questions related to normal and therapeutic nutrition and applicable to their study on the nutrition knowledge and attitudes of 867 registered nurses in Nebraska which were selected from "previously tested questionnaires" by Eppright et al. (1970) and Petersen and Kies (1972). New items were written, the test was reviewed by two nutritionists and two experts in the area of test construction, the test was pretested on a random portion of the sample, and item analysis was performed. No reliability coefficients were determined and construct validation procedures were not done.

In one of the earlier papers by Sims (1976) the reliability coefficients of the 23 true-false item nutrition knowledge test used in a study on the demographic and attitudinal correlates of nutrition knowledge of 163 mothers of preschool children were not determined. In addition to these 23 items developed by Eppright et al. (1970), the mothers were asked to name the foods thought to be necessary for their children each day. Evidence of more rigorous methodology is indicated in two later papers by this author (Grotkowski and Sims, 1978; Sims, 1978).

Construct validation procedures and the determination of the reliability of the knowledge test were not conducted in two other papers co-authored by Fox in 1977 (Krause and Fox, 1977; Stansfield and Fox, 1977). The first concerned the nutritional knowledge and

attitudes of 292 Nebraska physicians and in the second paper, these two variables were studied with 217 Nebraska grocery store managers. It is of interest to note that more strict test construction methods were not employed in a recent paper also co-authored by this researcher (Werblow et al., 1978) and published at the same time evidence for improved methodology appeared in the literature.

Thus it appears that the trend towards improving the research methodology has occurred along with more complex investigations into the interrelationships between nutrition knowledge and other attribute variables. Not only have the methods to measure knowledge become more refined, but mathematical techniques which permit ststistical analyses have replaced open-ended questioning methods in describing dietary practices.

F. SUMMARY AND CONCLUSIONS

The preceding review of literature will be summarized in three parts. A discussion on the lack of surveys on one segment of the population, young adult males, will be considered first of all, followed by comments on the methodology employed in studies measuring nutrition knowledge, and then by conclusions on the relationship between nutrition knowledge and dietary practices.

As indicated from this review, there is a lack of information regarding the nutrition knowledge and the dietary practices of young adult males. This is understandable since, in the traditional sense, women are more involved than males in food-related activities in the home and would seem to have more impact on the dietary practices of the family. However, there is unpublished evidence that the nutrition knowledge of males, especially in relation to cardiovascular health,

is of current concern (J.H. Sabry, personal communication[1]; N.E. Schwartz, personal communication[2]). Therefore, in order that relevant nutrition education programs can be designed for this group, an assessment of their nutrition knowledge is indicated.

It is clear that the early studies employed primarily subjective measures in testing nutrition knowledge. Open-ended questioning methods in which nutrition knowledge is assessed in a more unstructured format have been replaced by questionnaires of the true-false or multiple-choice variety. It has mainly been the recent papers using this fixed-alternative format that have attempted to determine construct validity and reliability, although as early as 1965 the reliability of one knowledge instrument was determined (Jalso et al., 1965). These two components of methodology have also been recently emphasized (N.E. Schwartz, personal communication[2]). Consideration of the research methodology must occur before the results of any research can be appropriately interpreted, and in this way, the focus of this study can be justified.

Any conclusions on the relationships between nutrition knowledge and dietary practices are difficult to make in view of the various approaches to the methodology. More or less reliable nutrition knowledge tests have been employed and dietary practices have been assessed qualitatively, quantitatively, and by statements in

---

[1] Sabry, J.H. 1979. Dept. of Family Studies, University of Guelph.

[2] Schwartz, N.E. 1979. Division of Human Nutrition, School of Home Economics, University of British Columbia.

[3] Ibid.

questionnaires. Whether or not it is justified to use linear regression equations in testing these relationships, will be considered later.

Nutrition educators should consider all relevant positive relationships between nutrition knowledge and dietary practices. This is an optimistic approach to the design and evaluation of nutrition education programs. Emphasis being placed on the negative or non-existent relationships is contrary to nutrition education efforts. Positive relationships between nutrition knowledge and dietary practices are summarized in the following table (Table 1). Of the fourteen relevant papers considered in the preceding review, more than twice as many indicated some kind of positive relationship (10 studies) than no relationship (4 studies). In addition, more reliability determinations were conducted in the former papers. Regardless of the extent of impact of nutrition knowledge, it is one of the many factors that has a bearing on food habits and is one that nutrition educators can change without being very concerned about the ethics of interfering with more personal attributes such as values, attitudes, and personality. These latter variables may, however, be subconsciously altered through nutrition education efforts. Conclusions by Caliendo and Sanjur (1978) lend support for the role of nutrition education.

> Nutrition classes, whether they be part of formal education curricula or in hobby or homemaking programs, were beneficial for improving the child's dietary quality. These classes were beneficial in ways other than through just a dissemination of knowledge; ...food habits can be intelligently redirected as needed.

Thus concludes the review of literature on research employing nutrition knowledge tests for one or more of three purposes. The

objectives of the study to be described are outlined in the next major section.

TABLE 1 continued

Reference	Nutrition Knowledge Test	Practice Index	Measure of Association
Al-Isi *et al.*, 1975	50 true-false items (Spearman-Brown split half coefficient, 0.86)	25 questions	$r = 0.68$, $p < 0.001$
MacFadyen, 1977	22 multiple-choice items	question concerning vitamin supplementation during training	significant at the 5 percent level
Grotkowski and Sims, 1978	20 multiple-choice and true-false items (Cronbach Alpha, 0.80)	3-day food records	significant at the 6 percent level with kilocalories
	self-evaluation of nutrition knowledge measured on a 10-point rating scale		energy intake $r=0.35$, $p<0.05$ protein intake $r=0.30$, $p<0.05$ fat intake $r=0.44$, $p<0.01$
Sims, 1978	20 multiple-choice and true-false items (Cronbach Alpha, 0.77)	3-day food records	with indices determined by factor analysis protein $r=0.41$, $p<0.001$, $\alpha=0.85$ dairy $r=0.32$, $p<0.01$, $\alpha=0.83$ energy $r=0.35$, $p<0.01$, $\alpha=0.87$ ascorbic acid $r=0.25$, $p<0.05$
Werblow *et al.*, 1978	31 true-false items	food pattern similarity scores for 50 food items	knowledge and training-weight control $r=0.24$, $p<0.05$ knowledge and pre-event weight control $r=0.25$, $p<0.05$
Phillips *et al.*, 1978	food and nutrition knowledge test	percentage of pre-sweetened cereals purchased	when older children were in the family $r=-0.35$, $p<0.10$

III. OBJECTIVES AND HYPOTHESES OF THE RESEARCH

Assumptions:

Several assumptions were made prior to the actual study. These are as follows:

1. The Food choice model proposed by Krondl and Lau (1978) regarding hypothetical personality types and their variations in food choice motives is both plausible and testable.
2. The I - E (internal-external) Locus of Control Scale developed by Rotter (1966) can be used to classify the target population with validity and reliability as to the degree of personality control.
3. Knowledge of nutrition can be tested with validity and reliability using a multiple-choice test.
4. Short term dietary practices can be measured with validity and reliability using the 3-day food record technique.
5. Seasonal variation in dietary practices has a limited impact on the nutrient intakes.

Broad Objective:

To assess the influence of nutrition knowledge and locus of personality control on the dietary practices of young adult males employed in sedentary occupations.

Two goals underly this broad objective and direct the list of specific objectives.

Goal I: To develop and validate an instrument designed to test the nutrition knowledge of adult groups.

Goal II: To apply the validated test instrument in a pilot study on

young adult males employed in a sedentary occupation.

The specific objectives of the pilot study are outlined.

Specific Objectives:

1. To review the literature that employs instruments designed to measure nutrition knowledge.
2. To develop a nutrition knowledge test relevant to the young male target group using recognized test writing procedures.
3. To validate the nutrition knowledge instrument using different population groups and the appropriate mathematical procedures.
4. To measure the level of knowledge of nutrition, in general, and nutrition related to cardiovascular disease of young adult males and to score this knowledge.
5. To classify the target population according to internal or external locus of personality control.
6. To collect information on the dietary practices of young adult males using 3-day food records and to rate these practices.
7. To determine the relationship between certain personality, biographical, and food habit variables and both nutrition knowledge and dietary practices using statistical analyses.
8. To determine the relationship between the nutrition knowledge score and the dietary practices score using statistical analyses.
9. To build a model to illustrate the factors influencing dietary practices.

The hypotheses for the relationships to be statistically determined are:

Hypotheses:

1. There is a positive relationship between nutrition knowledge and

dietary practices.

2. There is a relationship between locus of personality control and nutrition knowledge.
3. There is a relationship between locus of personality control and dietary practices.
4. There is a relationship between role in meal planning and preparation and nutrition knowledge.
5. There is a relationship between role in meal planning and preparation and dietary practices.
6. There is a relationship between source of foods and nutrition information and nutrition knowledge.
7. There is a relationship between source of foods and nutrition information and dietary practices.

The variables used in this study are defined below.

Operational Definitions of Variables:

Nutrition Knowledge - defined in relation to the score obtained on a 26-item multiple choice nutrition knowledge test

Dietary Practices - energy and intakes of 9 nutrients, quantitatively measured using the 3-day food record, scored in relation to the Dietary Standard for Canada (revised 1975), based on a maximum score out of 10

Locus of Personality Control - measured by the 23-item forced-choice instrument developed by Rotter (1966) with a higher score representing a greater degree of externality

Role in Meal Planning and/or Preparation - based on one of four categories included in a

fixed-alternative question

Source of Foods and Nutrition Information- both human and printed sources of foods and nutrition information were listed in response to open-ended questions

Conceptual Framework:

Assuming the hypotheses are true, the following scheme illustrates the relationship of nutrition knowledge to the dietary practices of the young adult male within the framework of this pilot study.

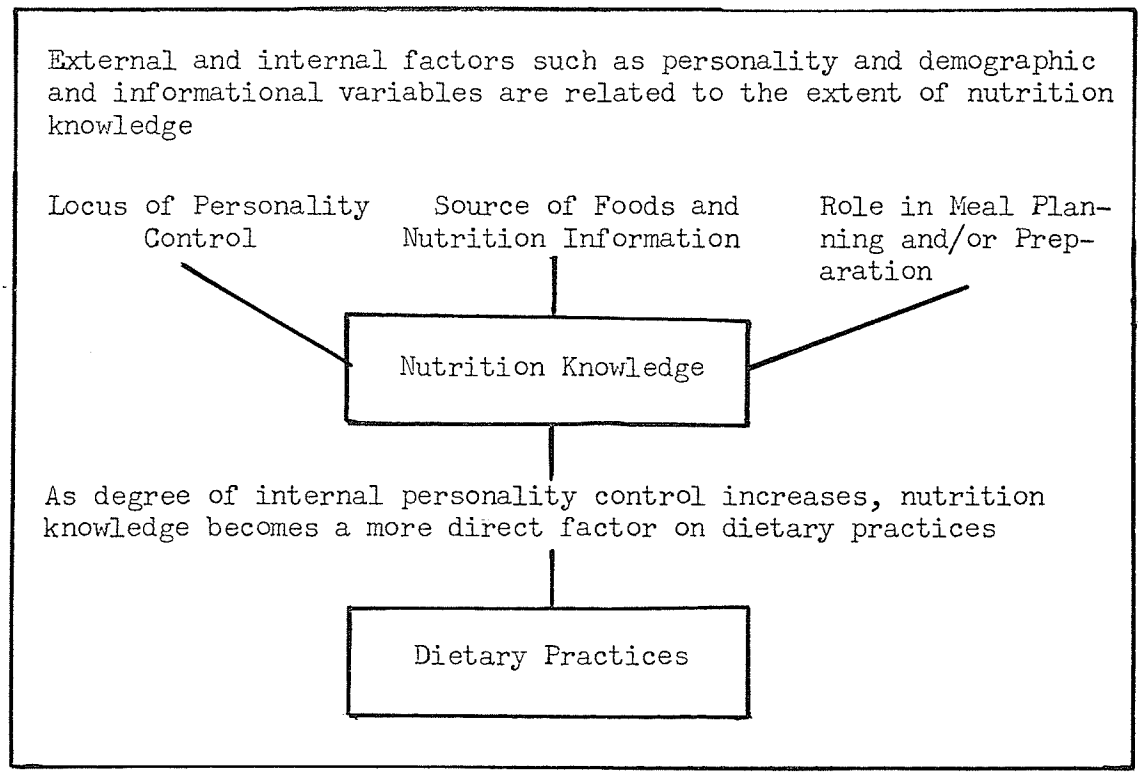

Figure 1: Conceptual framework

IV. METHODOLOGY

A. THE DEVELOPMENT OF AN INSTRUMENT TO TEST NUTRITION KNOWLEDGE WITH VALIDITY AND RELIABILITY

1. Multiple-Choice Format

The nutrition knowledge test instrument was developed in a step-wise manner with validation procedures occurring at each step. Ebel (1965) maintained that if modern knowledge and techniques of test construction are employed, tests can be made to yield scores with reliability coefficients close to 0.90 (1.0 represents a perfect correlation which is never attainable). Some of these guidelines are as follows: construct a longer test, use more homogeneous and discriminating items, and select items of middle difficulty (Ebel, 1965). After a review of some existing test instruments published in the literature, multiple-choice items were constructed according to the techniques suggested by Ebel (1965) and corresponding to the objectives of this study. Most texts on educational tests and measurements include the traditional approach to test construction and give details on item-writing (Ebel, 1965; Gronlund, 1976; Martuza, 1977). The multiple-choice format is the preferred format in the opinion of many test specialists (Ebel, 1965; Gronlund, 1976; Martuza, 1977) for several reasons. Multiple-choice tests tend to be more efficient; more objective, ie. less interrater and intrarater variability; and less subject to item sampling errors, ie. for a fixed amount of test time, they permit construction of a more representative sample as the item population of interest (Martuza, 1977). In addition, one can obtain information on the misconceptions held when alternatives other than the correct one are chosen. A "don't know" al-

ternative was included along with the four other alternatives in order to eliminate guessing on the part of the subjects, and thus, a more accurate assessment of knowledge could be obtained.

2. Content Validity

Forty-two five alternative multiple choice items pertaining to general nutrition concepts and nutrition in relation to cardiovascular disease were constructed. Some items included in a test by Préfontaine (1975) were used directly and some were modified. New items relevant to the topic of nutrition in relation to cardiovascular disease were composed. Emphasis was also placed on weight control since the ponderal index calculated from data obtained in the Nutrition Canada National Survey (Canada, 1973) indicated that half or more of the adult population was overweight. Forty-two percent of the young adult men (20 - 39 yrs.) of the general population were classified as overweight on the basis of this index. In addition, items based on the public's understanding of nutrition were also included (McNutt, 1977).

Prior to distribution to members of the Foods and Nutrition Department, some preliminary tests had been conducted on campus with students from different faculties of the University of Manitoba. This was useful in obtaining some information on the percentage of correct or incorrect answers for each test question. Staff and students of the Foods and Nutrition Department completed the questions and made corrections and suggestions for improving the items. Readability and timing were also checked at this time. The percentage of correct responses by the student group, in addition to suggestions made by the professionals, were used in revising these questions.

A meeting to discuss the contents of the questionnaire was

held with two graduate students in Foods and Nutrition, two professors of Nutrition, and the author. The five content areas of the 42-item test were discussed and certain questions were eliminated since they were not appropriate to the target population. The 31-item revised version of the test was distributed to four professors of the Foods and Nutrition Department for their comments. The contents of the 42-item and this 31-item revised version are indicated in Table 2.

TABLE 2

CONTENTS OF THE MULTIPLE-CHOICE NUTRITION KNOWLEDGE TEST

Content Area	42-Item Test no.	31-Item Test no.
Nutrition and cardiovascular disease	9	9
Balanced food selection	16	10
Food composition and nutrient sources	9	7
Nutrient functions	5	2
Nutrient requirements	3	3
Total	42	31

Following revisions based on their suggestions, a 30-item test was ready for the next step of validation. (One question under the content area of balanced food selection was omitted). The procedures just described were used to establish content validity. A copy of the 30-item nutrition test is included in Appendix A.

3. Construct Validity

The next step in the validation of the 30-item test instrument was construct validation. Of the various approaches to construct validity previously described, the "known groups" method was more appropriate to this study. The constructs presumed to account for test performance were first identified. Role in meal planning and preparation, knowledge of nutrition, exposure to foods, and decision-making involving the purchase and preparation of foods could influence the test scores in this study. The hypothesis that professionals and those individuals with greater exposure to foods and nutrition information should score higher than those with lesser exposure was then established. This hypothesis was tested by logical and empirical means and then it was tested with each test score in accordance to the procedures outlined by Gronlund (1976). Five groups of individuals differing in their exposure to foods and nutrition information were contacted personally and were asked to complete the 30-item nutrition test. It was predicted that the test scores would correspond to the following sequence of groups: professional dietitians and nutritionists (n=17), third year Foods and Nutrition students (n=25), a group of well-educated mothers (n=13), a group of mothers whose children attend a day care centre in a low socioeconomic area (n=14) and finally a group of businessmen employed in an investment company (n=20).

As was predicted, those with higher education and greater exposure to foods and nutrition information scored higher (Table 3).

TABLE 3

MEAN TEST SCORES ON THE 30-ITEM NUTRITION KNOWLEDGE TEST

Group	Test Score Mean	± S.D.
Professional dietitians and nutritionists (n=17)	89.4	7.4
Third year Foods and Nutrition students (n=25)	77.2	9.3
Well-educated mothers (n=13)	54.1	14.1
Mothers of a low socioeconomic area (n=14)	41.7	13.2
Businessmen (n=20)	34.5	2.3
Total N=89		

These findings correspond to comments by Sims (1976):

> In general, the literature seems to indicate that nutrition knowledge is more a function of the overall educational background of the individual rather than a separate and independent factor which acts directly to influence food choices.

In the study by Sims (1976) a strong correlation existed between nutrition knowledge and socioeconomic status ($r=0.53$, $p < 0.001$) and the Occupation-Education scale ($r=0.51$, $p < 0.001$). A weak relationship with income also occurred ($r=0.20$, $p < 0.01$). Nutrition knowledge was highly correlated with educational attainment in earlier studies (Young et al., 1956a; Morse et al., 1967, Harrison et al., 1969, Cosper and Wakefield, 1975) and in later studies by Phillips et al., 1978 ($r=0.63$ and 0.56, $p < 0.10$) and by Sims, 1978 ($r=0.55$, $p < 0.001$). Regarding the lower test

scores of the businessmen, Dwyer et al. (1970) commented, "it is a fairly consistent finding that females perform better than males on tests measuring nutritional knowledge." The following explanation was offered by these researchers.

> This is understandable since, in addition to being exposed to more nutrition through additional class hours in home economics, interest and concern about nutrition and related areas such as cooking and meal planning are probably higher among females (Dwyer et al., 1970).

This appears to be the case with the pretest scores of the 20 businessmen (Table 3).

4. Reliability

Following tabulation of the results, the test scores were analyzed for reliability by using the Statistical Packages for the Social Sciences[4] (SPSS) computer package for reliability. The Kuder-Richardson 20 coefficient obtained when the test scores of the 89 pretest papers for the 30-item test were combined was 0.91. A more appropriate comparison of the reliability coefficient of the test would be between the coefficient obtained for the pretest group of businessmen and for the study group of businessmen. However, the comparison based on the 89 pretest papers combined was considered adequate for this pilot study. Test-retest measures of reliability and the construction of equivalent forms of the test which are measures of stability and equivalence were not practical for this study. For the study group of 38 males this reliability coefficient was 0.67. It is notable that the value of this coefficient changed when given to a smaller more homogeneous population. Martuza (1977) explained that the coefficients obtained are directly related to the total test variance so that the greater the value of the test variance, the greater the value of the internal consistency estimate. He adds,

---

[4] SPSS Batch Release 7.0 Update Manual, March 1977, page 58

"Any norm-referenced test which is highly reliable when used within a heterogeneous population of individuals may be quite unreliable when used within a very homogeneous subset of the same population" (Martuza, 1977). An examination of the reliability equations lends support for this statement. Kerlinger (1973) discusses the traditional error theory basis for reliability in which reliability is defined through error. Accordingly, "reliability is the proportion of the 'true' variance to the total obtained variance of the data yielded by a measuring instrument" (Kerlinger, 1973). Considering the above definition in equation form, $r_{tt} = \frac{V\infty}{V_t}$ ($V\infty$ = true variance, V_t = total obtained), if the true variance is small, the reliability coefficient is low. When the true variance in this study decreased from the heterogeneous pretest group to the homogeneous study group there was a corresponding decrease in reliability. Other factors influencing reliability of the test results and relevant to this study have been defined (Gronlund, 1976):

1. The longer the test the higher the reliability since there is more adequate sample of behavior and the scores are less apt to be distorted by chance factors such as guessing.
2. The larger the spread of scores, the higher the reliability. Greater distances reduce the possibility of shifting positions. That is, errors of measurement have less influence on the relative position of individuals where the differences among group members are large or widespread.
3. Tests which are too easy or too difficult for the group members taking them will provide scores of low reliability because of the restricted range of scores.

Considering the question of how high the reliability coefficient should

be, it depends on the decision to be made and how confident we need to be about the decision being made (Gronlund, 1976). A reliability coefficient of approximately 0.70 would be suitable when one considers the decisions to be made based on the results of the test.

5. Item Analysis

Item analysis was performed on the 30-item nutrition test administered to both the 89 subject pretest group and the study group of 38 respondents. This was done in order to gather more evidence for justifying the contents of the nutrition test to be used in the final statistical analyses. The results of this procedure are presented in Table 4. The difficulty indices ranged from 0.19 to 0.96 for the pretest group and from 0 to 0.95 for the study group. The discrimination indices ranged from 0 to 0.96 for the pretest group and from -0.10 to 0.60 for the study group. A major feature to note is the different difficulty and discrimination indices achieved when the group of subjects changes from a more varied sample to a homogeneous one. In almost all cases, both indices are smaller for the more homogeneous sample. This corresponds to comments by Martuza (1977) that these indices are a function of the size and composition of the groups to which the items are administered. "Ideally, item analysis should be carried out using a large sample (several hundred examinees) which is very heterogeneous with respect to the characteristic" (Martuza, 1977). By using a more varied group in the first item analysis, these recommendations were followed. A higher reliability coefficient for the 30-item test was achieved (0.91 versus 0.67) for this varied group. The formulae applied to the item analysis data in order to obtain the difficulty and discrimination indices have been indicated by Gronlund (1976).

TABLE 4

RESULTS OF ITEM ANALYSIS ON THE 30-ITEM NUTRITION KNOWLEDGE TEST

Question Number	Difficulty Index Pretest[1]	Difficulty Index Study[2]	Discrimination Index Pretest	Discrimination Index Study
1	.42	.35	.58	.30
2	.54	.30	.83	.40
3	.50	.35	.67	-.10
4	.19	0	.21	0
5	.56	.25	.71	.50
6	.77	.70	.38	.20
7	.50	.45	.92	.50
8	.48	.60	.96	.20
9	.81	.70	.21	.20
10	.58	.45	.83	.30
11	.23	.15	.46	.10
12	.60	.40	.63	.60
13	.52	.35	.79	.10
14	.77	.90	.46	.20
15	.69	.25	.63	.30
16	.79	.40	.42	.20
17	.50	.05	.75	.10
18	.96	.95	0	.10
19	.75	.45	.50	.50
20	.52	.25	.88	.30
21	.85	.70	.29	.60
22	.40	.15	.71	.10
23	.60	.30	.63	.60
24	.71	.70	.33	.40
25	.92	.90	0	.20
26	.44	.10	.79	.20
27	.63	.60	.75	.20
28	.60	.40	.71	.40
29	.81	.50	.38	.40
30	.54	.45	.92	.50

[1] N=89

[2] N=38

6. Justification for the Test to be Used in the Statistical Analyses

The decisions for the inclusion or elimination of questions for the final test to be used in the statistical analyses were based on three criteria: 1) ambiguity of the question, 2) effects on the domain of basic concepts important for the general public to know and of concepts in relation to cardiovascular disease, and 3) the reliability of the test results when specific questions were eliminated. It was decided that four questions (numbers 4, 9, 18 and 25, Appendix A) should be eliminated to achieve a test suitable for further analyses. The reliability coefficient for this 26-item test was 0.69. Question 4 regarding the most important cause of heart disease was ambiguous to the pretest group and none of the study group answered it correctly. Question 30 tapped a similar domain of content. Question 9 could be subject to different interpretations; question 19 regarding snacking practices was a better question. Question 18 regarding fat content was a non-discriminating question. The proportion of correct responses to this item was high for both groups (96 and 95%) and the discrimination indices were low (0 and 0.10). The distractors for this question were not suitable. Similarly, question 25 was a non-discriminating question especially for the pretest group (discrimination index = 0). Questions 10 and 15 were better questions and were related to the similar concept about the type of fat or oil and good health. It was decided to include the other 26 questions in order to retain as much as possible of the domain of content and also the reliability coefficients did not improve markedly with more questions eliminated. The reliability coefficient reached a maximum of 0.73, however this test consisted of only 19

items, a domain too small for this study. The discrimination indices could not be counted on for these decisions since the study group was too homogeneous regarding the test scores. The initial 30-item test had 21 items on basic nutrition concepts (70%), and 9 items on nutrition related to cardiovascular disease (30%). With the four questions removed, these proportions were not changed significantly. Nineteen items (73%) covered basic concepts, while 7 items (27%) were related to cardiovascular disease. Therefore, a 26-item test with KR 20 reliability coefficients of 0.92 for the pretest group and 0.69 for the study group was selected for further analysis on the results.

B. THE APPLICATION OF THE INSTRUMENT IN A PILOT STUDY

1. Research Design

This study was a hypothesis-testing field study. Relationships and hypotheses were predicted and then tested in real life situations. According to Kerlinger (1973), although field studies are limited by the practical problems associated with these life situations, for example, obtaining a random sample, they are strong in realism. Besides the testing of relations among variables, this study could provide a basis for possible future, more systematic testing of hypotheses.

It was not a true experiment in which the variables were manipulated by the researchers, but instead it was ex post facto research. In this type of research the researcher starts with the observation of the dependent variable and retrospectively studies independent variables for their possible effects on the dependent variable.

> Ex post facto research is systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occured or because they are inherently not manipulable. Inferences about relations among variables are made, without direct intervention, from concomitant variation of independent and dependent variables (Kerlinger, 1973).

The independent variables, such as nutrition knowledge and locus of personality control, had already occurred and thus were measured, not manipulated. For example, nutrition knowledge was not manipulated through a nutrition education program; rather, it was measured by a specially designed instrument. Therefore, the variables were attribute not active variables.

Another feature of this ex post facto research design is the internally directed nature of the study. The generalization of the findings to the entire population of young adult males employed in sedentary occupations would not be valid.

> In basic research (as this study is), for example, generalizability is not the first consideration, because the central interest is the relations among variables and why the variables are related as they are. This puts an emphasis on the internal rather than the external aspects of the study (Kerlinger, 1973).

The reasons behind the inclusion or the elimination of certain variables are of importance and follow specific principles underlying the control of extraneous variables outlined by Kerlinger (1973). In this study, age, sex, and education were eliminated as variables and, therefore, were controlled through specific selection of the sample because they had been shown to be related to nutrition knowledge in one or more of the following papers (Young et al., 1956a; Morse et al., 1967; Harrison et al., 1969; Dwyer et al., 1970; Bremer and Weatherholtz, 1975; Cosper and Wakefield, 1975; Sims, 1976; Phillips et al., 1978; Sims, 1978).

> To eliminate the effect of a possible influential independent variable on a dependent variable, one can choose subjects so that they are as homogeneous as possible on that dependent variable (Kerlinger, 1973).

Internal or external control of personality was also hypothesized as an influential variable after an examination of the model proposed by Krondl and Lau (1978). Therefore, to control this variable it was built into the research design as a variable.

> An extraneous variable can be controlled by building it into the research design as an attribute variable, thus achieving control and yielding additional research information about the effect of the variable on the dependent variable and about its possible interaction with other independent variables (Kerlinger, 1973).

The type of interview is another consideration of the research design. A mail survey would not have been feasible in this study which involved a small number of respondents due to the high percentage of non-response associated with this type of approach and also the difficulty of explaining and later checking the food records. For greater accuracy of the results and an increased rate of return on the completed questionnaires, the personal interview format was indicated. In a similar study, Sims (1978) used a self-administered questionnaire delivered through the mail. Only in some cases was a personal interview necessary in order to verify portion sizes, ingredients of unusual items or brand names of items recorded. In the present study a group-administered approach was selected for the first interview for reasons of efficiency. Small groups of one to approximately seven or eight subjects received detailed instruction on the use of the food record. The nutrition knowledge test was not administered at that time since it was felt that the food record might have become biased by concepts covered in the test. The small rather than large groups and the personal interview approach were also important in the establishment of rapport with the subjects. This would have a bearing on the validity of the results and the seriousness with which the respondents undertook their various tasks. A second interview was necessary in order to check the food records for clarity and completeness. This provided an

additional opportunity to obtain information from the subjects. The nutrition knowledge and personality tests were administered, followed by certain biographical and food habit questions. This sequencing was effective in the efficient use of the one hour time period.

2. The Sample

a. Selection of Target Group

The young adult male population was selected as the target group for several reasons. Recently recommendations as amended and adopted June, 1977, by the Department of National Health and Welfare were published by the Committee on Diet and Cardiovascular Disease (Health Protection Branch, 1977a). Canadians were advised to follow an appropriate diet in order to lessen the risk towards cardiovascular disease and thereby assume some responsibility for their personal health (Appendix B). Nutrition education programs designed to increase the knowledge of nutrition in relation to heart disease have been planned as a result. Thus, the initial focus in this area appeared to be the spreading of sound nutritional knowledge. An appropriate group to study in this respect would be a group of individuals prone to coronary heart disease. More specifically, heart attacks rank first as a cause of death in males by age 35. Therefore, preventative health programs before and during the middle-age period of life are important.

It can be assumed that by age 25 the adult male would have finished his formal education and would be actively engaged in the work force. If this occupation were of a sedentary nature, this individual could easily succumb to overweight if his activity patterns were not in line with his food intake. Indirectly, obesity and lack of physical

fitness in addition to poor dietary habits, for example, excess salt and high saturated fat intakes are risk factors for heart disease especially in the adult male population. An investigation into the nutrition knowledge and practices of the 25 to 35 year old adult male group would emphasize the preventative outlook of this research since at age 25, heart disease ranks fourth rather than first as a cause of death (Health and Welfare Canada, 1976). A follow-up nutrition education program could focus on areas of limited nutrition knowledge bearing in mind the existence of other factors influencing food-related behaviors. To quote Leventhal (1973), "All the presently known risk factors for coronary heart disease have significant behavioral aspects...may well be that without effective attitude and behavioral change, prevention and treatment of chronic diseases such as arteriosclerosis are not possible."

Other reasons for the selection of the target group besides the risk of heart disease in the adult male population were: self-selection of food outside of the home, participation of male family members in food-related activities in the home, and lack of nutrition knowledge surveys on the young adult male population.

Considering self-selection of food outside of the home, there has been a trend during the past five years towards a greater per capita expenditure for food away from home in fast food outlets, restaurants, or other commercial establishments (Canadian Restaurant and Foodservices Association, 1977). Divorced from the internal influence of the family on food selection, the individual follows his own initiative in choosing from a variety of food alternatives. The home-

maker is no longer solely responsible for the food activities of the family members. Therefore, it is important to center upon the individual, himself, whether he be the teenager who habitually frequents the local fast food establishment or the businessman who eats lunch in company cafeterias, nearby restaurants or who possibly misses the noon meal. In order to determine the food consumption behavior of the young businessman and the necessity of a nutrition education program, a survey of this population would be valuable.

Participation of the male family members in food-related activities in the home is not to be overlooked. It is reasonable to assume that when the wife or mother is employed outside of the home the other family members, including the males, would have a greater responsibility and opportunity for food-related activities such as food purchasing and preparation. In an early paper, 89 percent of mothers interviewed indicated that there were foods that they seldom served because the husband did not like them. In addition it was found that the father had an influence on his child's food preference in that the variety of food offered to the child could be limited (Bryan and Lowenberg, 1958). Schafer (1978) reported that when there is some disagreement over the food served at a meal, both marriage partners perceived that the wife would have a greater tendency to yield than the husband. The strong influence that the husband has on the wife trying a new food has been studied (Cosper and Wakefield, 1975) and in another study it was reported that the fathers' food preferences were more important than the mothers' in determining family menus (Burt and Hertzler, 1978). Recently it has been stated that the mother is certainly "no longer the 'gatekeeper' of family nutrition if she ever was...If

the father takes more responsibility for grocery shopping and food preparation, he will have even more impact on family food choices" (Helmick, 1978). Therefore, the male influence on family eating practices is a significant issue.

Finally, there has been a lack of surveys on the young adult male population. As stated earlier, traditionally females have been more involved than males in the buying of food and the preparation of meals. For this major reason several studies have been conducted on the nutrition knowledge of homemakers under the assumption that those homemakers with better nutrition knowledge would plan more nutritious meals. Also, one or more of nutrition knowledge,attitudes and dietary practices has been studied among other groups besides homemakers and excluding the adult male. Thus, there is no published literature to date regarding the nutrition knowledge and dietary practices of the young adult male.

b. Sampling Procedures

A mixed sampling approach was used to procure the final sample of 38 subjects. The non-probability method called "purposive sampling" (Kerlinger, 1973) was employed initially in which deliberate effort was used to obtain typical groups or subjects in the sample, in this case, 25 to 35 year old males employed in an insurance company. Systematic sampling using specific intervals was the probability sampling technique used to select subjects from the computer list of 202 males of this age group.

An initial contact through the Personnel Office of the insurance company was made on October 23, 1978. At this time the project was ex-

plained and the Personnel Officer approved the use of his employees for the study (Appendix C). Arrangements were made regarding the contacting of a subsample from the computer list of employees. This list was not viewed by the author in order to maintain confidentiality. Every fourth name, then every fourteenth was selected by the secretary to obtain a sample of 60 subjects. Then, a letter written by the author regarding a general meeting at which time the details of the project were to be given,and covered by a letter from the Personnel Officer was sent to each employee sampled. Twenty of the 60 subjects came and agreed to participate in the study by signing the consent form (Appendix C). Because of the low response rate (33%), another subsample was drawn using a sampling interval of five. These employees were contacted in the same manner as the first sample. Eighteen of these 60 employees (30%) agreed to participate in the study. This resulted in a total sample of 38 subjects, 32 percent of the 120 subjects contacted and 19 percent of the total population of 25 to 35 year olds employed in the company and excluding top management positions. More persistent techniques could have been attempted in order to obtain a larger sample, however, 38 was considered sufficient for the pilot nature of the study and only those seriously interested in the study were wanted. The latter would help overcome the tendency towards incomplete records. Morgan et al. (1971) has outlined some factors for the refusal to participate in a nutrition survey. However in spite of the attempts to use some of their recommendations: re-sampling if a low response occurs, letters sent out explaining the survey, a reward for participation, initial contact by someone familiar to the employee; a low turn out

at the first meeting was experienced. It was felt that this was due to the increased work load of the employees at this time of the year and the moving of several offices into another building. A greater response rate would perhaps have occurred if the study was conducted at a more suitable time of the year for the employees.

Details of the final sample of 38 young men are as follows. Annual income ranged from $9600 to $22,200. This corresponds to income category C used in the report by Myres and Kroetsch (1978) on the influence of income index on the nutrient intake and food consumption patterns of Canadians based on Nutrition Canada data. A code number was assigned to each subject in order to maintain confidentiality. The sample was self-selected in that participation in the study was voluntary. This may have allowed those subjects with very poor eating habits to refrain from participation. However, this study is different from other studies reported in the literature in that the subjects did not see the test forms before consenting as is often the case with mailed questionnaire surveys. An example of the latter is a study by Sims (1978). Sixty-one lactating women returned their completed questionnaires in self-addressed, stamped envelopes after viewing them. The percent return following an initial telephone contact was not indicated.

3. Research Instruments

a. Nutrition Knowledge Test

The 30 multiple-choice item nutrition knowledge test as described in a previous section (IV. METHODOLOGY A.), was administered to the study group of 38 subjects. Content and construct validity and re-

liability coefficients were considered. A 26-item test was selected for the statistical analyses. Questions 4, 9, 18, and 25 were eliminated. A copy of the nutrition test and also the answers and explanations to 26 questions are included in Appendix A.

b. Food Record

Data on all food and beverages consumed by the sample over a three day period were collected in a booklet designed especially for this purpose. This three day period included two typical days (two weekdays) and one atypical day (one weekend). Sample pages of the three day food record are included in Appendix D. Decisions regarding the selection of this method for collecting the dietary data and the time period were made following a review of the literature on dietary survey methodology.

i. Review of Literature

Three major questions had appeared frequently in the early papers on dietary methodology: "What is the best way to obtain the information wanted, how long a period, and which days?" The answers to these and other questions have been sought after for many years by researchers of dietary methodology. The best method for short term dietary intake studies has been investigated (Huenemann and Turner, 1942; Bransby et al., 1948; Eppright et al., 1952; Young et al., 1952a, 1952b; Trulson, 1954; Adelson, 1960) in addition to methods for long term epidemiological studies (Young and Trulson, 1960; Abramson et al., 1963; Balogh et al., 1971; Hankin et al., 1978). Also, the complexity of comparing studies which have used different methods of data collection has been considered (O'Hanlon et al., 1978).

"How long a period," the second question, needs to be answered before the survey takes place and also has been the concern of many (Leverton and Marsh, 1939; McHenry et al., 1945; Chalmers et al., 1952; Trulson, 1955; Adelson, 1960). Finally, "which days" to include in the survey is of consideration (Leverton and Marsh, 1939; Chalmers et al., 1952; Eppright et al., 1952). Thus, the answers to these and other questions have been investigated in the literature.

Another prevailing issue has been the validity or accuracy of the various dietary survey methods in measuring actual intake. Sources of error in dietary surveys related to sampling procedures, short term food intakes not reflecting long term practices, inaccuracies of recording and calculating, memory lapses, and others have been discussed (McHenry et al., 1945; Young and Trulson, 1960; Marr, 1971; Fidanza, 1974). Young and Trulson (1960) emphasized that the greatest limitation in all methods is human error. They further commented, " a major defect in the collecting and processing of dietary data lies in our inability to make precise or even approximate statements concerning the validity and reliability of the various procedures in current use." However, where measurements are attempted it is important to determine the validity and the reliability of the methods (Marr, 1971). The current interest in this topic of internal validity is reflected in a review paper on the validity of 24-hour recalls (Anon., 1976) and in turn is succeeded by one of the few research studies on the internal validity of 24-hour recalls and the only study to date on the validity of the 7-day record (Gersovitz et al., 1978). Practical guidelines for improving the quality of the data collected have also appeared (Youland and Engle, 1976; Frank et al., 1977). Thus, it

becomes apparent that the shift in emphasis has been on quality control in order to increase the validity of the data.

The latter studies on dietary methodology do not dwell on the questions of "what method, how long, and which days" as the early work in this area indicates. The publishing of a review article summarizing this work related to epidemiological studies (Young and Trulson, 1960) and a comprehensive review on individual dietary survey methods (Marr, 1971) has possibly been responsible for this reduced emphasis. Conclusions made by these authors are appropriate to the rationale behind the methods chosen. "There is no generally accepted method of measuring the dietary intake of free-living individuals" (Marr, 1971)."...The best method depends on the objective of the study and the hypothesis to be tested" (Young and Trulson, 1960). An astute comment made by Beaton (1973) in relation to dietary surveys in the evaluation of nutritional status also reflects the above opinions, "...what we face in looking at the evaluation of nutritional status is to decide precisely what our objectives are, to pick the methodology for those objectives, and live with the limitations imposed by the methodology we have chosen."

ii. Rationale Behind the Use of the Three-Day Food Record

The rationale behind the use of the three-day food record, the time of the survey and the development of the recording booklet can be explained in terms of the objectives and hypotheses of the study, the limitations imposed by the sample size, and the characteristics of the target population.

The second objective besides the development of an instrument

with a high degree of validity and reliability to test nutrition knowledge was the application of this instrument in a pilot study to investigate the interrelationships of various attribute variables through the use of statistical analyses. This required the collection and reporting of data on individual rather than group nutrient intakes. In addition, to the individual rather than group emphasis, fairly accurate nutrient intake data was necessary for the statistical correlations. The use of a shorter record has been shown to produce more valid intake data than the longer five to seven day record. Gersovitz et al. (1978) used regression analyses in a study which was designed to test the internal validity of the 24-hour recall and the 7-day dietary record. It was concluded that during the early days of the record keeping, the record was generally valid for group comparisons of nutrient intakes, but the validity declined in later days. Within the first two days, validity criteria were met by 9 of the 10 slope coefficients, by days 3 to 4, six out of ten criteria were met and only three out of ten were met by the fifth to seventh days. An attempt was made to improve the validity of this pilot study by using the frequency question in the food habit questionnaire as a cross-check on the record. In addition, trained interviewers were employed to assist in the data collection. It has been reported that "interviewers having similar backgrounds and training and working as a team are able to obtain comparable data (Church et al., 1954.) Differences between interviewers rarely exceeded 10 percent of the allowance for each nutrient in the study by Church et al. (1954). Also the interviewers were instructed on the use of careful probing in order to obtain missed data. Campbell

and Dodds (1967) found that where no menu was available as a check to be used with the probing, the 24-hour recall omitted as much as 35 percent of the calorie intake for older men. The food records were also checked over. This is in line with the findings by Steele et al. (1951). Sixteen percent of the subjects with unchecked records had differences 10 percent or greater over the checked records. In reference to attempts made to validate different methods of measuring the intake of "free-living" individuals, Marr (1971) has stated "absolute reproducibility and validity are not achieved by any of them." However, this does not negate the attempt to improve dietary methodology. A final consideration of the objectives and hypotheses of the study is that young adult males served as the target population. There is a lack of comparable studies investigating the relationship between nutrition knowledge and nutrient intakes of this group although similar studies have been conducted using three day records and other target groups: the elderly (Grotkowski and Sims, 1978) and lactating women (Sims, 1978).

Limitations imposed by the small sample size (less than fifty individuals) and the characteristics of the target population (adult males in full employment) partly answered two of the questions commonly encountered: "Which method?" and "How long a survey?" With a small sample size less than 50 subjects and the emphasis on individual nutrient intakes, a 24-hour recall approach would not be suitable. Young et al. (1952b) reported that a 24-hour recall would be adequate for examinations of the mean intake of a group of about fifty and when 10 percent variability in results is tolerable. Regarding one-day time periods, "Dietary intakes vary from day to day. No one day's intake

has been shown to be valid for any group of individuals nor for any nutrient or calories. It is essential to survey, whether by recall or record for a sufficient period of time to enable 'customary' intake to be assessed" (Marr, 1971). Diet histories are not recommended in research studies where quantitative data on nutrient intakes is required (Huenemann and Turner, 1942). Also one method (the 3-day record) was used since according to Trulson (1954), for all practical purposes, one method should be used. Besides which method would be the best one in order to obtain the information necessary for the statistical correlations, a high rate of return on the data was extremely important due to the small sample size and the desirability of not having missing data for the analyses. This topic of rate of return has been discussed in the literature. Marr (1971) commented on a survey of pre-school children in which 95 percent reliable records were obtained when intakes were recorded in household measures for only three days. In the study by Gersovitz et al. (1978), 85 percent of the 65 subjects returned at least 2-day records, 78 percent returned 5-day records, and 60 percent returned the complete 7-day record. The authors concluded that there was a decrease in usable records as the length of the record keeping increased and also the nature of the sample was altered in that the more highly educated of the sample were overrepresented as the days progressed to seven. Ten percent of the adult men studied refused to co-operate and 7 percent produced 'doubtful' records in another study discussed by Marr (1971). These low co-operation rates were mainly from men who had consumed the majority of their meals away from home and recorded only a 'menu.' Conclusions by Marr (1971) are pertinent to this discussion on the length of time of the survey and

the response rates: "...it is not usually feasible for random samples of individuals to continue recording for periods longer than one or at most two weeks and in some circumstances shorter periods of time may be desirable if, for instance, co-operation rates could be increased by reducing the period of recording." Three days were, therefore, chosen in order to maximize compliance in the keeping of the records and to achieve a high rate of return on the records. (Thirty-seven of the thirty-eight completed all three days; the only incomplete record belonged to a subject who had become ill during the survey period).

"Which days and when to conduct the survey" also had to be answered. One weekend day was included due to variability of intakes during the weekend. This had been reported in an early study by Leverton and Marsh (1939). Social activities and change of routine were generally responsible for the variations in intakes of young college women. The two other days selected for this study were 'typical' weekdays. Considering the second of the above questions, this study had no epidemiological purpose, therefore, a short term survey of nutrient intake would be adequate. However the possible long term nature of the study is reflected by the comment by Marr (1971): "...adults who continue in a similar occupation and who are maintaining their weight are likely to show less variation than children or adolescents whose activities fluctuate from day to day." With reference to seasonal variations in intakes, it was desirable to avoid the harsh winter weather period and the holiday season. Saturday instead of Sunday was chosen in order to avoid festivities associated with the Grey Cup football game. Although the food supply available to Canadians does not differ ap-

preciably on a seasonal basis (Health Protection Branch, 1977b), there could be an increased tendency to remain indoors and avoid dining out during the cold weather. Lastly the fall time period rather than the spring was selected for the convenience of the author.

The final topic to consider under the heading of "Rationale" is the development of a booklet in which to record in household measures all food and beverages consumed plus any vitamin or mineral supplements. Precise weighing methods would not have been appropriate especially because of the meals eaten away from home. This had been supported by Marr (1971). In the Nutrition Canada National Survey (Canada, 1973), the lowest rate of return was experienced by the 20 to 39 adult male group. It was felt that the subjects would be more likely to record all items consumed, even in restaurants, if a convenient and inconspicuous booklet was provided. Also the information would be in one place thus decreasing the chance of losing pages of the record. Each day was divided into six time periods in order to make the recording easier for the subjects. The actual time periods were not critical to the study. If the subjects did not consume anything during a specific period, they were instructed to write "not eaten." This would tend to overcome any biases of changing one's food intake just to make sure that all meal or snack periods were covered. The percentage of certain nutrients eaten away from home was to be determined, therefore, allowance was made for specifying where the foods and beverages were consumed.

c. Personality Test

In a recent discussion by Krondl and Lau (1978) on food habit

modification, a hypothetical model was presented in which individuals were categorized into three types A, B and C, according to the degree of internal control. Type A or internally-controlled individuals were said to be presumably guided by "personal" motives in their selection of foods of which health belief and health knowledge were the two major components. In line with this typology of personality control, these authors stressed the importance of a personality assessment prior to the implementation of schemes designed to modify nutrition behavior. Possibly the effectiveness of nutrition education programs would be increased if the target audience was more clearly defined.

> In the study of food choice motives, typifying populations by the degree of internal/external control is indicated as different communication routes have to be used for different types of population groups if the modifying of food attitudes and changing of food use frequency (food habits) is to be successful (Krondl and Lau, 1978).

Thus, the above comments prompted the inclusion of an appropriate personality test in this study to measure personality control, the results of which would be used in the statistical analyses to determine the relationship between locus of personality control and both nutrition knowledge and dietary practices. It is notable that a recent paper (Schafer, 1979) investigated the relationship between the personality measure of self-concept and food behavior.

An appropriate scale to use in the assessment of locus of personality control is the Rotter I-E (Internal-External) locus of personality control test. It was designed by Rotter (1966) to be a measure of generalized expectancy of personality control rather than preference

for internal or external control. This easily-administered 29 forced-choice item test included 23 items from different life situations where locus of control attitudes might be relevant to behavior and also 6 filler items in order to make the test more ambiguous (Appendix E). A forced-choice format was used in order to decrease the correlations of this scale with the Marlowe-Crowne Social Desirability Scale (Rotter, 1975). This latter scale is used in the psychological literature.

When the sample is homogeneous Rotter (1975) stated that this test would be more suitable for investigations of group differences than for individual prediction.

> ...it was developed as a broad gauge instrument - not as an instrument to allow for very high prediction in some specific situation such as achievement or political behavior, but rather to allow for a low degree of prediction of behavior across a wide range of potential situations (Rotter, 1975).

In addition, since this is an additive scale, scoring is based on the number of external scores.

Appropriate at this time is the definition of internal or external control. This definition involves whether or not a person perceives that an event is contingent upon his own behavior or if it is under the control of luck, chance, or fate.

> When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event is interpreted in this way by an

> individual, we have labelled this a belief in external control. If the person perceives that the event is contingent upon his own behavior or his own relatively permanent characteristics, we have termed this a belief in internal control (Rotter, 1966).

An important consideration regarding the use of any sociological or psychological measuring device is the reliability or validity of the scale. Implications and limitations of the research on the I-E construct as a personality variable have been presented in a review paper by Joe (1971) who concluded, "Evidence generally supports the validity of Rotter's concept." Test-retest measures of reliability have been reported (Rotter, 1966) for different samples and for intervening time periods varying from 1 to 2 months ($r = 0.49 - 0.83$) and for intervening periods of 2 months ($r = 0.48 - 0.84$) and also 6 weeks ($r = 0.75$). Internal consistency estimates of reliability ranged from 0.65 to 0.79 with nearly all of the coefficients in the 70's. This level has been termed "reasonable" by Rotter (1966).

Several comments by Prociuk and Lussier (1975) who presented an analysis and bibliography of 2 years of research on this scale (1973-1974) are relevant to this topic.

> ...despite the several weaknesses of the I-E scale which have been identified e.g. social desirability, this scale continues to be the most widely employed measure of generalized expectancies for reinforcement...it is clear that I-E locus of control continues to be widely recognized as an important personality determinant of behavior...Reported findings indicate that this construct has proven to be useful in predicting a variety of behaviors, and the relationships found between internal-external control and important social variables have undoubtedly contributed to its present popularity as an area of investigation.

d. Biographical and Food Habit Questionnaire

The standardized and highly structured biographical and food habit questionnaire (Appendix F) was answered following self-administered nutrition knowledge and personality tests in the second interview lasting approximately one hour. The purposes of this schedule were threefold: to obtain certain biographical information, to explore relationships that had been investigated by other researchers, and to use some questions for validity purposes, ie. as a cross check on the food record. The open-ended, the fixed-alternative, and the scaling questions had been included to correspond to one or more of the above aims. The personal interview approach to obtain this information was chosen since more valid and complete results could be achieved than with a self-administered format. By structuring the personal interview, less time would be taken to complete this section.

Three types of questions were included in the schedule: open-ended (questions 2,5,6,7,8,13), closed-or-fixed-alternative (questions 1,4,9,11,12), and the scaling type (question 10). The interviewers were given specific instructions regarding the use of these questions. In the open-ended type, the alternatives provided were not disclosed to the subjects; instead they were included to facilitate the recording of the responses by categories and by the interviewers. The possibility of biased responses especially to questions 7 and 8 regarding human and printed sources of information on foods and nutrition could be reduced in this way. The fixed-alternative questions included those with the "yes" or "no" type of alternative and those where the choices were shown to the subjects through the use of cards. The cards were used either to ease the tension that could be associated with some

questions (questions 11 and 12) and/or to facilitate the answering of certain questions (questions 9 and 10). The interview would proceed much faster when the respondents could consult the cards, not having to rely upon their own memories. Regarding the scaling question (question 10), the interviewers were instructed to shuffle the deck of cards which specified the influences on a person's food choices. This would insure a random order of presentation and would decrease the tendency of the subjects to become fatigued and devote little thought to the responses farther down the list. This randomization technique had not been reported by Schafer (1978) who used the same scaling procedure in his research.

Considering the rationale behind the inclusion of specific questions, the first six questions concerned the attribute variables of following a special diet and both general and nutrition education. These items were included since these variables could have a considerable effect on the scores of the nutrition knowledge test and the outcomes of the food records. Nutrition instruction beyond the elementary, junior or senior high school level was considered to be of greatest importance.

The two questions regarding sources of nutrition information (questions 7 and 8) and the one question (question 9) regarding the role in meal planning and preparation were included in order to determine the relationships between each of these variables and both nutrition knowledge and dietary practices. Interest in these variables had been expressed (Schwartz, 1975; Schwartz and Barr, 1977). Question 10 regarding influences on a person's food choices was included for comparison purposes with other papers that had used this type of

scaling technique (Schafer, 1978; Schafer, 1979). This ten-point scaling format with 1 representing no influence and 10, a great deal of influence, had been used sucessfully by this preceding author with 116 adult males (average age - 30.5 yrs.) and 116 adult females (average age 28.0 yrs.) in a large scale study on social and psychological factors influencing food choices.

The last three questions (questions 11 - 13) were included for descriptive purposes. However, question 11 concerning the frequency with which a person eats a particular item was also included as a cross check on the accuracy of the food record. Moderate consumption of these 13 food items either of a highly saturated, salty, or alcoholic nature, had been recommended (Murray and Rae, 1978). Question 12 was used to obtain some indication of the use of salt by this group. Question 13 was asked to discover any special foods or supplements consumed and possible misconceptions related to their use.

Another rating scale that had been used in the first interview was the "Self-evaluation of Nutritional Knowledge" scale used by Grotkowski and Sims (1978) and later by Sims (1978). This scale extended from 1 (no knowledge) to 10 (as much knowledge as professionals) and was used for comparison purposes.

4. Implementation of the Study

a. Interviewer Training

A two hour training session was held by the author for the dietary interviewers, two pre-Master's students in Foods and Nutrition, and a graduate of the four-year undergraduate Nutrition program.

The agenda for this session is included in Appendix G. Prior to this meeting, the interviewers were required to fill out the three-day food record. The completed records were used as a basis for discussion of possible problem areas and codes. Common food items, possibly consumed by the target group, were coded and time for a general question period was included. At the end of the session, the interviewers were asked to conduct practice interviews on their own time before the actual study.

b. Interview Protocol

Standardized forms and a checklist for each interview were developed in order to insure high interrater reliability. This concept had been discussed by Fruin and Davison (1978) in a paper stressing the importance of validity and reliability in all research ventures. Also, as quoted earlier, "interviewers having similar backgrounds and working as a team are able to obtain comparable data" (Church et al., 1954). Samples of these forms are included in Appendix G. These forms, along with the test instruments, were included in a sequentially-organized folder for each interviewer. The interviewers were required to schedule their own interviews once initial contact had been made with subjects in the first interview. A blank calendar was made available for this purpose.

c. Location and Duration of the Study

Consent to proceed with the study had been granted by the Ethics Committee at the University of Manitoba. Due to the necessity of sampling twice in order to have a large enough sample size, the interviews were conducted at two distinct times in the Personnel Office of the company.

The first group of subjects (n = 20) received their first 30 minute interview on November 20 or 21, 1978. At this time the consent form was completed and a "self-evaluation" of their nutrition knowledge was made (Appendix C). Then they received instruction by one of the interviewers on how to record all foods and beverages consumed for the three days: Thursday, November 23; Friday, November 24; and Saturday, November 25. During the second interviews which lasted one hour and were held approximately one week later, the food records were checked over and the subjects were asked to fill out the self-administered questionnaire. The subjects were asked not to disclose the contents of the nutrition knowledge and the personality test to other subjects. The second group (n = 18) had their first interview on Friday, November 24 and were asked to keep their food records for the three days: Saturday, November 25; Monday, November 27; and Tuesday, November 28. Following this time period, they had a second interview and completed the identical forms as the first group. All of the data had been collected by Friday, December 1. It was important to complete the interviews in a short time span in order to minimize discussion of the study amongst the subjects. The Personnel Office was instrumental in the organization of the interviews. Several employees assisted in freeing the interview rooms at varying time periods depending upon when the interviewers had scheduled an appointment. In addition, the subjects were called if they were late or did not appear for their appointments. Except for a few subjects who forgot to bring their records to the second interview or who forgot the interview entirely, the interviews ran smoothly.

5. Data Analysis

a. Nutrition Knowledge Test

The multiple-choice nutrition knowledge test was scored by assigning a mark of "1" to a correct response and "0" to an incorrect response. The sum of the correct responses was used in determining a total score on the test for each individual. The scores on the 26-item test were used in the statistical analyses. The means and standard deviations for both the 30- and the 26-item test for the entire group were calculated. The frequency of subject response to every alternative for each question was also computed. This was useful in determining the percentage of individuals who knew the answer, the percentage who did not, and the percentage of the total group that possessed erroneous nutrition knowledge and also where these misconceptions occurred. These data were used in calculating perceived knowledge and accuracy of knowledge as defined by Dugdale et al. (1979):

$$\text{Perceived Knowledge} = \frac{\text{No. of questions marked with an alternative}}{\text{Total no. of questions}}$$

$$\text{Accuracy of Knowledge} = \frac{\text{No. of correct responses}}{\text{No. of questions marked with an alternative}}$$

b. Dietary Practices

Dietary data were obtained from the 3-day food records in which the subjects were asked to record all food and beverages consumed for three specified days (3. Research Instruments b.). These items were transferred to coding sheets and food code numbers based on those published in the United States Department of Agriculture Handbook No. 8 (Watt and Merrill, 1963) were assigned. These codes had been used in the

data base for the Nutrition Canada National Survey (Canada, 1973) which also served as the primary data base for this study. Where the amounts were recorded in household measures by the subjects, these values were converted into grams.

Several changes or modifications to the primary data base were made. New codes were added to reflect the enrichment of Canadian products. These code numbers were: skim milk, 4047A; grape juice, 1088A; hard roll, 1900A; hamburger bun, 1902A; hot dog bun, 1902B; and cinnamon bun, 1905A. The nutrient values for these items were obtained from the Canadian publication, "Nutrient Value of Some Common Foods" (Health Services and Promotion Branch and Health Protection Branch, 1979). The gram weights for each unit (slice) of bread were obtained from the preceding publication rather than from the Nutrition Canada data base. The weight of one slice of white enriched bread, for example, was recorded as 30 grams rather than 23 grams. In this way, the nutrient values in the Nutrition Canada data base would correspond more closely to the Canadian data. Nutrient data of products served by McDonald's Restaurants was available (Anon., 1978). New codes were added (9000 - 9017) to allow for the nutrient content of these items. In addition, a new code number (394A) was added to include low-calorie beer in the data base. The Nutrition Canada data base was changed to allow for a lesser amount of total calories for this product (129 kcal versus 150 kcal for a 12 ounce bottle). The other nutrient values would be similar for both the regular and the low-calorie products (Labatt's Manitoba Brewery, personal communication)[5]

---

[5] Sales Office, Labatt's Manitoba Brewery, Winnipeg, Manitoba, February 1979.

Other code numbers were assigned to each food item. They described the following information: who prepared the item and where it was eaten (the group number), on what day the item was consumed (the day number), and at what meal or snack was the item consumed (the meal number). The group or location number cards were: 1, home prepared and eaten at home; 2, home prepared and eaten away from home; 3, prepared away and eaten away in restaurants, cafeterias, and other commercial establishments excluding place of work; 4, prepared away and eaten away at place of work; 5, prepared away and eaten at home; and 6, prepared away from home by friends and relatives. The total amount of nutrients consumed through meals and snacks prepared and eaten away from home in restaurants, cafeterias, snack bars, fast food establishments, and from vending machines was determined by combining the data from codes 3 and 4. Food prepared away and eaten away at place of work was given a separate code in order that the contribution of the company's facilities to the subjects' total daily nutrient intake could be determined. This information was supplied to the Foodservice Supervisor of the company. The following day numbers were used: 1, weekday; 2, weekday; 3, weekend day. By using separate code numbers for the weekdays and the weekend day, this would accommodate future analyses of the nutrient intake on weekends if these were desired. Six numbers were assigned to the six meal or snack periods: 1, breakfast; 2, morning snack; 3, noon meal; 4, afternoon snack; 5, evening meal; and 6, evening snack. As mentioned earlier, the purpose of this breakdown into six time periods was to make recording more convenient for the subjects.

The next step in the analyses of the food record data was the preparation for key-punching and the actual computer run on the data. The data

were transferred from the code sheets to 80 column computer coding sheets. This information was then key-punched by a professional key-punch operator at the University of Manitoba. Nutrient intake data were obtained through a specially-designed computer program based on program language PL1 and run on an IBM 370/168 machine.

The data were examined in two major sections. Both group and individual data were considered in the first section. The total mean daily nutrient intake over three days for the entire group was compared to the recommendations in the Dietary Standard for Canada, revised 1975, for the 19 to 35 year old reference male (Health and Welfare Canada, 1976b). Adjustments for thiamin, riboflavin, and niacin were made based on the mean caloric intake of the group. Two activity patterns, B and C, (2840 kcal and 2500 kcal, respectively) were used in evaluating the energy content of the diet. The percentage distribution of kilocalories from protein, fat and carbohydrate was determined. Nutrient intakes obtained from vitamin and mineral preparations were not considered in the total nutrient intakes. In a recent report (Health Protection Branch, 1977b), mean nutrient intakes for adult males (20-39 years) were above the recommended intakes with the exception of folate. Therefore, it was unlikely that vitamin or mineral supplements would be necessary for this group of adult males. The supplements that were consumed were discussed separately and served as an indication of misconceptions held about foods and nutrition. The number of subjects who met or exceeded the recommendations for energy and 12 nutrients were considered. This cut-off method was less subject to problems with extreme values. In the analyses of the results of the Nutrition Canada National Survey (Canada, 1973) median values had been considered in order to reduce the effect of extreme

values. No recommendations are listed in the Canadian Dietary Standard for fat and carbohydrate, therefore, the recommendations by the Committee on Diet and Cardiovascular Disease were used. The amount of dietary fat should be reduced to at least 35 percent of kilocalories and at least 50 percent of the kilocalories should be provided by carbohydrate. The remainder would represent the percent of kilocalories derived from protein, in this case, 15 percent. This is close to the figure of 14 percent reported on the average consumption of protein in the diet for males 20 to 39 years (Health Protection Branch, 1977b) and of income level C (Myres and Kroetsch, 1978).

In the second part of the discussion of the nutrient intakes, only group data were considered. Mean daily intakes of the entire group were converted to percentages in order to examine the percent contribution of all commercial foodservice establishments and only the cafeteria and vending operations of the place of work to the total daily nutrient intake of the group. The distribution of the kilocalories in the diet away from home was also considered. This provided some quantitative data for the trend towards the increased expenditure for food away from home (Canadian Restaurant and Foodservices Association, 1977).

A dietary practice score was determined for each subject at two levels of energy and at the recommended level for 9 nutrients. Two energy levels, 2840 kcal and 2500 kcal, were used based on the available evidence regarding the activity patterns of this group. The 9 nutrients considered were those for which the data base was complete: protein, calcium, phosphorus, iron, thiamin, riboflavin, niacin, ascorbic acid and vitamin A. A point was assigned when the mean daily intake of a nutrient or energy met or exceeded the recommended levels. If a subject's

intake met the levels for all 9 nutrients and energy, he would have accumulated ten points and therefore his dietary practice score would be ten. If one nutrient was consumed in amounts less than the recommended, the dietary practice score for this individual would be 9 points, and so on. If an intake was less than the recommended level, but within 5 percent of the level, it was considered as meeting the recommendation. The standards for thiamin, riboflavin, and niacin were based on each individual's mean energy intake rather than 2840 kcal or 2500 kcal. The dietary practice score was used to test the relationship between dietary practices and the three variables, nutrition knowledge, locus of personality control, and role in meal planning and/or preparation. The two levels of energy were considered in order to determine the effect, if any, of scoring based on different standards on the outcomes of the statistical tests.

c. Personality Test

The Rotter I -E Personality scale is an additive scale and the number of external choices are totalled for a maximum of 23 points. The cut-off point for internality is a score of 9 and the usual convention in the statistical analyses is to treat the data as two categories, internally-controlled and externally-controlled individuals (L. Breen, personal communication [6]).

Reliability analysis of this scale was not done since several coefficients had been published in the literature (Rotter, 1966). Since the test group was homogenous according to sex, race and social class, "reasonable" reliability coefficients (Rotter, 1966) would be expected.

---

[6] L. Breen, Associate Professor, Dept. of Psychology, University of Manitoba, July 1979.

Reliability coefficients close to this level (KR20 = 0.70) had been achieved for the nutrition knowledge test.

d. Biographical and Food Habit Questionnaire

Frequency distributions for the data on demographic and certain food habit variables were constructed. Data from questions 1 to 9 and 12 were incorporated in the appropriate tables. Mean values and standard deviations from the "Self-evaluation of Nutritional Knowledge" and "Influence on Food Choices" (Question 10) scales were also calculated.

It was not reasonable to categorize the responses to questions 7 and 8 according to the accuracy of the information source since too many assumptions had to be made. For example, one could consider human sources of questionable accuracy to be wives, mothers, friends or relatives, and personnel in health food, grocery, or drug stores. Accurate sources could be physicians and nurses, dietitians, nutritionists, and home economists. However, accurate foods and nutrition information could be passed on by highly knowledgeable friends or relatives, whereas misinformation could be spread by certain members of the medical profession. This same argument holds for printed information sources. Accurate sources would be government publications and scientific books and journals, while sources of questionable accuracy might be health food store literature, Adelle Davis-type books, cookbooks, popular pocketbooks, newspapers and popular magazines. However, accurate as well as inaccurate information may be included in some of the above printed sources.

e. Statistical Analyses

i. Introduction

A discussion by Kerlinger (1973) on the four types of measure-

ment scales: nominal, ordinal, interval, and ratio and the appropriate statistical tests to accompany each scale raised certain questions prior to the statistical analyses of the data. On the one hand Kerlinger (1973) stated that personality tests are actually ordinal scales and should be analyzed with the nonparametric measures of association such as Kendall's tau and Spearman's rho. However, on the other hand he stated, "Yet, though most psychological scales are basically ordinal, we can with considerable assurance assume equality of interval." This assumption of equal intervals would lend the data to parametric statistical analyses which assume that the data were normally distributed. For example, by using the Pearson's r correlation coefficient the assumption of normality is made and thus the chance of disproving the null hypothesis is increased over that when the nonparametric counterpart is used. Following a discussion on the pros and cons of assuming that these scales are interval ones, Kerlinger (1973) concluded, "The best procedure would seem to be to treat ordinal measurements as though they were interval measurements, but to be constantly alert to the possibility of gross inequality of intervals."

Since a normal distribution was considered not applicable to the present study, nonparametric statistical procedures were used. However, this raises the question as to why the stronger parametric tests were used in similar types of research published in the current literature especially since the distribution of data on nutrient intakes is under consideration (Schafer, 1978; Grotkowski and Sims, 1978; Sims, 1978; Schafer, 1979). Apparently these researchers wanted to get the most out of their data by assuming normality of the distribution whether or not this assumption was justified. This is in

accordance with comments made by Fisher (1935), who has been considered the founder of modern statistics.

> Every experiment may be said to exist only in order to give the facts a chance of disproving the null hypothesis...The value of the experiment is increased whenever it permits the null hypothesis to be more readily disproved.

A philosophical dichotomy thus exists. Is one more justified to use stronger tests and more assumptions on the data in order to increase the value of the experiment, or should one offer less opportunity to disprove the null hypothesis, but make fewer assumptions? Therefore, in the present study by using the nonparametric methods, fewer assumptions on the data were made (ie. normality of the distribution; interval data). The assumption of continuity was, however, made whether or not this was actually the case.

> ...complete continuity of distributions is only a mathematical abstraction that never occurs in the actual measurement of attributes. For complete continuity, infinitely precise measurement would be required...In actual measurement, all scales have discrete steps rather than infinitely fine gradations (Nunnally, 1967).

In line with the above discussion, Fruin and Davison (1978) stressed the importance of using the appropriate statistical technique for the conditions of the study and the type of data collected.

ii. Measures of Association

The Spearman and Kendall measures of association for ranked data were computed between the three variables, nutrition knowledge, locus of personality control, and dietary practices using the appropriate computer package program (Nie et al., 1970). Both tests produce coefficients

based on the agreement between two sets of ordinal data and include an adjustment for tied observations. However, the Kendall coefficient is more meaningful when the data contain a large number of tied ranks (Nie et al., 1970) and as a "rule of thumb" tau should be used more readily when a fairly large number of cases are classified into a relatively small number of categories. The data from the personality test were considered as ordinal rather than categorical data due to the small number of subjects in the external category (4 subjects).

The Kruskal-Wallis test with an adjustment made for tied observations (Hollander and Wolfe, 1973) was used to determine if there was a relationship between role in meal planning and preparation and both nutrition knowledge and dietary practices. The distribution-free Multiple Comparisons test, valid for unequal sample sizes, (cited in Hollander and Wolfe, 1973) was applied to the data to locate where the differences occurred.

iii. Level of Significance

The 5 percent level of significance was chosen. A lower level was not justified because the methods employed in studies such as the present one are less precise than those under more controlled laboratory conditions and also Type I errors are not that serious in the present study. The probability values are also included in tables indicating the relationships among certain variables.

V. RESULTS AND DISCUSSION

A. INDEPENDENT AND DEPENDENT VARIABLES

1. Nutrition Knowledge

The distribution of marks for the 38 subjects on both the 30-item (KR20 = 0.67) and the 26-item (KR20 = 0.69) nutrition knowledge tests are shown in Figure 2. In the 26-item test, the scores ranged, with one exception, from 4 (15%) to 17 (65%). One subject received an almost perfect score of 24 (92%). Only seven subjects scored greater than 50 percent. Mean scores plus standard deviations and ranges on both tests are shown in Table 5.

TABLE 5

MEAN SCORES AND VARIABILITY OF SCORES ON THE 30- AND 26- ITEM NUTRITION KNOWLEDGE TEST FOR 38 MALES, 25 - 35 YEARS

Number of Items	Mean Score ± Standard Deviation		Range
30	12.3 (41.0%)	3.9 (13.0%) [1]	7 - 27 (23.3% - 90.0%)
26	9.9 (38.1%)	3.8 (14.6%)	4 - 24 (15.4% - 92.3%)

[1] percentages in parentheses

Thus, the level of nutrition knowledge of this group of 25 to 35 year old males is low. This would be expected if they had little exposure to foods and nutrition information. Direct comparison of these results to

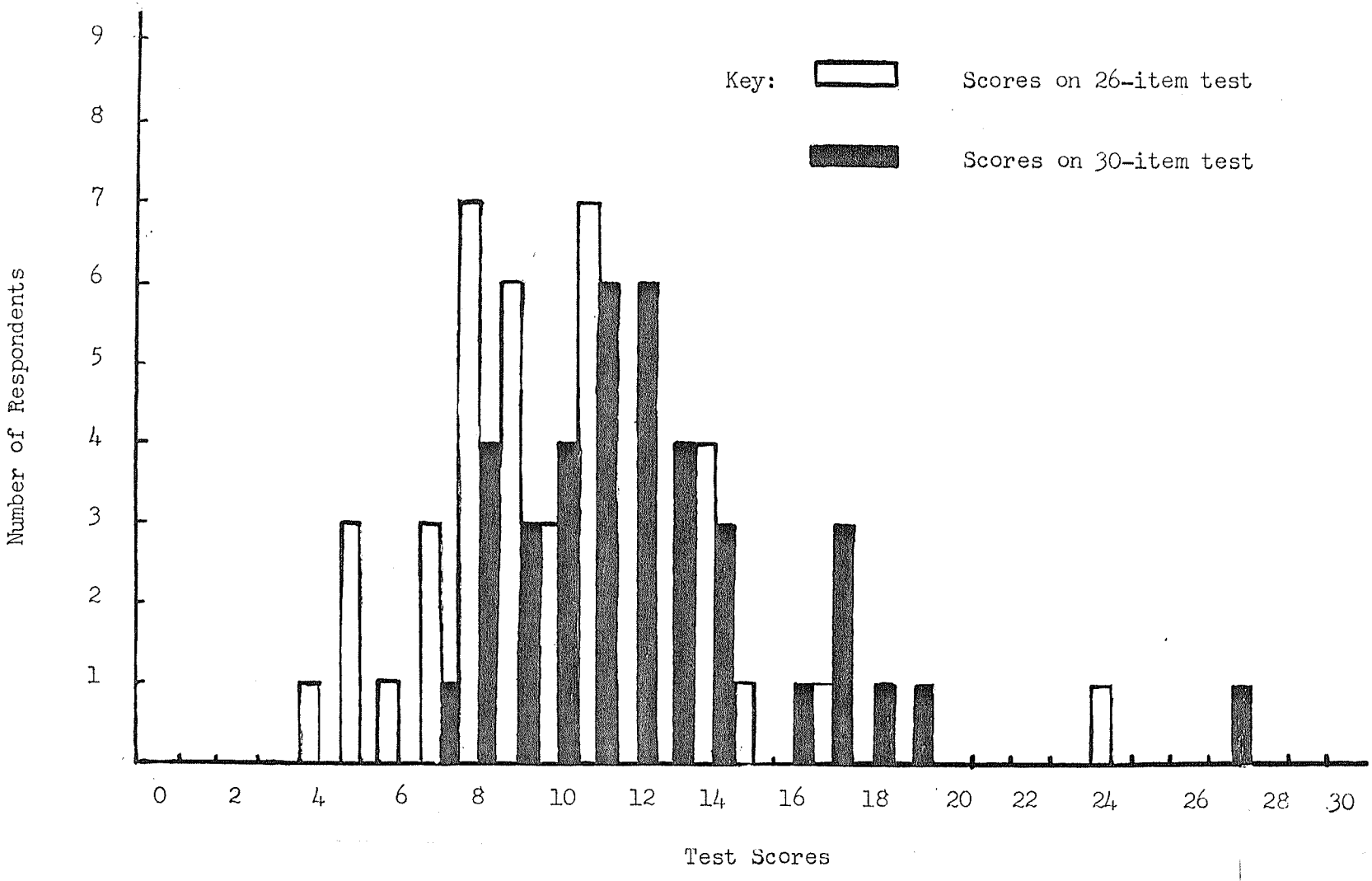

Figure 2: Distribution of marks for 38 males, 25-35 years, on the nutrition knowledge test

other studies is difficult due to the lack of studies on the nutrition knowledge of adult males. However in relation to the pretest, this group scored higher on the average than the group of 20 businessmen of the same age range (mean score 30%) and the same as the 14 mothers whose children attended a day care centre in a low socioeconomic area (mean score 38%). The results of this pretest have been summarized earlier in Table 3 for the 30-item version of the test.

The frequencies of subject response to every alternative for each question are indicated in the following five tables (Tables 6, 7, 8, 9, 10). The results are grouped according to five content areas: balanced food selection, nutrient functions and requirements, food composition and nutrient sources, weight control, and the relationship between nutrition knowledge and cardiovascular disease. Discussion of the general nutrition knowledge questions (n=21) precedes the discussion on nutrition related to cardiovascular disease (n=9). Statements regarding the differences in knowledge between the different content areas must be interpreted with caution since the item difficulty varies between questions.

The prevalence of misconceptions about foods and nutrition information can potentially do more harm than the lack of nutrition knowledge. Nutrition educators may find it just as hard or more so to convince those possessing erroneous knowledge to accept knowledge based on scientific principles than to educate the unknowledgeable. Therefore perceived knowledge and the accuracy of knowledge for the 38 males as a group for the 26-item test is also considered in these tables. If a subject marked any alternative besides the "don't know" category, he must have believed that he had that knowledge. This is perceived knowledge. However, this does not reflect in any way the accuracy of this

knowledge. The proportion of correct responses to the number of questions believed to be true provides an indication of the accuracy of this knowledge. The formulae for these indices have been presented earlier (5. Data Analysis. a. Nutrition Knowledge Test). Ideally, a high level of accuracy of knowledge can counteract the spread of erroneous perceived knowledge. On the average, the perceived knowledge of the entire group was 84 percent, while the accuracy of this knowledge was only 45 percent. As a group the mean correct knowledge was 38 percent.

Balanced Food Selection

Eighteen percent identified the balanced meal correctly (Question 1) while almost three times this percentage believed that the meal of steak, baked potato and carrots was balanced. It appears that the subjects were less likely to consider hamburgers as a part of a balanced meal or were more likely to ignore the milk group as part of a complete meal.

One-fifth of the sample would complete a breakfast with a novel breakfast item such as a cheese sandwich (Question 2) while three times as many would select another fruit or a "nutrient-empty" source of calories. That breakfasts do not have to be balanced with traditional food items such as with cereals or with eggs, was not realized by many of the subjects.

Forty-two percent believed they should consume 3 to 4 glasses of milk daily (Question 3). This could reflect past knowledge of the recommendations learned when they were adolescents.

Only three respondents knew the 4 Food Groups (Question 11).

Of interest is that all subjects believed that they possessed knowledge in this area. However, 74 percent knew that in order to eat properly, foods should be chosen from all the food groups (Question 21), whatever they might be. This relatively high percentage of correct responses corresponds with that found by Stansfield and Fox (1977), that 88 percent of grocers knew that vitamin pills are not needed by most people if a well-balanced diet is consumed. According to a study by Lindamood and Gunning (1977), 69 percent of the sample of college students could name the Four Food Groups. No details of the question format were provided in the abstract. The less susceptible a question is to chance correct responses, the more difficult the question. In the present study the 38 males may have answered the question on the Four Food Groups with little thought and may not have expected the correct answer to have been "none of the above." The item difficulty index for this question was 0.23 for the pretest sample, indicating that this question was relatively difficult.

A similar percentage (73.7%) correctly answered the general statement concerning the amount and type of foods eaten and the adequacy of one's diet (Question 6).

Regarding the general question on snacking (Question 19), an equal percentage of respondents (47.4%) answered it either correctly or incorrectly. Not understood by almost half of the respondents is the fact that snack foods can constitute any food item that is consumed apart from the regular meals and does not solely imply the traditional empty-calorie "junk" foods. Although the second question on snacking (Question 9) is subject to interpretation, 63 percent selected fresh fruit as the best snack while half as many selected the concentrated

TABLE 6

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO BALANCED FOOD SELECTION

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
1. Which of the following represents a balanced meal?			92.1	20.0
* a. hamburger, coleslaw, milk	7	18.4		
b. steak, baked potato, carrots	20	52.6		
c. chicken, whole wheat bread, milk	8	21.1		
d. ham, mashed potatoes, bread	0	0.0		
e. don't know	3	7.9		
Total	38	100.0		
2. A good breakfast should include fruit juice and			86.8	24.2
a. buttered toast and banana	17	44.7		
b. buttered toast and jam	7	18.4		
* c. a cheese sandwich	8	21.1		
d. a cake donut	1	2.6		
e. don't know	5	13.2		
Total	38	100.0		
3. The number of servings of milk and milk products that adult males should consume daily is			94.7	30.6
a. none	2	5.3		
b. one	7	18.4		
* c. two	11	29.0		
d. three to four	16	42.1		
e. don't know	2	5.3		
Total	38	100.1		

TABLE 6 continued

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
11. The food groups to include in your diet for good health are:			100.0	7.9
a. sugars and starches, fats, milk and milk products, meats and meat alternatives	1	2.6		
b. meats and alternatives, bread and cereals, fruits and vegetables	11	29.0		
c. milk and milk products, meats, fruits and vegetables	23	60.5		
* d. none of the above	3	7.9		
e. don't know	0	0.0		
Total	38	100.0		
21. In order to eat properly every day, you should			94.7	77.8
a. eat natural foods containing no food additives	1	2.6		
b. take multi-vitamin pills	0	0.0		
* c. choose foods from all the food groups	28	73.7		
d. all of the above	7	18.4		
e. don't know	2	5.3		
Total	38	100.0		
6. Which of the following statements is correct?			92.1	80.0
a. Nutritious diets are more important for children than for adults.	1	2.6		
* b. The amount and type of foods eaten determines the adequacy of one's diet.	28	73.7		
c. Nutrient intakes greater than nutrient needs are beneficial.	0	0.0		
d. all of the above	6	15.8		
e. don't know	3	7.9		
Total	38	100.0		

TABLE 6 continued

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
19. Which of the following statements is correct?			94.7	50.0
a. It is not recommended to snack if you eat three regular meals each day.	5	13.2		
* b. Snack foods should be selected to help meet total daily nutrient needs.	18	47.4		
c. There are only a few nutritious foods available for snacks.	1	2.6		
d. all of the above	12	31.6		
e. don't know	2	5.3		
Total	38	100.1		
9. The best snack for your health would be				
a. raisins	13	34.2		
* b. fresh fruit	24	63.2		
c. ice-cream	0	0.0		
d. none of the above	1	2.6		
e. don't know	0	0.0		
Total	38	100.0		
20. If you participate in sports, your diet should include			100.0	18.4
* a. a wide variety of foods	7	18.4		
b. more protein	15	39.5		
c. more sugar	5	13.2		
d. all of the above	10	26.3		
e. don't know	1	2.6		
Total	38	100.0		

* denotes correct response

sugar-containing alternative, raisins.

Only 18 percent answered the question on diet and sports correctly (Question 20) while a large percentage (79%) believed that the diet would have to be modified in some way. The presence of this erroneous knowledge is of interest due to the current emphasis on participating in some form of physical activity.

Perceived knowledge was high for all 8 questions regarding balanced food selection ranging from 86.8% to 100%. Accuracy of knowledge was more variable (7.9% - 80.0%). It was very low (7.9%) for the question on the 4 Food Groups (Question 11) and was high for only two questions (Questions 21 and 6). For 6 of the 8 questions the percentage of accuracy was below or equal to 50 percent. Therefore, although the respondents believed strongly that they possessed knowledge about balanced food selection, the accuracy of this knowledge was limited.

Nutrient Functions and Requirements (Table 7)

That a negligible amount of energy is used for intellectual work was known by 29 percent of the sample (Question 13). Close to this percentage thought that high or moderate levels would be used for this mental form of work.

A very high percentage (92.1%) recognized that all three components: fats, starches, and water, are needed in the diet (Question 14). Of interest is that of the remainder who did not answer the question correctly, all of them thought that fats were not needed.

Only 16 percent knew that fats have three functions in the body (Question 22). Over twice this number did not know the functions while the largest percentage (42.1 %) thought that fatty foods only supplied

energy. It could be speculated that lack of total knowledge regarding other important functions of fats could lead to almost total elimination of fats in highly suspect weight control schemes by individuals who believe that fats only provide energy.

Forty percent of the sample identified that carbohydrate foods (Question 27) either increased the amount of calories in the body (18.4%) and/or interfered with the building of body tissues along with supplying energy to the body (21.1%). Lack of knowledge concerning the functions of these two nutrients is apparent. This may be of significance when there is almost complete elimination of some and excessive intakes of other energy-providing components in the diet when unbalanced weight control diets are adhered to. The following of low carbohydrate diets as was reported by 3 subjects is an example of this questionable practice.

In general, perceived knowledge of 3 of the four questions on nutrient functions and requirements was high (86.8% - 100%), however it was moderate (63.2%) for question 22 on the function of fatty foods. Also the accuracy of responses to this question were low (25%). Accuracy of knowledge ranged from 25.0% to 92.1% and was high (92.1%) for only question 14 regarding the substances needed in the diet. This contradicts the very low level of accuracy related to the question on balanced food selection and the 4 Food Groups (Question 11). Thus, the subjects knew the major dietary components but were not able to correctly identify the major food groups from which these nutrients could be derived.

TABLE 7

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO NUTRIENT FUNCTIONS AND REQUIREMENTS

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
13. The amount of energy used for intellectual work is			86.8	30.0
a. enormous	1	2.6		
b. high	9	23.7		
c. moderate	12	31.6		
* d. negligible	11	29.0		
e. don't know	5	13.2		
Total	38	100.1		
14. In addition to protein, the other substances needed in your diet are			100.0	92.1
a. fats	0	0.0		
b. starches	2	5.3		
c. water	1	2.6		
* d. all of the above	35	92.1		
e. don't know	0	0.0		
Total	38	100.0		
22. Fatty foods			63.2	25.0
a. supply energy to the body	16	42.1		
b. protect body organs	2	5.3		
c. carry vitamins in the body	0	0.0		
* d. all of the above	6	15.8		
e. don't know	14	36.8		
Total	38	100.0		

TABLE 7 continued

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
27. Carbohydrate foods			94.7	58.3
* a. supply energy to the body	21	55.3		
b. interfere with the building of body tissues	0	0.0		
c. increase the amount of calories stored in the body	7	18.4		
d. all of the above	8	21.1		
e. don't know	2	5.3		
Total	38	100.1		

* denotes correct response

Food Composition and Nutrient Sources (Table 8).

The largest percentage (39.5%) thought that peanut butter was a complete source of protein (Question 5). Surprisingly, almost equal numbers selected the other alternatives: cheese (18.4%), baked beans (13.2%), and bran cereals (15.8%). This lack of knowledge is most likely not reflected in the protein status of the sample, since these vegetable protein sources are usually complemented in the diet by other sources of protein. Although highly unlikely in our country, should vegetable sources of protein be consumed alone, this lack of knowledge could be of concern.

Close to equal numbers thought carbohydrate, protein, fat, and alcohol and fat, carbohydrate, and vitamins as providing energy (36.8% vs. 31.6%). It is interesting to note that some respondents thought of vitamins, minerals, and even water as energy sources (Question 7).

Only 13 percent identified skim milk and buttermilk as containing similar amounts of fat (Question 8). Knowledge of this fact may not be that important if these items are consumed infrequently by this group. However, erroneous knowledge of the other alternatives based on more common food items is of more significance. The largest percentage (31.6%) thought that low-calorie margarine had the same amount of fat as the regular kind. In a study by Cho and Fryer (1974), 61 percent and 63 percent, respectively, of the two groups of subjects answered the true-false question concerning diet and regular margarine correctly.

Almost all of 38 subjects (37) correctly answered question 18 concerning the least amount of fat. This question could have been made more difficult if more discriminating alternatives were chosen. However,

it was not used in the statistical analyses.

Equal numbers (34.2%) identified two vegetables of different food composition and two fats of similar composition as containing the same number of calories (Question 28). This low rate of correct response could have important implications for individuals who follow self-selected weight control programs and have little relevant knowledge about food composition. In a study by MacFadyen (1977) only 16 percent of the sample (n=101) knew that butter and margarine have similar caloric contents. Seventy percent believed that butter and margarine have different caloric contents. Fifty-six percent of 73 deaf students and 84 percent of the 93 normal hearing students believed that butter contains more calories than margarine in a study by Garton and Bass (1974). Based on the low number of correct responses to several questions, these authors suggested that students "might be easy prey for faddists." In fact, this would be the case for any individual with low knowledge of nutrition.

A large percentage (86.8%) identified apples and oranges as both good sources of vitamin C (Question 17). Fallacies instilled at an early age, for example, "an apple a day keeps the doctor away," may have contributed to this response. Also considering unique sources of vitamin C, in a study by Stansfield and Fox (1977), only 33 percent of the 217 grocers knew that strawberries, cantaloupe, and green peppers were sources of the nutrient. Twenty-nine percent responded incorrectly while one-third were uncertain.

Compared to the preceding two sections uncertainty of knowledge in this content area became apparent as evidenced by the lack of indications of 100 percent perceived knowledge. Low levels of accuracy were

TABLE 8

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO FOOD COMPOSITION AND NUTRIENT SOURCES

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
5. Which of the following is a source of complete protein?			86.8	21.2
a. peanut butter	15	39.5		
* b. cheese	7	18.4		
c. baked beans	5	13.2		
d. bran cereals	6	15.8		
e. don't know	5	13.2		
Total	38	100.1		
7. In which of the following groups do all components provide energy?			81.6	45.2
* a. carbohydrate, protein, fat, and alcohol	14	36.8		
b. fat, vitamins, and minerals	3	7.9		
c. carbohydrate, fat, and water	2	5.3		
d. fat, carbohydrate, and vitamins	12	31.6		
e. don't know	7	18.4		
Total	38	100.0		
8. Which of the following foods contain similar amounts of fat?			68.4	19.2
a. a serving of deep fried fish and a serving of oven baked fish	4	10.5		
b. a scoop of ice cream and a scoop of ice milk	5	13.2		
* c. a glass of skim milk and a glass of buttermilk	5	13.2		
d. a teaspoon of low-calorie margarine and a teaspoon of regular margarine	12	31.6		
e. don't know	12	31.6		
Total	38	100.1		

TABLE 8 continued

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
18. Which of the following foods contains the least amount of fat?				
* a. fish	37	97.4		
b. steak	1	2.6		
c. ground beef	0	0.0		
d. wieners	0	0.0		
e. don't know	0	0.0		
Total	38	100.0		
28. Which of the following foods contain the <u>same</u> number of calories?			76.3	44.8
a. a piece of cake and an apple	0	0.0		
b. a potato and a tomato	13	34.2		
c. a glass of whole milk and a glass of skim milk	3	7.9		
* d. a teaspoon of butter and a teaspoon of margarine	13	34.2		
e. don't know	9	23.7		
Total	38	100.0		
17. Which of the following foods are good sources of Vitamin C?			97.4	2.7
* a. broccoli and tomatoes	1	2.6		
b. lettuce and green peppers	2	5.3		
c. apples and oranges	33	86.8		
d. none of the above	1	2.6		
e. don't know	1	2.6		
Total	38	100.0		

* denotes correct response

also present (2.7% - 45.2%). For all 5 questions, the percentage of accuracy was below 50 percent. Misconceptions about the importance of both apples and oranges as good sources of vitamin C are widespread among this group. Accuracy of knowledge of foods with similar amounts of fat (Question 8) and sources of complete protein (Question 5) were similarly low (19.2% and 21.2%, respectively). However, the questions regarding energy (Question 7) or the number of calories (Question 28) were answered with over twice as much accuracy as the preceding two (45.2% and 44.8%, respectively).

Weight Control (Table 9)

Sixty-three percent identified lack of exercise (Question 24) as the most common cause of weight gain in adults. Almost equal numbers felt that too much fat or carbohydrate were the primary causes. The same percentage (63.2%) correctly chose to eat less of all foods in order to lose weight safely (Question 29). None of the respondents believed that liquid protein formulae should be consumed while 21 percent thought that a low carbohydrate diet should be followed. These percentages of correct response are low if one considers the significance of overweight and obesity as nutrition-related diseases in the Canadian population.

Perceived knowledge was similar for both questions (94.7% and 97.4%) and accuracy of knowledge was the same for both questions, however, at a lower level (64.9% and 66.7%).

Relationship Between Nutrition Knowledge and Cardiovascular Disease (Table 10)

Although there is no one cause of heart disease, 45 percent identified increased blood fats as the most important one (Question 4). The

TABLE 9

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS RELATING TO WEIGHT CONTROL

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
24. The most common cause of weight gain in adults is			97.4	64.9
a. weight increases with age	1	2.6		
b. more fat is eaten than the body uses	5	13.2		
c. too much carbohydrate is eaten	7	18.4		
* d. lack of exercise	24	63.2		
e. don't know	1	2.6		
Total	38	100.0		
29. The safest way to lose weight is to			94.7	66.7
a. eat a high protein diet	4	10.5		
b. drink liquid protein formulas	0	0.0		
c. eat a low carbohydrate diet	8	21.1		
* d. eat less of all foods	24	63.2		
e. don't know	2	5.3		
Total	38	100.1		

* denotes correct response

ambiguity of this question discounts its use in the statistical analysis.

A large percentage (71.1%) recognized that high blood pressure (Question 16) could be controlled by eating less salt. Three subjects possessed misconceptions in this area by selecting all three alternatives.

Two-fifths of the sample (39.5%) knew that polyunsaturated fats lowered blood cholesterol (Question 12). However, only 5 percent (2 subjects) identified linoleic acid (Question 26) as the component which decreases the level of fatty substances. This latter fact is not as critical as knowing the role of polyunsaturated fatty acids. Using a true-false question, a higher percentage of respondents (50% and 64%) in a study by Cho and Fryer (1974) knew that polyunsaturated fats would not increase blood cholesterol.

Forty-two percent were aware that cholesterol was a fatty substance made by the body (Question 23). Slightly over half of this number identified cholesterol as a harmful substance present when one has heart disease. An almost equal number thought that it was a protein. Sixty-nine percent of the subjects in a study by Cho and Fryer (1974) knew that cholesterol was a normal body constituent.

Twenty-nine percent of the subjects each chose soft or hard margarine as the best fat to spread on bread (Question 15). Close to this percentage (23.7%) admitted they had no knowledge in this area. However, a larger percentage (47.4%) identified sunflower oil (Question 10) as the best oil. Also 87 percent would choose vegetable oils for pan-frying (Question 25). It could appear that the subjects were more certain of vegetable oils and good health than about the hydrogenated forms of these oils. However, the differences in item difficulty

should also be considered. In another study, Cho and Fryer (1974) found that a low percentage of subjects (20 and 17 percent) recognized that corn, soybean, and coconut oils were not all high in polyunsaturated fats. Education regarding the composition of solid fats such as the various forms of margarine on the market, appears warranted for this study group.

Forty percent of the respondents could identify the association of fat with a decreased risk of heart disease (Question 30). Sixteen percent felt that protein and carbohydrate in addition to type of fat were implicated in heart disease. One-fifth of the respondents admitted that they had no knowledge in this area. This is also an area where nutrition education is needed.

Perceived accuracy ranged from 10.5% to 92.1% for the seven questions concerning the relationship between nutrition and cardiovascular disease. The subjects believed that they had very low knowledge concerning the role of polyunsaturated fats (57.9%) and linoleic acid (10.5%) while for the other 5 questions they felt they possessed a considerable amount of knowledge (73.7% - 92.1%). The lowest level of accuracy (37.9%) was still higher than the lower levels for the three content areas having more than 2 questions. This is encouraging in respect to the spread of erroneous knowledge in the more general nutrition areas.

This concludes the discussion of the results which has focussed on the distribution of marks on the total test in general, the frequencies of subject response to every alternative for every question, and the levels of perceived knowledge and accuracy of knowledge. Nutrition education is necessary for this group of young adult males due to the

TABLE 10

DISTRIBUTION OF RESPONSES TO NUTRITION KNOWLEDGE QUESTIONS CONCERNING THE RELATIONSHIP BETWEEN NUTRITION AND CARDIOVASCULAR DISEASE

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
4. The most important cause of heart disease is				
a. increased blood fats	17	44.8		
b. high blood pressure	11	29.0		
c. physical inactivity	5	13.2		
* d. none of the above	0	0.0		
e. don't know	5	13.2		
Total	38	100.2		
16. In some people, high blood pressure can be controlled by			92.1	77.1
* a. less salt	27	71.1		
b. less carbohydrate	5	13.2		
c. garlic and other strong vegetables	0	0.0		
d. all of the above	3	7.9		
e. don't know	3	7.9		
Total	38	100.1		
12. Polyunsaturated fats			57.9	68.2
a. have no effect on the body	3	7.9		
b. are harmful to the body	0	0.0		
* c. lower blood cholesterol	15	39.5		
d. raise blood cholesterol	4	10.5		
e. don't know	16	42.1		
Total	38	100.0		

TABLE 10 continued

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
26. Which one of the following can decrease the level of fatty substances in your blood?			10.5	50.0
a. cholestearic acid	0	0.0		
b. acetic acid	2	5.3		
c. lauric acid	0	0.0		
* d. linoleic acid	2	5.3		
e. don't know	34	89.5		
Total	38	100.1		
23. Cholesterol is			89.5	47.1
a. a harmful substance present in blood when one has heart disease	9	23.7		
* b. a fatty substance made by the body	16	42.1		
c. a protein which is deposited in the blood vessels	7	18.4		
d. a fatty substance found in vegetable oils	2	5.3		
e. don't know	4	10.5		
Total	38	100.0		
15. If you were concerned about your health, the best fat to spread on your bread would be			76.3	37.9
a. butter	6	15.8		
* b. soft margarine	11	29.0		
c. hard margarine	11	29.0		
d. all of the above	1	2.6		
e. don't know	9	23.7		
Total	38	100.1		

TABLE 10 continued

	Respondents No.	Respondents %	Perceived Knowledge %	Accuracy of Knowledge %
10. If you were concerned about your health, the best oil to use in salad dressings would be			73.7	64.3
a. peanut oil	7	18.4		
b. coconut oil	0	0.0		
c. olive oil	3	7.9		
* d. sunflower oil	18	47.4		
e. don't know	10	26.3		
Total	38	100.0		
25. If you were concerned about your health, which of the following would you use for pan-frying?				
* a. vegetable oils	33	86.8		
b. margarine	2	5.3		
c. butter	0	0.0		
d. all of the above	0	0.0		
e. don't know	3	7.9		
Total	38	100.0		
30. Which of the following statements is correct?			79.0	50.0
a. Diets low in animal protein are associated with an increased risk of heart disease.	0	0.0		
b. A low carbohydrate diet is associated with a decreased risk of heart disease.	9	23.7		
* c. The type of fat in the diet is associated with a decreased risk of heart disease.	15	39.5		
d. all of the above	6	15.8		
e. don't know	8	21.1		
Total	38	100.1		

* denotes correct response

low average knowledge score of the group and the lack of knowledge or presence of erroneous knowledge in several content areas. It would be encouraging to know as a nutrition educator that sound nutritional knowledge was being passed on to other family members by male in addition to female family members.

2. Dietary Practices

a. Total Nutrient Intake

i. Group Data

The mean daily intake of kilocalories and 12 nutrients for 37 respondents in comparison to the Canadian Dietary Standard (revised 1975) is shown in Table 11. Mean daily intakes of 9 nutrients met or exceeded the recommended intakes. The intakes of energy, vitamin B_6, and folate were below the recommended levels (93%, 80%, and 56%, respectively). However, caution is expressed when interpreting these latter intakes. Both the completeness of the data base and the appropriateness of the recommendations should be considered.

The intake of vitamin B_6 which is 20 percent below the recommendation and folate intakes can be discussed in terms of the food composition data base. In the Nutrition Canada data base, close to 70 percent of the food codes have values for vitamin B_6 and vitamin B_{12} and pantothenic acid. The values for the raw foods were assigned to all the cooked foods. When the proportions of ingredients in a formulated food were not known, the term "not applicable" was assigned to the food code for the above three nutrients. Seventy percent is still, however, a relatively high level for the completeness of the data base and the intake of vitamin B_6 is

TABLE 11

MEAN DAILY INTAKE OF KILOCALORIES AND 12 NUTRIENTS COMPARED TO THE RECOMMENDED DAILY INTAKE IN THE CANADIAN DIETARY STANDARD [1]

	Mean Intake	± Standard Deviation	CDS	% CDS
Energy (kcal)	2639	834	2840 [2]	93
Protein (g)	101	35	56	180
Calcium (mg)	1062	567	800	133
Phosphorus (mg)	1540	536	800	193
Iron (mg)	16	6	10	160
Thiamin (mg)	1.3	0.6	0.5/1000 kcal [3]	100
Riboflavin (mg)	2.4	1.5	0.6/1000 kcal [3]	150
Niacin (NE)	41	16	6.6/1000 kcal [3]	241
Ascorbic Acid (mg)	117	106	30	390
Vit. B_6 (mg)	1.6	0.8	2.0	80
Vit. B_{12} (mcg)	14.3	15.9	3.0	477
Vit. A (RE)	1432	1928	1000	143
Free Folate (mcg)	112	92	200	56

[1] Canadian Dietary Standard (Revised 1975), reference male: 19-35 yrs., 70 kg, 176 cm

[2] Energy requirements based on activity pattern B, 2840 kcal; for activity pattern C, 2500 kcal, kilocalories provided are 106% of standard

[3] The recommended intake was adjusted according to the 3-day mean caloric intake of the group of 37 males.

close to the recommended intake. Limitations of the data on the folate composition of foods have also been reported in the literature (Health Protection Branch, 1977b). In spite of these latter inadequacies of the data base, it was concluded, "Such defects, however, should not obscure the value of the first national assessment of folic acid intake" (Health Protection Branch, 1977b).

Regarding the appropriateness of the standard, the recommended intakes are possibly over-estimated for vitamins B_6 and folate. Similarly, the influence of activity patterns on the energy requirement is of significance when selecting the appropriate energy level. In a report on the influence of an income index on the nutrient intake and food consumption patterns of Canadians using data from the Nutrition Canada National Survey, Myres and Kroetsch (1978) emphasized that "recommended folate intakes were based on older analyses of foods which give higher values than the values found in this study using more precise analytical techniques." Therefore, it would be more appropriate to discuss intakes on a relative basis between individuals than as an indication of an inadequate intake. In a study on 195 males employed in an insurance company intakes of folate, 64 percent of the standard, were reported (J. Sabry, personal communication)[7]. Similarly, the recommended vitamin B_6 intakes based on assumptions of certain levels of protein consumed by Canadians may be over-estimated (B.E. McDonald, personal communication)[8]. Two levels of energy (2840 kcal and 2500 kcal)

---

[7] J.H. Sabry. 1979. Dept. of Family Studies, University of Guelph.

[8] B.E. McDonald. 1979. Dept. of Foods and Nutrition, University of Manitoba.

were also considered in order to take into account the effect of any differences in activity patterns on the energy requirements of this group. The mean intake is 93% of the requirement of 2840 kcal which is close to the requirement calculated (2898 kcal) using the method outlined by the Joint FAO/WHO Committee on Energy and Protein Requirements (World Health Organization, 1973). A reference weight of 70 kg and light activity which is 90 percent of this standard based on moderate activity were considered. When the level of 2500 kcal is used, the requirement is met by the group (106%). Therefore, the intakes of energy, vitamin B_6 and folate should be interpreted with some reservation. It would not be correct to report that these intakes below the standard represent inadequate intakes.

The mean daily nutrient intakes of the respondents in this study are compared to the mean daily intakes of similar subjects in other studies (Table 12). As reported in the literature, all the subjects were free-living men, ages ranged from 20 to 55 years depending on the study, and in two studies the men were employed in sedentary occupations. Similar to the Winnipeg study, nutrient intakes generally met or exceeded the Canadian recommendations. None of the authors reported intakes that were below the Standard with the exception of reservations that were made in one paper regarding the interpretation of the folate data (Myres and Kroetsch, 1978). Dietary intakes of thiamin were reported as being adequate when adjustments for the mean caloric intakes were not considered (Health Protection Branch,1977b ; Myres and Kroetsch, 1978). However the thiamin intakes of the preceding studies (93% and 94%, respectively) are too close to the standard to be considered inadequate.

Of interest to note is that in general the mean intakes reported

TABLE 12

COMPARISON OF THE THREE DAY MEAN DAILY INTAKE OF 37 WINNIPEG MALES, 25-35 YRS., WITH THE MEAN DAILY INTAKE OF SIMILAR GROUPS REPORTED IN THE LITERATURE

Energy and Nutrients	Winnipeg Study, 1978	Minnesota, 1953 and 1954 [1]	Britain, 1963 [2]	Canadian Prairie, 1970-2 [3]	Nat. Sample Canadians, 1970-2 [4]	Canada, 1970-2 [5]	Maine, 1977-8 [6]
Energy (kcal)	2639	2500	2852	3349	3374	3422	2972
Protein (g)	101	95	82	124	119	121	115
Calcium (mg)	1062	900	--	1189	1081	1079	1197
Phosphorus (mg)	1540	--	--	--	--	--	1847
Iron (mg)	16	14	--	19	18	19	17
Thiamin (mg)	1.3	1.2	--	1.7	1.6	1.6	1.5
Riboflavin (mg)	2.4	2.1	--	3.0	2.6	2.6	2.4
Niacin (NE)	41	17 (mg)	--	51	48	49	26
Ascorbic Acid (mg)	117	103	--	114	118	120	101
Vitamin B_6 (mg)	1.6	--	--	--	--	--	--
Vitamin B_{12} (mcg)	14.3	--	--	--	--	--	--
Vitamin A (RE)	1432	8000 (I.U.)	--	2145	1551	1599	6794 (I.U.)
Free Folate (mcg)	112	--	--	120	118	122	--

-- data not available

1 Results from 1-week weighed food records of 119 business and professional men aged 45-55, Adelson and Keys, 1962

2 Results from 1-week weighed food records of 99 bank men aged 40-55, Morris et al., 1963

3 Results adapted from 24-hour recalls of 189 Canadian males aged 20-39 of the Prairie Region of the Nutrition Canada National Survey, Health Protection Branch, 1977b

4 Results adapted from 24-hour recalls of 999 Canadian males aged 20-39 of the Nutrition Canada National Survey, Health Protection Branch, 1977 b

5 Results from 24-hour recalls of 754 Canadian males aged 20-39 and representing Income Index C (Annual Income>$ 5,999), Myres and Kroetsch, 1978

6 Results adapted from 24-hour recalls of 180 Maine males aged 23-50, Cook et al., 1979

from surveys using either the one-week or 3-day food record were lower than the results from surveys using the 24-hour recall method. This is not to discount the differences in ages of the subjects and possibly differences regarding other demographic variables. However, of the 24-hour recalls, results of a later study (Cook et al., 1979) were more similar in magnitude for the caloric intake. In a less recent study of a group of non-institutionalized elderly subjects by Gersovitz et al. (1978), the dietary recall slightly over-estimated the actual intake while the record tended to understate the actual intake. Protein intakes were significantly different for the recall, while energy and thiamin were significantly different for the record. However, both recall and record were reported as about equally accurate in estimating the actual intakes.

Regional differences in nutrient intake may account for some of the differences between the lower mean intakes of the Winnipeg sample and the entire National sample of males aged 20 to 39. For example, the median intakes of males, 20-39 years, in the National Nutrition Canada Survey are compared to the corresponding data for the Manitoba region in Table 13. Of the nine variables under consideration, seven of the Provincial median intakes were less than the National intakes. Only the intakes of riboflavin and calcium exceeded the National values. This compares closely to the data in a previous table (Table 12) where all of the mean intakes of the 37 Winnipeg subjects were lower than the mean intakes for the entire Prairie Region sample of 189 males aged 20 to 39 except for ascorbic acid which was slightly greater. With reference to the mean intakes based on an income index (Myres and Kroetsch, 1978), in all cases the mean intakes of the Winnipeg sample were lower.

TABLE 13

COMPARISON OF MEDIAN INTAKES OF MANITOBA MALES, 20-39 YRS., WITH NATIONAL MEDIAN INTAKES [1]

Energy and Nutrients	Provincial Median Intake	
	Less than National	Greater than National
Calories	yes	
Protein	yes	
Thiamin	yes	
Riboflavin		yes
Niacin	yes	
Ascorbic Acid	yes	
Vitamin A	yes	
Calcium		yes
Iron	yes	

National Survey, N=997, except for protein where N=962

Manitoba Survey, N=70, except for protein where N=69

[1] Adapted from the Nutrition Canada National Survey, Canada (1973)

The percentage distribution of kilocalories from protein, fat, and carbohydrate in relation to the Recommendations by the Committee on Diet and Cardiovascular Disease (1977) is presented in Table 14. Ninety-three percent of the mean caloric intake in this study was distributed in the following manner: protein - 15%, fat - 36%, carbohydrate - 42%. These were close to the recommended proportions. The remaining 7 percent of kilocalories may be partly accounted for by alcohol intake. In the other studies, protein ranged from 12-16 percent, fat 40-42 %, and carbohydrate 40-45%. The lower percentage of calories provided by fat (36%) in the diet of the group of 37 men is of interest. More surveys on a similar young target group would be necessary to confirm whether the fat intake was characteristic of this specific group of 25 to 35 year olds or whether this was representative of a trend towards a decreased proportion of calories from fat sources.

Worthy of mention besides the mean daily intakes and the percentage distribution of kilocalories, is the variability of the mean nutrient intakes. Standard deviations expressed as percentages about the mean are listed in Table 15. For the Winnipeg study these ranged from 32 percent to a high of 135 percent. In a recent study by Cook _et al_.(1979) similar large standard deviations were found (40-150%, Table 15).

In order to explain any inter-subject variability which could have led to the large standard deviations, 10 percent of the subjects (n=4) were randomly sampled and the nutrient intakes for all three days and the means and standard deviations were examined. Variability

TABLE 14

PERCENT DISTRIBUTION OF CALORIC INTAKE FROM PROTEIN, FAT AND CARBOHYDRATE IN COMPARISON TO THE RECOMMENDATIONS OF THE COMMITTEE ON DIET AND CARDIOVASCULAR DISEASE (1977)

	Recommended Percentages [1]	Winnipeg Study, 1978 [2]	Minnesota, 1953 and 1954 [3]	Britain, 1963 [4]	Can. Prairie Region, 1970-72 [5]	National Can. Sample 1970-72 [6]	Canada, 1970-72 [7]	Maine 1977-78 [8]
Protein	15	15	15	12	15	14	14	16
Fat	35	36	40	41	42	41	41	42
Carbohydrate	50	42	45	45	40	42	42	42

[1] Murray and Rae, 1978

[2] Results from 3-day measured records of 37 Winnipeg males aged 25-35

[3] Results from 1-week weighed food records of 119 business and professional men aged 45-55, Adelson and Keys, 1962

[4] Results adapted from 1-week weighed food records of 99 bank men aged 40-55, Morris et al., 1963

[5] Results adapted from 24-hour recalls of 189 Canadian males aged 20-39 of the Prairie Region of the Nutrition Canada National Survey, Health Protection Branch, 1977b

[6] Results adapted from 24-hour recalls of 999 Canadian males aged 20-39 of the Nutrition Canada National Survey, Health Protection Branch, 1977b

[7] Results adapted from 24-hour recalls of 754 Canadian males aged 20-39 and representing Income Index C (Annual Income > $5, 999), Myres and Kroetsch, 1978

[8] Results adapted from 24-hour recalls of 180 Maine males aged 23-50, Cook et al.,1979

TABLE 15

VARIABILITY OF THE MEAN DAILY INTAKES OF KILOCALORIES AND 12 NUTRIENTS EXPRESSED AS PERCENT DEVIATION ABOUT THE MEAN

Energy and Nutrients	Winnipeg Study, 1978 [1]	Maine, 1977 - 1978 [2]
Vitamin A	135	150
Vitamin B_{12}	111	--
Ascorbic Acid	91	101
Free Folate	82	--
Riboflavin	63	58
Calcium	53	74
Vitamin B_6	50	--
Thiamin	46	53
Niacin	39	51
Iron	38	44
Protein	35	40
Phosphorus	35	44
Energy	32	43
Range	32 - 135	40 - 150

-- data not available

[1] Results from 3-day records of 37 Winnipeg males aged 25 - 35

[2] Results adapted from 24-hour recalls of 180 Maine males aged 23 - 50, Cook et al., 1979

about the mean ranged from 1 to 89 percent for energy and the 12 nutrients. There was no consistent pattern of nutrients with high or low values. Variability for ascorbic acid (50%) and vitamin A (49%) was the highest and folate (1%) and riboflavin (10%) the lowest for one subject, while for another subject variability was highest for vitamin B_{12} (51%) and calcium and iron (48%) and lowest for ascorbic acid and folate (4%). These differences could be explained by the consumption of different foods by each subject over the three days. Similar conclusions about inter-individual variability have been made by Hankin et al. (1967) based on 7-day measured food records of 93 Japanese-American men. The large individual differences in daily eating patterns were revealed by the heterogeneity of the variances which were said to be typical among urban cosmopolitan groups in industrialized countries. Similarly, comments by Morris et al. (1963) support these conclusions.

> There is, nevertheless, bound to be variability in an individual's recorded food intake due both to 'biological'- including seasonal, day-to-day, and even hour-to-hour variability in the individual, and 'observer variability' in the measurement.

Regarding the intra-individual variability, intakes of vitamin A and ascorbic acid were highly variable in the Winnipeg study. This compares closely to the data by Cook et al. (1979) in which vitamin A and ascorbic acid followed by calcium and riboflavin had the highest percentages of deviation. Excluding vitamin B_{12} and folate from this discussion, the preceding four nutrients had the highest percentages for the study group. Intakes of protein and phosphorus and energy were the most stable for both studies.

These results are comparable to other studies. Based on 10-14 day weighed food records, close to half or more of the subjects in a study by Huenemann and Turner (1942) had intakes of phosphorus, protein, and calories having less than 20 percent variation. In addition, the greatest number of cases had 60 percent and over variation for vitamins A, C, and D. While attempting to estimate the number of days in a diet record required for a certain level of precision, Chalmers et al. (1952) found that vitamins A and C had much greater variation and therefore these nutrients were not included with the others in the estimation. Calories and protein could be estimated with the highest precision. Trulson (1955) reported that the intake of protein showed less variation than did vitamin A, while the most substantial differences were found for vitamins A and C by Eppright et al. (1952), Young et al. (1953), and Adelson (1960) and for vitamins A and D by Yudkin (1951). The least variation has also been reported for calories and protein by Eppright et al. (1952). Intakes of vitamin A and ascorbic acid could be expected to fluctuate since these nutrients are unevenly distributed among foods so that the occasional use of a few foods rich in these nutrients would create large standard deviations. Day to day use of fruits and vegetables may be more variable than that of the other three food groups or the nutrient content within the fruits and vegetables themselves is more variable than the foods in the other groups. Finally, with respect to the magnitude of the standard deviations, in general, large standard deviations have been reported in a review by McHenry et al. (1945) and wide daily variation has been recognized as typical in western diets (Yudkin, 1951).

The percent contribution of 9 food groups described for the Nutrition Canada data base to the intake of energy and other nutrients of the group of 37 adult males is included in Appendix H, Table 1.

ii. Individual Data

Data on individual intake of 12 nutrients and energy is included in Appendix H, Table 2. The number of respondents who met or did not meet the recommendations for two levels of energy and 9 nutrients is shown in Table 16. The recommendations for protein, phosphorus, niacin, and ascorbic acid were met by all subjects. All except one of the subjects met the level for iron and almost all met the recommendation for riboflavin. Seventy percent of the subjects met the energy level of 2500 kcal, while only 54 percent met the higher level of 2840 kcal. More subjects did not meet than met the recommendations for thiamin (54.1% versus 45.9%). Close to one-third of the respondents did not meet the calcium level (27.0%) and over one-third were below the recommendation for vitamin A (37.8%). It was stated earlier that the mean intakes of the group generally met or exceeded the recommended levels. However, one should not overlook the fact that by using the mean intakes as a reference, less than adequate intakes of specific individuals are not apparent.

The distribution of respondents by dietary practice score is presented in Table 17. When the energy requirement was set at 2500 kcal, more subjects received the maximum energy score of 10.

TABLE 16

NUMBER OF RESPONDENTS[1] WHO MET OR DID NOT MEET THE C.D.S.[2] FOR KILOCALORIES AND 9 NUTRIENTS

Energy and Nutrients	Met	Did Not Meet
Energy (2840 kcal)	20 (54.1)[3]	17 (45.9)
Energy (2500 kcal)	26 (70.3)	11 (29.7)
Protein	37 (100.0)	0 (0.0)
Calcium	27 (73.0)	10 (27.0)
Phosphorus	37 (100.0)	0 (0.0)
Iron	36 (97.3)	1 (2.7)
Thiamin	17 (45.9)	20 (54.1)
Riboflavin	34 (91.9)	3 (8.1)
Niacin	37 (100.0)	0 (0.0)
Ascorbic Acid	37 (100.0)	0 (0.0)
Vitamin A	23 (62.2)	14 (37.8)

[1] N=37 males, 25-35 yrs

[2] Canadian Dietary Standard, (Revised 1975), 19-35 yr. male, 70 kg, 176 cm

[3] Percentages in parenthesis

TABLE 17

DISTRIBUTION OF RESPONDENTS BY DIETARY PRACTICE SCORE [1]

Dietary Practices Score	Energy Requirement 2840 kcal		Energy Requirement 2500 kcal	
10	6	(16.2)[2]	10	(27.0)
9	11	(29.7)	10	(27.0)
8	12	(32.4)	9	(24.3)
7	4	(10.8)	4	(10.8)
6	3	(8.1)	3	(8.1)
5	1	(2.7)	1	(2.7)
Total	37	99.9	37	99.9

1 Maximum score 10 based on energy and 9 nutrients

2 Percentages in parenthesis

Intakes of protein, fat and carbohydrate in relation to the recommendations concerning cardiovascular health are summarized in Table 18. Almost the same number of respondents had intakes equal to or less than the recommendations (n=20) as had intakes greater than the recommendations (n=17) for protein. The reverse was true for fat: 16 equal to or less than the recommendations and 21 above. Results for carbohydrate were less similar. Only three subjects had intakes greater than the recommended 50 percent of total calories as carbohydrate. Eighty-seven percent had intakes less than this standard. It has been recommended that Canadians should consume at least 50 percent of calories as carbohydrate, reducing the intake of sugar and replacing it with starches

(Murray and Rae, 1978). This was certainly not followed by four subjects who recorded intakes of 29%,(n=2), 30% (n=1), and 32% (n=1) of kilocalories as carbohydrate. Nine subjects had carbohydrate intakes between 35 to 40 percent of calories. These low intakes could reflect misconceptions regarding the role of carbohydrates in the diet. The popularity of low carbohydrate diets could possibly account for some of the low intakes of this group. The distribution of kilocalories for each subject is included in Appendix H, Table 3.

Seventeen subjects (45% of the total sample) reported to have taken vitamin, mineral, and/or other dietary supplements during the study period. A general description of these supplements is as follows: drug store brands of multivitamins with or without iron or other minerals, vitamin C and E supplements alone, lecithin, and protein supplements. In almost half of these cases, supplementation was not warranted. This was especially true for ascorbic acid since all the subjects met or exceeded the recommendations with diet alone (Table 16). Two subjects reported having consumed a protein supplement, but these were not justified due to their adequate mean daily intakes of this nutrient (81 g and 99 g, respectively). Where intakes less than the recommendations existed, improvements could be made through a varied and well-balanced selection of foods.

TABLE 18

INTAKES OF PROTEIN, FAT, AND CARBOHYDRATE IN RELATION TO THE RECOMMENDATIONS OF THE COMMITTEE ON DIET AND CARDIOVASCULAR DISEASE (1977)[1]

Nutrient	Number of Respondents with Intakes [2 3]		
	Less than Recommendations	Equal to Recommendations	Greater than Recommendations
Protein	13 (35.1)	7 (18.9)	17 (45.9)
Fat	13 (35.1)	3 (8.1)	21 (56.8)
Carbohydrate	32 (86.5)	2 (5.4)	3 (8.1)

[1] Recommended levels: protein - 15%, fat - 35%, carbohydrate - 50%, Murray and Rae, 1978

[2] N=37 males, 19-35 yrs.

[3] Percentages in parentheses

b. Nutrient Intake Away From Home at Commercial Eating Establishments and Place of Work

The intake of 12 nutrients and energy at commercial eating establishments and place of work is shown in Table 19 as a percentage of the total daily intake. Between 31 and 38 percent of these nutrients and energy were from foods prepared and eaten away from home at these locations. The contribution of the place of work alone ranged from 12 to 18 percent of the total daily nutrient intake. Therefore, at least one-third of the nutrients of this group of young males was obtained from sources outside of the home. These numbers correspond to data on the proportion of Canada's food dollar spent on food away from home. In 1976, 28 percent of the food dollar was spent on food away from home and for 1978 and the early 1980's, estimates have been

set at 35 percent and 40 percent, respectively. In addition, per capita expenditures have increased 82.9% for food at home and 104.9% for food away from home during the last 5 years (Canadian Restaurant and Foodservices Association, 1977). Therefore, there has been an increased amount of money spent on food away from home in Canada.

TABLE 19

NUTRIENT INTAKE FROM FOODS PREPARED AND EATEN AWAY AT COMMERCIAL EATING ESTABLISHMENTS [1] AND PLACE OF WORK [2]

Energy and Nutrients	% of Total Daily Intake [3]	% Contribution of Place of Work [3]
Energy	37	14
Protein	37	15
Fat	37	15
Carbohydrate	34	15
Calcium	31	17
Phosphorus	36	16
Iron	35	14
Thiamin	33	14
Riboflavin	32	13
Niacin	38	14
Vitamin C	32	15
Vitamin A	34	12
Vitamin B_6	36	13
Vitamin B_{12}	33	18
Free Folate	35	13

[1] Commercial eating establishments include restaurants, snack bars, private club food service facilities, and other profit foodservice operations

[2] Place of work includes staff cafeteria and vending operations

[3] Based on group data of 37 males, 25-35 yrs., including place of work

The distribution of kilocalories in the diet consumed away from home in relation to the total distribution and the Recommendations of the Committee on Diet and Cardiovascular Disease (1977) is indicated in Table 20. The distribution away from home was similar to the total pattern except that carbohydrate was reduced from 42 percent to 39 percent. Ten percent of kilocalories instead of seven was provided by alcohol.

TABLE 20

PERCENT DISTRIBUTION OF KILOCALORIES IN THE DIET IN RELATION TO THE RECOMMENDATIONS OF THE COMMITTEE ON DIET AND CARDIOVASCULAR DISEASE (1977)

Nutrient	Recommendations [1]	Total Distribution [2]	Distribution Away From Home [3]
Protein	15	15	15
Fat	35	36	36
Carbohydrate	50	42	39

[1] Murray and Rae, 1978

[2] Based on mean intakes of group of males 25-35 yrs.

[3] Includes restaurants, snack bars, and other profit foodservice operations and cafeteria and vending operations at place of work

The time costs involved in the dietary survey part of the present study are outlined in Appendix J, Table 1.

3. Personality

The distribution of scores on the Rotter (1966) Internal-External Locus of Personality Control Scale is indicated in Table 21. Considering a score of nine or less as an indication of internality (L. Breen, personal communication),[9] 34 subjects (89.5%) can be classified as internally controlled while 4 (10.5%) are externally-controlled. Based on a review by Joe (1971), it was predicted that the study group would be grouped along the internal end of the scale. Rotter (1966) commented that when groups are homogeneous as in this study this scale would be useful for classifying the group rather than for making individual predictions. Joe (1971) summarized the findings of several relationships between Internal-External control and personality.

> ...the findings depict externals, in contrast to internals, as being relatively anxious, aggressive, dogmatic, and less trustful, and more suspicious of others, lacking in self-confidence and insight, having low needs for social approval, and having a greater tendency to use sensitizing modes of defenses.

Regarding ethnic group and social class, and based on several studies, it was found that Negroes and lower-class individuals generally had higher external scores than whites and middle-class individuals (Joe, 1971).

> ...data is consistent with the theoretical expectation that individuals who are restricted by environmental barriers and feel subjected to limited material opportunities would develop an externally oriented outlook on life (Joe, 1971).

---

[9] L. Breen, Associate Professor, Dept. of Psychology, University of Manitoba, July 1979.

TABLE 21

FREQUENCY DISTRIBUTION OF SCORES ON THE ROTTER (1966) INTERNAL-EXTERNAL LOCUS OF PERSONALITY CONTROL SCALE [1]

Score	Number of Respondents
0	2
1	0
2	2
3	6
4	3
5	4
6	1
7	3
8	8
9	5
10	0
11	2
12	1
13	0
14	0
15	1
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0

[1] 23 forced-choice item personality test developed by Rotter (1966) and scored in favor of externality, ie. high score represents more external

Concerning attempts to control the environment Joe (1971) reported that several early studies showed that "internals" exhibited more initiative in their efforts to attain goals and to control their environments than did "externals." In addition, "internals" control their own impulses better and show a greater tendency to seek information and adopt behavior patterns which facilitate personal control over their environments (Joe, 1971). This latter characteristic regarding information seeking is of interest. If consulting nutrition information sources could be seen as a way to improve their food selection for better health, this study group of "internals" would be more likely to seek out the appropriate information source.

4. Other Attribute Variables

a. Demographic Data

In addition to the data obtained through the company (age, 25-35; annual income, $9600-22,000) the following information presented in Tables 22 and 23 regarding the general education, nutrition education, and the adherence to special diets was obtained by personal interview as discussed earlier (3. Research Instruments d. Biographical and Food Habit Questionnaire).

The majority of the respondents (81.6%) had some university or vocational training, six subjects completed high school, and the remaining subject had grade 10 - 11 education (Table 22). The distribution of subjects by nutrition instruction is indicated in Table 23. Of the thirteen subjects that received some form of nutrition instruction, 12 received this instruction at elementary, junior, or senior

TABLE 22

DISTRIBUTION OF RESPONDENTS BY EDUCATION

Level of Educational Attainment	No.	%
Grade 10 - 11	1	2.6
Completed high school	6	15.8
University or vocational training	31	81.6
Total	38	100.0

TABLE 23

DISTRIBUTION OF RESPONDENTS BY NUTRITION INSTRUCTION

Received Nutrition Instruction	No.	%
Yes	13	34.2
No	25	65.8
Total	38	100.0

high school. One individual reported that he received 11 to 15 hours of instruction at university. Nutrition information at an early school age may be forgotten in later years or may be relatively out of date so as to reduce its effect on the outcomes of the nutrition knowledge test. As reported earlier, the mean score on the nutrition test was a low 38 percent.

Thirty-four of the subjects (89.5%) were not on a special diet during the study period. Of the four who reported that they followed one, three diets were of the low carbohydrate type, while one involved solely "natural foods."

b. Sources of Information About Foods and Nutrition

The distribution of respondents by the information source is presented in Tables 24 and 25. With reference to human information sources, the majority of the subjects consulted either a wife (26.3%) or no human sources of foods and nutrition information (36.8%) as indicated in Table 24.

TABLE 24

DISTRIBUTION OF RESPONDENTS BY HUMAN INFORMATION SOURCE

Human Source	No.	%
Wife	10	26.3
Mother	4	10.5
Friends or relatives	3	7.9
Personnel in health food, grocery, or drug stores	1	2.6
Physician or nurse	6	15.8
Dietitian, nutritionist, or home economist	0	0.0
No sources	14	36.8
Total	38	99.9

Not all the subjects were married, therefore the "wife" category would not be applicable to them.

Data concerning printed sources of information are shown in Table 25. Most of the subjects consulted newspapers and popular magazines (42.1%) for their information.

TABLE 25

DISTRIBUTION OF RESPONDENTS BY PRINTED INFORMATION SOURCE

Printed Source	No.	%
Adelle Davis type books	3	7.9
Cookbooks and other popular books	5	13.2
Government publications	3	7.9
Newspapers and popular magazines	16	42.1
Health food store literature	0	0.0
Scientific books and journals	3	7.9
No sources	8	21.1
Total	38	100.1

c. Role in Meal Planning and/or Preparation

In Table 26 the various roles in meal planning and/or preparation by the respondents are outlined. Most of the subjects (52.6%) shared the responsibilities for these activities with other individuals. Almost the same numbers were involved in the other categories (7, 6, and 5, respectively).

TABLE 26

DISTRIBUTION OF RESPONDENTS BY ROLE IN MEAL PLANNING AND/OR PREPARATION

Role in Meal Planning and/or Preparation	No.	%
Sole planner and/or preparer of meals on a regular basis	7	18.4
Sole planner and/or preparer of meals on an occasional basis	6	15.8
Share responsibilities with other persons	20	52.6
No involvement	5	13.2
Total	38	100.0

d. Use of Salt

The salting practices of the group are indicated in Table 27. Only 3 subjects reported never using salt in food preparation or at the table. Thirteen subjects admitted to salting food at the table before tasting food. This habitual use of salt is not recommended. Canadians are advised to reduce their intake of salt as a preventative measure against hypertension which is a risk factor in cardiovascular disease (Murray and Rae, 1978).

TABLE 27

DISTRIBUTION OF RESPONDENTS BY USE OF SALT

Use of Salt	No.	%
Salt food at the table before tasting food	13	34.2
Never use salt in food preparation or at the table	3	7.9
Only add salt to food at the table if it is needed	22	57.9
Total	38	100.0

e. Scale Values of Influences on Food Choices and Self-Evaluation of Nutritional Knowledge

The mean scores of the various influences on a person's food choices are indicated in Table 28. Personal preference (7.8) and taste or appearance of food (7.2) had the greatest influence on food choices of the study group. The standard deviations were also the lowest of the 14 influences. Convenience and habit and personal health were the next most influential (6.8 and 6.5, respectively), followed by health of other household members and availability (6.2). Opinions of friends (2.3) and other relatives (2.5), children's preference (2.9), and the mass media (3.3) had the least influence on food choices.

These results are compared in the same table, Table 28, to those adapted from a study by Schafer (1978). No standard deviations were

TABLE 28

DEGREE OF INFLUENCE [1] OF VARIOUS PERSONAL AND SOCIAL FACTORS ON MALES' FOOD CHOICES

Type of Influence	Winnipeg Study, 1978 [2]		Midwestern U.S. Towns, 1978 [3]
	Mean Score	± S.D.	Mean Score
Personal preference	7.8	1.5	7.5
Personal health	6.5	2.5	6.5
Health of other household members	6.2	2.9	7.0
Wife's preference	5.8	2.5	7.4
Children's preference	2.9	2.0	4.6
Opinions of other relatives	2.5	2.1	1.8
Opinions of friends	2.3	1.8	2.6
Cost	4.3	2.2	6.2
Nutrition knowledge	5.1	2.3	---
Mass media-newspapers, advertisements, T.V.	3.3	2.2	3.6
Convenience or habit	6.8	2.1	---
Taste or appearance of food	7.2	1.7	---
Weight control	5.5	2.6	---
Availability	6.2	2.3	---

--- data not available

1 Mean scores based on a 10-point scale, with 1 = no influence and 10 = a great deal of influence

2 Results from 38 males aged 25-35 yrs.

3 Results adapted from study of 116 males, average age 30.5 years, by Schafer, 1978

reported for this study. Personal preference (7.5) received the highest mean score similar to the study group. In addition, opinions of friends and relatives (2.6 and 1.8, respectively) and the mass media (3.6) had the lowest influence on food behavior. Schafer (1978) reported that "the single most important influence for both husband and wife was his or her own personal preference." Also, "the only external force that seemed to carry as much impact on food behavior as the internal personal and health concerns was the cost of food." Measures of association were not computed between these scale values and other variables, such as dietary practices, as had been done by Schafer (1978). There was some question regarding the reliability of this scale since no reliability coefficients were reported. In agreement with Nunnally (1967), a test-retest method of measuring stability over a period of time would be applicable to this instrument if the first testing would have little influence on the second testing and if the subjects could be interviewed again. However it does not seem practical with large scattered samples.

The mean score on the 10-point "Self-evaluation of Nutritional Knowledge Scale" used in previous research by Grotkowski and Sims (1978) and Sims (1978) was 4.9 ($\pm$ 1.5). Other scores reported following use of this scale are shown in Table 29. Again, the test-retest method of assessing reliability would be applicable providing that there was no nutrition education during the interval preceding the second measurement.

TABLE 29

SELF - EVALUATION OF NUTRITIONAL KNOWLEDGE [1]

Young Men, 1978 [2]	Non-institutionalized Elderly, 1978 [3]	Lactating Women, 1978 [4]
4.9	4.8	6.0

[1] Mean scores based on 10-point scale, 1= no knowledge and 10= as much as professionals

[2] Results from 38 males, aged 25-35 yrs.

[3] Results from 64 non-institutionalized elderly, Grotkowski and Sims (1978)

[4] Results from 61 lactating women, Sims (1978)

B. RELATIONSHIPS AMONG INDEPENDENT AND DEPENDENT VARIABLES

1. Discussion of Hypotheses

The hypotheses will be discussed in terms of the alternate hypotheses. That there is no relationship among the variables is stated under the null hypotheses.

Ha_1: There is a positive relationship between nutrition knowledge and dietary practices.

Kendall and Spearman rank correlation coefficients between the variable pairs, nutrition knowledge and dietary practice, are shown in Table 30.

TABLE 30

CORRELATION COEFFICIENTS BETWEEN NUTRITION KNOWLEDGE AND DIETARY PRACTICES [1]

Variable Pair	Kendall Coefficient	Kendall p-level	Spearman Coefficient	Spearman p-level
Nutrition Knowledge with Dietary Practices [2]	-0.2236	0.957	-0.2989	0.964
Nutrition Knowledge with Dietary Practices [3]	-0.1205	0.823	-0.1688	0.841

[1] Computed using 1-tailed test of statistical significance

[2] Energy requirement at 2840 kcal

[3] Energy requirement at 2500 kcal

When the dietary practice score is based on the energy level of 2840 kcal, there is a significant negative relationship between nutrition knowledge and dietary practices. Therefore, as nutrition knowledge increases, there is a decrease in the dietary practices score for this fairly homogeneous group of young men. Using the level of 2500

kcal in the dietary practice score, the correlation coefficients are lower and the negative relationship is not significant at the 5 percent level. The distribution of respondents by dietary practice score (2840 kcal) and mean nutrition knowledge score is indicated in Table 31.

TABLE 31

DISTRIBUTION OF RESPONDENTS BY DIETARY PRACTICE SCORE[1] AND NUTRITION KNOWLEDGE SCORE [2]

Dietary Practice Score	No.	%	Mean Nutrition Knowledge Score	%
10	6	16.2	8.5	32.7
9	11	29.7	9.6	36.9
8	12	32.4	10.1	38.8
7	4	10.8	10.0	38.5
6	3	8.1	12.3	47.3
5	1	2.7	9.0	34.6
Total	37	99.9		

[1] Maximum score 10 for energy and 9 nutrients (2840 kcal)
[2] Maximum score 26

The majority of the respondents (78.3%) had a practice score of 8 or more. The mean nutrition knowledge scores tended to increase as the dietary practice scores decreased. This trend was shown when the correlation coefficients were computed. One would have expected the reverse trend to have occurred ie. greater knowledge would be related to better dietary practices. The restricted range of the dietary practice scores (close to 80% scored 8 or better) would have an effect on re-

ducing the size of the correlation coefficient (Nunnally, 1967). In addition, the nutrition knowledge scores tended to be skewed to the right so that the majority of the respondents scored low on the test. (Only 7 subjects scored greater than 50 percent). In order to have optimum conditions for testing the relationships between two variables, Kerlinger (1973) emphasized the importance of maximizing the experimental variance by having the sample vary on both independent and dependent variables.

> If the independent variable does not vary substantially, there is little chance of separating its effect from the total variance of the dependent variable, so much of which is often due to chance. It is necessary to give the variance of a relation a chance to show itself, to separate itself, so to speak, from the total variance, which is a composite of variances due to numerous sources and chance (Kerlinger, 1973).

Experimental variance would not be maximized because most of the subjects consumed their meals and snacks in the same cafeteria. Thus, the restricted variance on both independent and dependent variables could allow more opportunities for chance occurences in the present study.

Ha_2 : There is a relationship between locus of personality control and nutrition knowledge.

The correlation coefficients between locus of personality control and nutrition knowledge are listed in Table 32.

TABLE 32

CORRELATION COEFFICIENTS BETWEEN LOCUS OF PERSONALITY CONTROL AND NUTRITION KNOWLEDGE[1]

Variable Pair	Kendall		Spearman	
	Coefficient	P-level	Coefficient	P-level
Locus of Personality Control with Nutrition Knowledge	-0.1532	.213	-0.2184	.188

[1] computed using 2-tailed test of statistical significance

The relationship is not significant and the correlation coefficients are low, however, the trend is in the negative direction. The greater the degree of externality, the lower the nutrition knowledge score or the greater the degree of internality, the higher nutrition knowledge. If seeking more information about nutrition was perceived as a method to control one's health, more internally-controlled individuals would tend to seek out nutrition information and thus, they would likely score higher on the nutrition knowledge test. As previously mentioned 34 respondents (89.5%) were classified as internally-controlled individuals. Few were externally-controlled and thus the effects of restricted range come into effect.

Ha_3 : There is a relationship between locus of personality control and dietary practices.

Kendall and Spearman correlation coefficients for the above relationship are included in Table 33.

TABLE 33

CORRELATION COEFFICIENTS BETWEEN LOCUS OF PERSONALITY CONTROL AND DIETARY PRACTICES [1]

Variable Pair	Kendall		Spearman	
	Coefficient	p-level	Coefficient	P-level
Locus of Personality Control with Dietary Practices[2]	0.1880	0.150	0.2478	0.140
Locus of Personality Control with Dietary Practices[3]	0.2128	0.102	0.2851	0.088

[1] Computed using 2-tailed test of statistical significance

[2] Energy requirement 2840 kcal

[3] Energy requirement 2500 kcal

Again the coefficients are low, however, they are in the positive direction. Thus, the trend is for better dietary practices to be associated with a greater degree of externality. When a one-tailed test is used, the Kendall and Spearman coefficients are significant at the 5 percent level for the energy level of 2500 kcal ($p < 0.051$ and $p < 0.044$, respectively).

Ha_4 : There is a relationship between role in meal planning and preparation and nutrition knowledge.

The mean ranks of the nutrition knowledge scores for the four populations, sole planner or preparer of meals on a regular basis, sole planner or preparer on an occasional basis, share responsibilities with others, and no involvement in these activities, were taken into account (Appendix I, Table 1) when computing the Kruskal-Wallis test statistic

(Figure 3). The null hypothesis was rejected at the level, $p < 0.025$, therefore, nutrition knowledge scores were not the same for all populations. Following the application of the Multiple Comparisons Test for unequal sample sizes (Appendix I), it was found that the nutrition knowledge scores were significantly different between the sole planner and/or preparer on a regular basis and the sole planner and/or preparer on an occasional basis. There was no other difference between the groups. Therefore, the extent to which an individual is the sole planner and/or preparer of meals has an effect on the outcomes of the nutrition knowledge test. It could be speculated that if the involvement in these activities is more regular or intense, there would be more interest in acquiring foods and nutrition information. Involvement on a limited basis may do little to heighten one's interest in foods and nutrition and consequently nutrition knowledge would be much lower for these individuals.

The formula for computing the Kruskal-Wallis test statistic H (H' includes an adjustment for ties) is illustrated below:

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{k} n_j \left(R_{.j} - R_{..}\right)^2$$

$$H' = \frac{H}{1 - \left(\sum_{j=1}^{g} T_j \Big/ \left[N^3 - N\right]\right)}$$

where N = number of observations in all k samples together

$R_{.j}$ = average rank of sample j

$R_{..}$ = average rank over all N observations $\frac{N+1}{2}$

g = number of tied groups

$T_j = (t_j^3 - t_j)$, with t_j the size of tied group j

Ha_5 : There is a relationship between role in meal planning and preparation and dietary practices.

The mean ranks of the dietary practice scores for both 2840 kcal and 2500 kcal were not significantly different at the 5 percent level between the four groups of planning and/or preparation of meals (Appendix I, Table 1). Therefore, in the present study dietary practices were not influenced by the role in meal planning and/or preparation.

Ha_6 : There is a relationship between source of foods and nutrition information and nutrition knowledge.

The relationship between these two variables could not be tested by statistical means because the number of respondents in certain categories was less than five and because it was difficult to classify the sources according to accuracy of information. Instead, the mean test scores for all human and printed sources were computed (Tables 34 and 35). Interpretation of these tables is limited because the mean test score depends upon the other type of source of foods and nutrition information. For example, those individuals who consulted no human sources of foods and nutrition information had the second highest average nutrition knowledge test score

(Table 34). However, they may have consulted accurate printed sources of information or had no exposure to individuals possessing erroneous knowledge of the topic. The latter would be instrumental to the degree of accuracy of knowledge possessed.

TABLE 34

DISTRIBUTION OF HUMAN INFORMATION SOURCE BY NUTRITION KNOWLEDGE SCORE

Human Information Source	No.	%	Mean Test Score [1]	%
Wife	10	26.3	9.0	34.6
Mother	4	10.5	10.3	39.6
Friends or relatives	3	7.9	8.0	30.8
Personnel in health food, grocery or drug stores	1	2.6	14.0	53.8
Physician or nurse	6	15.8	8.5	32.7
Dietitian, nutritionist, or home economist	0	0.0	---	---
No sources	14	36.8	11.1	42.7
Total	38	99.9		

--- data not available

[1] maximun score 26

In Table 35 as could be expected, those subjects who consulted scientific books and journals had the highest average test score. Again, those in the "no sources" category received the second highest test score. The same argument as for human sources applies here. Those who consulted no printed sources may have received accurate information from certain human sources. Of interest to note is that there were fewer subjects that did not consult printed sources (n=8) than did not consult human sources (n=14). Therefore, the printed media could be considered more useful in conveying foods and nutrition information to this group of adult males.

TABLE 35

DISTRIBUTION OF PRINTED INFORMATION SOURCE BY NUTRITION KNOWLEDGE SCORE

Printed Information Source	No.	%	Mean Test Score [1]	%
Adelle Davis type books	3	7.9	9.7	37.3
Cookbooks and other popular books	5	13.2	8.0	30.8
Government publications	3	7.9	10.3	39.6
Newspapers and popular magazines	16	42.1	8.8	33.8
Health food store literature	0	0.0	---	---
Scientific books and journals	3	7.9	14.7	56.5
No sources	8	21.1	11.4	43.8
Total	38	100.1		

--- data not available

[1] maximum score 26

Ha_7 : There is a relationship between source of foods and nutrition information and dietary practices.

The relationship between these two variables could not be tested by statistical means because the previous two problems of small cell size and defining the accuracy of information sources were in effect. The mean dietary practice scores (2840 kcal) for all human and printed information sources were computed (Tables 36 and 37). In Table 36, the mean practice scores for the human information sources are similar and high (Range 8.0 - 9.0).

TABLE 36

DISTRIBUTION OF HUMAN INFORMATION SOURCE BY DIETARY PRACTICE SCORE [1]

Human Information Source	No.	%	Mean Practice Score
Wife	9	24.3	8.6
Mother	4	10.8	8.0
Friends or relatives	3	8.1	9.0
Personnel in health food, grocery or drug stores	1	2.7	9.0
Physician or nurse	6	16.2	8.0
Dietitian, nutritionist, or home economist	0	0.0	---
No sources	14	37.8	8.1
Total	37	99.9	

--- data not available

[1] energy requirement 2840 kcal, maximum score 10

There is a greater spread of mean dietary practice scores when printed information sources are considered (Table 37). The range in this case is from 7.0 to 9.3.

TABLE 37

DISTRIBUTION OF PRINTED INFORMATION SOURCE BY DIETARY PRACTICE SCORE[1]

Printed Information Source	No.	%	Mean Practice Score
Adelle Davis type books	3	8.1	8.7
Cookbooks and other popular books	5	13.5	8.4
Government publications	2	5.4	7.0
Newspapers and popular magazines	16	43.2	8.2
Health food store literature	0	0.0	---
Scientific books and journals	3	8.1	9.3
No sources	8	21.6	8.1
Total	37	99.9	

--- data not available

[1] energy requirement 2840 kcal, maximum score 10

In both tables dietary practice scores were high (8.1) when no sources were consulted. However, if no human sources were consulted, certain printed information sources may have had an effect on the dietary practices of this "no sources" group and vice versa.

2. Discussion of Statistical Procedures Used in Other Studies

Certain questions were raised when the results of the present study were being analyzed. These pertained to the assumption of normality, the appropriateness of certain procedures which are only applicable to variables where the concept of a linear relationship "makes sense," and the relationship between nutrition knowledge and dietary practices (ie.is the definition of the latter variable meaningful?)

a. Assumption of Normality

Three statistical procedures or test statistics that have appeared frequently in the literature are: 1) Pearson product-moment correlation coefficient for continuous variables, 2) the Chi-square test for categorical variables, and 3) the One-way Analysis of Variance. If a researcher uses 1) or 3) it is assumed that the distribution of the data is normal. There are distribution-free counterparts to these techniques that one might select if there was any question regarding the normality of the distribution. This is especially the case with the variable, dietary practices. One might speculate that the distribution of this variable is not normal, but rather is skewed. Therefore, when the association of dietary practices and another variable such as nutrition knowledge is to be tested, it may be more appropriate to choose a distribution-free test. None of the studies measuring the relationship between dietary practices and other variables used the distribution-free statistics such as Spearman's rho or the Kruskal-Wallis test statistic, for example. Instead, statistics based on the assumption of

normality were employed. Were these researchers justified in assuming that the distribution of nutrient intakes is normal? How much discussion has been undertaken in the past as to whether or not nutrient intakes are normally distributed? These questions were raised in the present study, however, it is difficult to provide any conclusive answers to them at the present time without further discussion among other professionals.

b. Appropriateness of Procedures

Linear regression analysis, path analysis, and factor analysis are statistical procedures applicable to variables that are linearly related. Before one attempts any of these, one should be convinced that the data fit the linear model. For example, when testing the relationship between nutrition knowledge and dietary practices, defined by nutrient intakes, one should question whether or not these two variables are linearly related. Sims (1978) presented a curvilinear model of the suggested relationship between nutrition knowledge and intake of iron. This model was stated to be appropriate when dietary practices are defined as intakes of energy and certain nutrients. However, nutrient intakes greater than the recommended are not necessarily better since excessive intakes of certain nutrients may actually be harmful. Therefore, as knowledge increases it is not reasonable to expect nutrient intake to keep increasing. Thus, the curvilinear model appears justified.

Opposing statements made by Sims (1978) are of interest. These concern the procedure, path analysis, which was attempted in work by this author. "Path analysis is a special type of multivariate analysis that

deals with a closed system of variables assumed to be linearly related" (Sims, 1978). Later on this author discussed the curvilinear relationship between the variables, nutrition knowledge and nutrient intakes. Why was path analysis attempted if these variables were not linearly related? Therefore, the contradictory nature of this research is evident. Linear regression techniques were not computed in the present study since they were not considered appropriate.

Factor analysis is another procedure that was used by Sims (1978). It involves the weighted linear combinations of the original variables (Kleinbaum and Kupper, 1978). If the nutrient intake data are inserted into the mathematical combinations, the size of the nutrient intake would appear to influence the contribution of that certain nutrient to the factor. However the question is raised as to whether or not factor analysis is appropriate to nutrient intake data. Intakes of a nutrient that exceed the recommended level are not necessarily better but they may have a considerable influence on the factor scores. Should intakes much greater than 100 percent of the recommended be truncated to the recommended or even below the recommended level to make the analysis more meaningful? This procedure was not reported by Sims (1978). By using factor analysis it appears that the author supports its use in dealing with nutrient intake data. It is not possible at present to make any definitive statements regarding the use of factor analysis to classify nutrient intakes into "meaningful" groups. The paper by Sims (1978) has left many questions unanswered and it would be desirable to have them solved before the use of this technique becomes more fashionable in the literature.

c. Interpretation of the Relationships Between Nutrition Knowledge and Dietary Practices

The interpretations of the relationships between nutrition knowledge and dietary practices may or may not be justified based on the definition of dietary practices (and also the way in which nutrition knowledge is measured). Operational definitions of dietary practices such as energy and intakes of certain nutrients are not as meaningful in research applications such as this one. When used in a linear combination with other variables especially nutrition knowledge, it is not appropriate to treat an increased nutrient intake as better once the recommended levels have been reached. It would be more suitable to score the dietary practices in some way so that a higher score would reflect better practices and give an indication of total dietary practices. Then linear relationships could be tested.

VI. SUMMARY AND CONCLUSIONS

A select group of 38 adult males, 25 to 35 years, participated in a short term study designed to measure the nutrition knowledge and dietary practices of this group. In general, the target population was a well-educated,internally-controlled group with basically no exposure to nutrition education outside of elementary, junior, or senior high school. Most of the subjects consulted newspapers or magazines for their nutrition information and shared the responsibilities for meal planning and/or preparation with someone else.

Extensive work was done on the development and validation of the nutrition knowledge test. The Kuder-Richardson 20 reliability coefficient for the 26-item final version of the test was 0.69 for the study group. The level of nutrition knowledge of this group was low. In general, they had a high level of perceived nutrition knowledge, however, the low level of accuracy of this knowledge reflects the existence of misconceptions regarding foods and nutrition in specific content areas. The subjects strongly believed that they possessed knowledge about balanced food selection, however, the accuracy of this knowledge was limited. They knew the major dietary components, (protein, fat, and carbohydrate), but were not able to correctly identify the major food groups from which nutrients could be obtained. A high degree of uncertainty and a low level of accuracy of knowledge about food composition existed. In addition, there was a low percentage of correct response to the questions on weight control. This is important if the significance of overweight and obesity as nutrition-related

diseases in the Canadian population is considered. In the area of cardiovascular health, the group answered more questions correctly regarding vegetable oils and good health than about the hydrogenated forms of oils.

With respect to the dietary practices of the group, the mean nutrient intakes generally met or exceeded the Canadian recommendations. In addition, the distribution of kilocalories in the diet for the entire group was close to the recommended proportions. A high level of intra- and inter-subject variability in nutrient intakes existed and the majority of the respondents received a high dietary practice score based on the intake of 9 nutrients and energy over a 3-day period. Seventeen of the respondents reported having consumed a vitamin, mineral, or protein supplement during the study period. Finally, at least one-third of the nutrients for the group were consumed away from home.

The relationship between the independent and dependent variables is summarized according to the model that was originally constructed (III. Objectives and Hypotheses of the Research). In the following diagram (Figure 3), the Kendall correlation coefficients and the level of significance are presented. Only two relationships are significant at the 5 percent level. The internally-directed nature of the study and the restricted range of the sample should be kept in mind. This is, however, no attempt to portray path analysis. It is surprising that nutrition knowledge was negatively related to dietary practices. One would hope, as a nutrition educator, that as nutrition knowledge increased, dietary practices would increase. However, as stated earlier, it is difficult to make any firm statements regarding the relationships between nutrition knowledge and dietary practices.

Basically it is a methodology problem, and in the present study, the homogeneous nature of the sample could have had an impact on the results obtained.

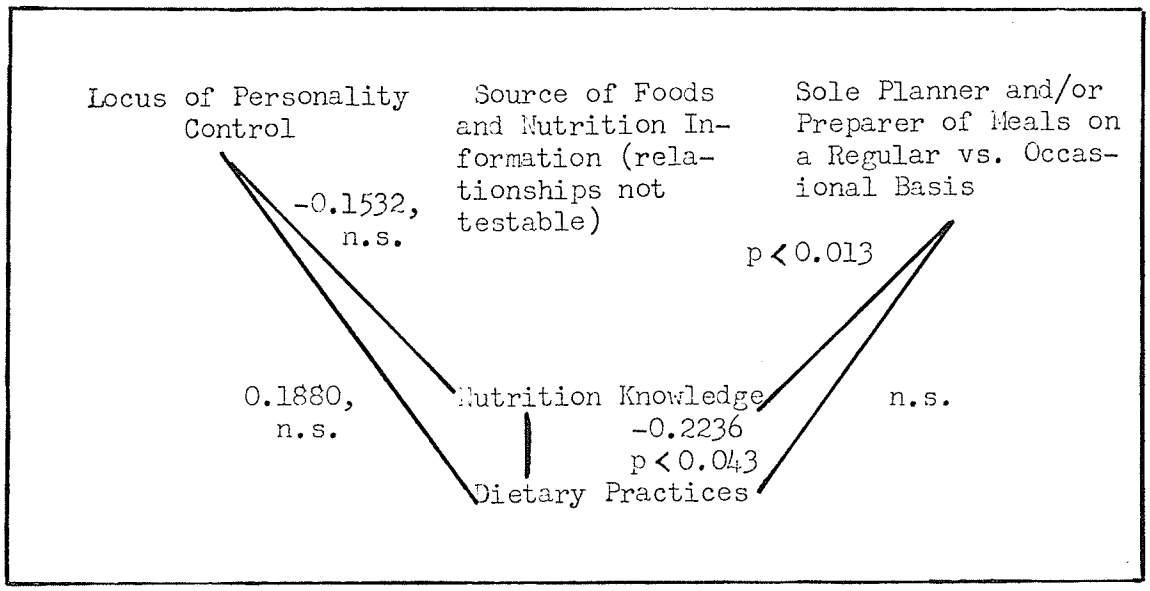

Figure 3: Schematic presentation of the relationships between independent and dependent variables

VII. IMPLICATIONS AND RECOMMENDATIONS

A. IMPLICATIONS FOR NUTRITION EDUCATORS

Several implications for nutrition educators have arisen through the use of the knowledge test to assess the level of nutrition knowledge. Nutrition education is indicated for this group of adult males because of the low level of nutrition knowledge possessed by the group and also because of the lack of knowledge or the existence of erroneous knowledge in several content areas. Nutrition knowledge based on facts obtained during elementary, junior, or senior high school days needs to be up-dated. For example, this is the case for areas on recommended adult servings of milk and the vitamin C content of foods. In order to enhance the spread of sound nutritional knowledge especially among the family, exposure to reliable foods and nutrition information is important. Also, because of the trend towards an increased amount of income spent on food away from home, individuals need to be more informed regarding their selection of food away from the influence of the family. Individuals who have a low level of nutrition knowledge are susceptible to erroneous information and misleading advice by food faddists and certain health food store personnel. It is important to provide this adult group with the rationale behind certain recommended dietary practices through nutrition education efforts so that more informed decisions regarding dietary practices can be made.

The nutrition knowledge test was useful in pinpointing certain content areas in which knowledge was lacking. It was also useful in

arousing interest and discussion among the subjects who returned to receive the results of the study. This group wanted to know how well they did on the test and where they went wrong. Ideas for nutrition education programs are as follows. Erroneous knowledge regarding the cause of weight gain in adults existed. Some subjects felt that the consumption of too much fat or carbohydrate was responsible. The rationale behind the rejection of fad weight reduction schemes in which one or more of the energy providing nutrients is drastically reduced in the diet should be presented. In particular, the popularity of low carbohydrate reducing diets warrants this. Education regarding sound weight reduction programs and balanced food selection could be viewed as a preventative measure for those who are presently not overweight but for whom overweight might become a problem in later years. Overweight and obesity are important nutrition-related diseases in the adult population. In the nutrition and cardiovascular health area, knowledge of the best fats and oils for good health could be expanded since the group answered more questions correctly regarding vegetable oils than the hydrogenated forms of these oils. The rationale behind the emphasis on dietary fats could be outlined since not all the subjects identified the relationship of dietary fat to cardiovascular disease. However, the depth of coverage would depend upon the individual's ability to understand the content area.

In addition to the low level of knowledge in certain areas of nutrition, questionable dietary practices have indicated the necessity for nutrition education. Several subjects consumed vitamin, mineral, or protein supplements during the study period which were generally

not justified. A varied and well-balanced selection of foods should be emphasized. This could lead into a discussion and activities related to food composition since the subjects had a low level of knowledge in this area. An advanced approach for this group of well-educated males would be to focus on food composition in order to help explain the rationale behind the Four Food Groups. In addition to a well-balanced selection of foods, the importance of the distribution of kilocalories in the diet among the three major energy-yielding components should be considered. Not all subjects had patterns of caloric distribution resembling the recommended. Finally, because of the important contribution of foodservices away from home to the nutrient intake of the group, the nutrition education program could emphasize balanced food choices in commercial foodservice operations.

The personality characteristics of the target population could also be capitalized upon when designing a nutrition education program. Internally-controlled individuals who recognize the positive relationship between nutrition and health might be more easily educated and more likely to use reliable information sources. Access to reliable nutrition information should be facilitated for internally-directed individuals.

B. METHODOLOGY ISSUES

Besides the implications for nutrition educators, there are certain methodological issues that may be important for those who wish to undertake a similar type of research. First of all, when using tests to measure knowledge of nutrition, these tests should be carefully con-

constructed and tested for validity and reliability so a truer assessment of knowledge in relation to other known groups can be achieved. Secondly, the researcher should make sure that operational definitions of dietary practices are appropriate to the research. In studies which involve the linear correlation of nutrition knowledge with a measure of dietary practices, this latter variable should be scored in some way as to reflect the adequacy of the diet. For example, dietary assessments based on servings from the Food Groups or based on the intake of energy and nutrients should be converted into meaningful scores so that a higher score would represent a more adequate diet. Then it would be appropriate to use statistical tests which are based on the assumption that a linear relationship holds for nutrition knowledge and dietary practices.

BIBLIOGRAPHY

Abramson, J.H., Slome, C. and C. Kosovsky. 1963. Food frequency as an epidemiological tool. Am. J. Pub. Health 53: 1093.

Adelson, S.F. 1960. Some problems in collecting dietary data from individuals. J. Am. Dietet. Assoc. 36: 453.

Adelson, S.F. and A. Keys. 1962. Diet and some health characteristics of 123 business and professional men and methods used to obtain the dietary information. ARS 62-11, United States Department of Agriculture.

Al-Isi, I.J., Kanawati, A.A. and D.S. McLaren. 1975. Formal education of mothers and their nutritional behavior. J. Nutr. Ed. 7: 22.

Anon. 1976. The validity of 24-hour dietary recalls. Nutr. Rev. 34: 310.

Anon. 1978. Nutritional Analysis of Fast Foods. Ross Timesaver 5(5), September-October. Ross Laboratories, Columbus, Ohio.

AuCoin, D., Haley, M., Rae, J., and M. Cole. 1972. A comparative study of food habits: influence of age, sex and selected family characteristics. Can. J. Pub. Health 63: 143.

Balogh, M., Kahn, H.A. and J.H. Medalie. 1971. Random repeat 24-hour dietary recalls. Am. J. Clin. Nutr. 24: 304.

Beaton, G.H. 1973. In "The Assessment of Nutritional Status, Proceedings of the Miles Symposium '73", ed. Hawkins, W.W. p. 27. The Nutrition Society of Canada.

Boek, J.K. 1956. Dietary intake and social characteristics. Am. J. Clin. Nutr. 4: 239.

Bransby, E.R., Daubney, C.G. and J. King. 1948. Comparison of results obtained by different methods of dietary survey. Am. J. Pub. Health 2: 7.

Bremer, M. and W. M. Weatherholtz. 1975. Nutrition attitudes in a university community. J. Nutr. Ed. 7: 60.

Brown, A.M., McKenzie, J.C. and J. Yudkin. 1963. Knowledge of nutrition amongst housewives in a London suburb. Nutrition 17: 16.

Brown, G.B., Celender, I.M., and A.E. Sloan. 1978. What the U.S. consumer knows, thinks -- and practices when it comes to nutrition. Food Product Development May: 35.

Bryan, M.S. and M.E. Lowenberg. 1958. The father's influence on young children's food preferences. J. Am. Dietet. Assoc. 34: 30.

Burt, J.V. and A.A. Hertzler. 1978. Parental influence on the child's food preference. J. Nutr. Ed. 10: 127.

Caliendo, M.A. and D. Sanjur. 1978. The dietary status of preschool children: an ecological approach. J. Nutr. Ed. 10: 69.

Campbell, V.A. and M.L. Dodds. 1967. Collecting dietary information from groups of older people. J. Am. Dietet. Assoc. 51: 29.

Canada. Department of National Health and Welfare, Ottawa. Nutrition Canada National Survey. 1973. Nutrition: A National Priority. Information Canada.

Canadian Restaurant and Foodservices Association. 1977. Canada's Foodservice Industry Size and Scope.

Carver, L.R. and K.S. Lewis. 1979. A nutrition knowledge test for elementary school teachers. J. Nutr. Ed. 11: 68.

Chalmers, F.W., Clayton, M.M., Gates, L.O., Tucker, R.E., Wertz, A.W., Young, C.M. and W.D. Foster. 1952. The dietary record- how many and which days? J. Am. Dietet. Assoc. 28: 711.

Cho, M. and B.A. Fryer. 1974. Nutritional knowledge of collegiate physical education majors. J. Am. Dietet. Assoc. 65: 30.

Church, H.N., Clayton, M.M., Young, C.M., and W.D. Foster. 1954. Can different interviewers obtain comparable dietary survey data? J. Am. Dietet. Assoc. 30: 777.

Cook, R.A., Taber, L.A.L., and B.E. Footer. 1979. Anthropometric and dietary patterns of Maine adults. Nutr. Rep. Int. 19: 179.

Cornely, P.B., Bigman, S.K., and D.D. Watts. 1963. Nutritional beliefs among a low-income urban population. J. Am. Dietet. Assoc. 42: 131.

Cosper, B.A. and L.M. Wakefield. 1975. Food choices of women. J. Am. Dietet. Assoc. 66: 152.

Coughenour, C.M. 1972. Functional aspects of food consumption activity and family life cycle stages. J. Marr. Family 34: 656.

Dugdale, A.E., Chandler, D. and K. Baghurst. 1979. Knowledge and belief in nutrition. Am. J. Clin. Nutr. 32: 441.

Dwyer, J.T., Feldman, J.J. and J. Mayer. 1970. Nutritional literacy of high school students. J. Nutr. Ed. 2: 59.

Ebel, R.L. 1965. "Measuring Educational Achievement," Prentice-Hall, Inc., New Jersey, pp. 149-200, 308-375.

Emmons, L. and M. Hayes. 1973. Nutrition knowledge of mothers and children. J. Nutr. Ed. 5: 134.

Eppright, E.S. 1947. Factors influencing food acceptance. J. Am. Dietet. Assoc. 23: 579.

Eppright, E.S., Brown-Patton, M., Marlatt, A.L. and M.L. Hathaway. 1952. Dietary study methods. V. Some problems in collecting dietary information about groups of children. J. Am. Dietet. Assoc. 28: 43.

Eppright, E.S., Fox, H.M., Fryer, B.A., Lamkin, G.H. and V.M. Vivian. 1970. The North Central Regional Study on diets of preschool children. 2. Nutrition knowledge and attitudes of mothers. J. Home Ec. 62: 327.

Fathauer , G.H. 1960. Food habits - an anthropologist's view. J. Am. Dietet. Assoc. 37: 335.

Fidanza, F. 1974. Sources of error in dietary surveys. Nutr. Diet. 20: 105.

Fisher, R.A. 1935. "The Design of Experiments." Oliver and Boyd Ltd., Edinburgh.

Fox, H.M., Fryer, B.A., Lamkin, G.H., Vivian, V.M., and E.S. Eppright. 1970. The North Central Regional Study of diets of preschool children. 1. Family environment. J. Home Ec. 62: 241.

Frank, G.C., Berenson, G.S., Schilling, P.E. and M.C. Moore. 1977. Adapting the 24-hr. recall for epidemiologic studies of school children. J. Am. Dietet. Assoc. 71: 26.

Fruin, M.J. and M.L. Davidson. 1978. Some considerations in the measurement of change. J. Am. Dietet. Assoc. 73 : 15.

Garton, N.B. and M.A. Bass. 1974. Food preferences and nutrition knowledge of deaf children. J. Nutr. Ed. 6: 60.

Gersovitz, M., Madden, J.P. and H. Smiciklas-Wright. 1978. Validity of the 24-hour dietary recall and seven-day record for group comparisons. J. Am. Dietet. Assoc. 73: 48.

Gronlund, N.E. 1976. "Measurement and Evaluation in Teaching," 3rd. ed., Macmillan Publishing Co., Inc., New York.

Grotkowski, M.L. and L.S. Sims. 1978. Nutritional knowledge, attitudes, and dietary practices of the elderly. J. Am. Dietet. Assoc. 72: 499.

Hankin, J.H., Reynolds, W.E. and S. Margen. 1967. A short dietary method for epidemiologic studies. II. Variability of measured nutrient intakes. Am. J. Clin. Nutr. 20: 935.

Hankin, J.H., Rawlings, V. and A. Nomura. 1978. Assessment of a short dietary method for a prospective study on cancer. Am. J. Clin. Nutr. 31: 355.

Harrison, G.G., Sanchez, A.M. and C.M. Young. 1969. Public health nurses' knowledge of nutrition. J.Am. Dietet. Assoc. 55: 133.

Health and Welfare Canada. 1976a. Report of the Committee on Diet and Cardiovascular Disease.

Health and Welfare Canada. 1976b. Dietary Standard for Canada.

Health Protection Branch. 1977a. Recommendations for Prevention Programs in Relation to Nutrition and Cardiovascular Disease. Health and Welfare Canada.

Health Protection Branch. 1977b. Nutrition Canada: Food Consumption Patterns Report. Health and Welfare Canada.

Health Services and Promotion Branch and Health Protection Branch. 1979. Nutrient Value of Some Common Foods. Health and Welfare Canada.

Helmick, S.A. 1978. Family living patterns - projections for the future. J. Nutr. Ed. 10: 155.

Hertzler, A.A. and C. Owen. 1976 . Sociologic study of food habits - a review. I. Diversity in diet and scalogram analysis. J. Am. Dietet. Assoc. 69: 377.

Hollander, M. and D.A. Wolfe. 1973. "Nonparametric Statistical Methods," p. 125. John Wiley & Sons,Inc., New York.

Huenemann, R.L. 1956. Combating food misinformation and quackery. J. Am. Dietet. Assoc. 32: 623.

Huenemann, R.L. and D. Turner. 1942. Methods of dietary investigation. J. Am. Dietet. Assoc. 18: 562.

Jalso, S.B., Burns, M.M. and J.M. Rivers. 1965. Nutritional beliefs and practices. J. Am. Dietet. Assoc. 47: 263.

Joe, V.C. 1971. Review of the internal-external control construct as a personality variable. Psych. Reports 28: 619.

Kerlinger, F.N. 1973. "Foundations of Behavioral Research," 2nd. ed., Holt, Rinehart and Winston, Inc., New York.

Kleinbaum, D.G. and L.L. Kupper. 1978. Factor analysis. In "Applied Regression Analysis and Other Multivariate Methods," pp. 376-413. Wadsworth Publishing Co., Inc., Belmont, California.

Krause, T.O. and H.M. Fox. 1977. Nutritional knowledge and attitudes of physicians. J. Am. Dietet. Assoc. 70: 607.

Krondl, M.M. and D. Lau. 1978. Food habit modification as a public health measure. Can. J. Pub. Health 69: 39.

Kuder, G.F. and M.W. Richardson. 1937. The theory of the estimation of test reliability. Psychometrika 2: 151.

Lee, D.L. 1957. Cultural factors in dietary choice. Am. J. Clin. Nutr. 5: 166.

Leventhal, H. 1973. Changing attitudes and habits to reduce risk factors in chronic disease. Am. J. Card. 31: 571.

Leverton, R.M. and A.G. Marsh. 1939. Comparison of food intakes for weekdays and for Saturday and Sunday. J. Home Ec. 31: 111.

Lindamood, D.M. and B.E. Gunning. 1977. College nonvegetarians vs. vegetarians - food habits and knowledge. J. Nutr. Ed. 9: 25. (Abstr.).

MacDiarmid, J.C. 1957. A study of food misinformation prevalent in Canada. J. Can. Dietet. Assoc. 19: 22.

MacFadyen, K.L. 1977. An assessment of the relationships among nutrition knowledge, attitudes and dietary practices of competitive swimmers in Winnipeg. M.Sc. thesis, University of Manitoba, Winnipeg, Man.

Marr, J.W. 1971. Individual dietary surveys: purposes and methods. World Rev. Nutr. Dietet. 13: 105.

Martuza, V.R. 1977. "Applying Norm-Referenced and Criterion-Referenced Measurement in Education," Allyn and Bacon, Inc., Boston, pp.122-168.

McBean, L.D. and E.W. Speckmann. 1974. Food faddism: a challenge to nutritionists and dietitians. Am. J. Clin. Nutr. 27: 1071.

McCarthy, M.E. and J.H. Sabry. 1973. Canadian university students' nutrition misconceptions. J. Nutr. Ed. 5: 193.

McHenry, E.W., Ferguson, H.P. and J. Gurland. 1945. Sources of error in dietary surveys. Can. J. Pub. Health 36: 355.

McNutt, K.W. 1977. Public understanding of nutrition - implications for education programs. Contemporary Nutrition: 2: 1. General Mills Nutrition Dept., Minneapolis.

Mead, M. 1943. The factor of food habits. The Annals of the American Academy. 225: 136.

Moore, H.B. 1957. The meaning of food. Am. J. Clin. Nutr. 5: 77.

Morgan, P.M., Demarest, L.E., Unglaub, W.G. and R.S. Hubbard. 1971. Some factors for refusal to participate in a nutrition survey. J. Nutr. Ed. winter: 103.

Morris, J.N., Marr, J.W., Heady, J.A., Mills, G.L. and T.R.E. Pilkington. 1963. Diet and plasma cholesterol in 99 bank men. Bri. Med. J. i: 571.

Morse, E.H., Clayton, M.M. and L. Cosgrove. 1967. Mothers' nutrition knowledge. J. Home Ec. 59: 667.

Murray, T.K. and J. Rae. 1978. Nutrition and heart disease - a prevention program. J. Can. Dietet. Assoc. 39: 6.

Myres, A.W. and D. Kroetsch. 1978. The influence of family income on food consumption patterns and nutrient intake in Canada. Can. J. Pub. Health 69: 208.

Nie, N.H., Hull, C.H., Jenkins, J.G., Steinbrenner, K. and D.H. Bent. 1975. "Statistical Package for the Social Sciences," 2nd ed. McGraw-Hill Book Company, New York, pp. 288-290.

Nunnally, J.C. 1967. "Psychometric Theory," McGraw-Hill Book Company, New York.

O'Hanlon, P. and M.B. Kohrs. 1978. Dietary studies of older Americans. Am. J. Clin. Nutr. 31: 1257.

Petersen, M.E. and C. Kies. 1972. Nutrition knowledge and attitudes of early elementary teachers. J. Nutr. Ed. winter: 11.

Phillips, M.G. 1971. The nutrition knowledge of medical students. J. Med. Ed. 46: 86.

Phillips, D.E., Bass, M.A. and E. Yetley. 1978. Use of food and nutrition knowledge by mothers of preschool children. J. Nutr. Ed. 10: 73.

Podell, R.N., Gary, L.R. and K. Keller. 1975. A profile of clinical nutrition knowledge among physicians and medical students. J. Med. Ed. 50: 888.

Préfontaine, M. 1975. Construction and validation of a nutrition test. J. Nutr. Ed. 7: 152.

Prociuk, T.J. and R.J. Lussier. 1975. Internal-external locus of control: an analysis and bibliography of two years of research (1973-1974). Psych. Reports 37: 1323.

Pumpian-Mindlin, E. 1954. The meanings of food. J. Am. Dietet. Assoc. 30: 576.

Rotter, J.B. 1966. Generalized expectancies for internal versus external control of reinforcement. Psychol. Monographs 80, Whole No. 609.

Rotter, J.B. 1975. Some problems and misconceptions related to the construct of internal versus external control of reinforcement. J. Consult. Clin. Psych. 43: 56.

Schafer, R.B. 1978. Factors affecting food behavior and the quality of husbands' and wives' diets. J. Am. Dietet. Assoc. 72: 138.

Schafer, R.B. 1979. The self-concept as a factor in diet selection and quality. J. Nutr. Ed. 11: 37.

Schwartz, N.E. 1975. Nutritional knowledge, attitudes, and practices of high school graduates. J. Am. Dietet. Assoc. 66: 28.

Schwartz, N.E. 1976. Nutrition knowledge, attitudes and practices of Canadian Public Health Nurses. J. Nutr. Ed. 8: 28.

Schwartz, N.E. and S.I. Barr. 1977. Mothers - their attitudes and practices in perinatal nutrition. J. Nutr. Ed. 9: 169.

Schulte, V.S.R. 1963. Relationships between the belief in food fallacies and the education attainment levels of upper-class homemakers in New York City. Diss. Abstr. 24: 723.

Selltiz, C., Wrightsman, L.S. and S.W. Cook. 1976. "Research Methods in Social Relations," 3rd. ed., pp. 160-197. Holt, Rinehart and Winston, New York.

Sims, L.S. 1976. Demographic and attitudinal correlates of nutrition knowledge. J. Nutr. Ed. 8: 122.

Sims, L.S. 1978. Dietary status of lactating women. II. Relation of nutritional knowledge and attitudes to nutrient intake. J. Am. Dietet. Assoc. 73: 147.

Sims, L.S. and P.M. Morris. 1974. Nutritional status of preschoolers. J. Am. Dietet. Assoc. 64: 492.

Stansfield, P. and H. Fox. 1977. Grocers - nutrition knowledge and attitudes. J. Nutr. Ed. 9: 69.

Steele, B.F., Franklin, R.E., Lightbody Smudski, V. and C.M. Young. 1951. Use of checked seven-day records in a dietary survey. J. Am. Dietet. Assoc. 27: 957.

Steelman, V.P. 1976. Attitudes toward food as indicators of subcultural value systems. Home Ec. Research J. 5: 21.

Suter, C.B. and H.F. Barbour. 1975. Identifying food-related values of low-income mothers. Home Ec. Research J. 3: 198.

Thompson, J. K. and N.E. Schwartz. 1977. Nutrition knowledge, attitudes and practices of eighth grade students. J. Can. Dietet. Assoc. 38: 222.

Todhunter, E.N. 1973. Food habits, food faddism and nutrition. World Rev. Nutr. Dietet. 16: 286.

Trulson, M.F. 1954. Assessment of dietary study methods. I. Comparison of methods for obtaining data for clinical work. J. Am. Dietet. Assoc. 30: 991.

Trulson, M.F. 1955. Assessment of dietary study methods. II. Variability of eating practices and determination of sample size and duration of dietary surveys. J. Am. Dietet. Assoc. 31: 797.

Vickstrom, J.A. and H.M. Fox. 1976. Nutritional knowledge and attitudes of registered nurses. J. Am. Dietet. Assoc. 68: 453.

Walter, J.P. 1973. Two poverties equal one hunger. J. Nutr. Ed. 5: 129.

Wang, V. 1971. Food information of homemakers and 4-H youths. J. Am. Dietet. Assoc. 58: 215.

Watt, B.K. and A.L. Merrill. 1963. Composition of Foods: Raw, Processed, Prepared. Agr. Res. Serv. Handbook No. 8. U.S. Government Printing Office, Washington, D.C.

Werblow, J.A., Fox, H.M., and A. Hueneman. 1978. Nutritional knowledge, attitudes, and food patterns of women athletes. J. Am. Dietet. Assoc. 73: 242.

Wilhelmy, O., Young, C.M. and H.L. Pilcher. 1950. Nutritional status survey, Groton Township, New York. III. Nutrient usage as related to certain social and economic factors. J. Am. Dietet. Assoc. 26: 868.

Wilson, M.M. and M.W. Lamb. 1968. Food beliefs as related to ecological factors in women. J. Home Ec. 60: 115.

Woolcott, D.M. 1971. An assessment of the knowledge and application of nutrition principles and their relationship to availability and use of nutrition information by homemakers in an isolated community. M. Sc. thesis, University of Manitoba, Winnipeg, Manitoba.

World Health Organization. 1973. Energy and Protein Requirements. Wld. Hlth Org. Techn. Rep. Ser., No. 522.

Youland, D.M. and A. Engle. 1976. Practices and problems in HANES. J. Amer. Dietet. Assoc. 68: 22.

Young, C.M., Chalmers, F.W., Church, H.N., Clayton, M.M., Tucker, R.E., Wertz, A.W. and W.D. Foster. 1952a. A comparison of dietary study methods. I. Dietary history vs. seven-day-record. J. Am. Dietet. Assoc. 28: 124.

Young, C.M., Hagan, G.C., Tucker, R.E. and W.D. Foster. 1952b. A comparison of dietary study methods. II. Dietary history vs. seven-day record vs. 24-hour recall. J. Am. Dietet. Assoc. 28: 218.

Young, C.M., Franklin, R.E., Foster, W.D. and B.F. Steele. 1953. Weekly variation in nutrient intake of young adults. J. Am. Dietet. Assoc. 20: 459.

Young, C.M., Waldner, B.G. and K. Berresford. 1956a. What the homemaker knows about nutrition. II. Level of nutrition knowledge. J. Am. Dietet. Assoc. 32: 218.

Young, C.M., Berresford, K. and B.G. Waldner. 1956b. What the homemaker knows about nutrition. III. Relation of knowledge to practice. J. Am. Dietet. Assoc. 32: 321.

Young, C.M. and M.F. Trulson. 1960. Methodology for dietary studies in epidemiological surveys. II. Strengths and weaknesses of existing methods. Am. J. Pub. Health 50: 803.

Yudkin, J. 1951. Dietary surveys: variation in the weekly intake of nutrients. Br. J. Nutr. 5: 177.

APPENDICES

APPENDIX A

NUTRITION QUESTIONNAIRE AND ANSWERS TO 26 ITEMS

SECTION A SELF-ADMINISTERED QUESTIONNAIRE

Introduction:

This questionnaire is part of my Master's thesis project in Community Nutrition at the University of Manitoba. The purpose of this project is to obtain a better understanding of the nutrition knowledge and eating practices of young adult males.

Your answers will be kept strictly confidential, so please do not hesitate to accurately answer all questions. Names will not be included in the data analysis.

This questionnaire consists of 2 parts. Please answer all items in both parts.

Your participation in this project is appreciated.

Thankyou.

Marlene Batt
Graduate Student
University of Manitoba
Bus. phone: 474-9554

NOTE: Part II of self-administered questionnaire is included in Appendix E

PART I

Subject Number 174

NUTRITION QUESTIONNAIRE

Instructions: Choose the BEST answer of the four answers provided.
Place a circle around the letter of the ONE best answer.
Please answer ALL questions.

Example: The Winnipeg Jets compete in the team sport:

a. baseball
(b) hockey
c. football
d. soccer
e. don't know

Please disregard this column.

1. Which of the following represents a balanced meal?

a. hamburger, coleslaw, milk
b. steak, baked potato, carrots
c. chicken, whole wheat bread, milk
d. ham, mashed potatoes, bread
e. don't know

2. A good breakfast should include fruit juice and

a. buttered toast and banana
b. buttered toast and jam
c. a cheese sandwich
d. a cake donut
e. don't know

3. The number of servings of milk and milk products that adult males should consume daily is

a. none
b. one
c. two
d. three to four
e. don't know

4. The most important cause of heart disease is

a. increased blood fats
b. high blood pressure
c. physical inactivity
d. none of the above
e. don't know

5. Which of the following is a source of complete protein?

a. peanut butter
b. cheese
c. baked beans
d. bran cereals
e. don't know

6. Which of the following statements is correct?

   a. Nutritious diets are more important for children than for adults.
   b. The amount and type of foods eaten determines the adequacy of one's diet.
   c. Nutrient intakes greater than nutrient needs are beneficial.
   d. All of the above.
   e. Don't know.

7. In which of the following groups do all components provide energy?

   a. carbohydrate, protein, fat, and alcohol
   b. fat, vitamins, and minerals
   c. carbohydrate, fat and water
   d. fat, carbohydrate, and vitamins
   e. don't know

8. Which of the following foods contain similar amounts of fat?

   a. a serving of deep fried fish and a serving of oven baked fish
   b. a scoop of ice cream and a scoop of ice milk
   c. a glass of skim milk and a glass of buttermilk
   d. a teaspoon of low-calorie margarine and a teaspoon of regular margarine
   e. don't know

9. The best snack for your health would be

   a. raisins
   b. fresh fruit
   c. ice-cream
   d. none of the above
   e. don't know

10. If you were concerned about your health, the best oil to use in salad dressings would be

   a. peanut oil
   b. coconut oil
   c. olive oil
   d. sunflower oil
   e. don't know

11. The food groups to include in your diet for good health are:

   a. sugars and starches, fats, milk and milk products, meats and meat alternatives
   b. meats and alternatives, bread and cereals, fruits and vegetables
   c. milk and milk products, meats, fruits and vegetables
   d. none of the above
   e. don't know

12. Polyunsaturated fats

a. have no effect on the body
b. are harmful to the body
c. lower blood cholesterol
d raise blood cholesterol
e. don't know

13. The amount of energy used for intellectual work is

a. enormous
b. high
c. moderate
d. negligible
e. don't know

14. In addition to protein, the other substances needed in your diet are

a. fats
b. starches
c. water
d. all of the above
e. don't know

15. If you were concerned about your health, the best fat to spread on your bread would be

a. butter
b. soft margarine
c. hard margarine
d. all of the above
e. don't know

16. In some people, high blood pressure can be controlled by eating

a. less salt
b. less carbohydrate
c. garlic and other strong vegetables
d. all of the above
e. don't know

17. Which of the following foods are good sources of Vitamin C?

a. broccoli and tomatoes
b. lettuce and green peppers
c. apples and oranges
d. none of the above
e. don't know

18. Which of the following foods contains the least amount of fat?

a. fish
b. steak
c. ground beef
d. wieners
e. don't know

19. Which of the following statements is correct?

    a. It is not recommended to snack if you eat three regular meals each day.
    b. Snack foods should be selected to help meet total daily nutrient needs.
    c. There are only a few nutritious foods available for snacks.
    d. All of the above.
    e. Don't know.

20. If you participate in sports, your diet should include

    a. a wide variety of foods
    b. more protein
    c. more sugar
    d. all of the above
    e. don't know

21. In order to eat properly every day, you should

    a. eat natural foods containing no food additives
    b. take multi-vitamin pills
    c. choose foods from all the food groups
    d. all of the above
    e. don't know

22. Fatty foods

    a. supply energy to the body.
    b. protect body organs.
    c. carry vitamins in the body.
    d. all of the above.
    e. don't know.

23. Cholesterol is

    a. a harmful substance present in blood when one has heart disease
    b. a fatty substance made by the body
    c. a protein which is deposited in the blood vessels
    d. a fatty substance found in vegetable oils
    e. don't know

24. The most common cause of weight gain in adults is

    a. weight increases with age
    b. more fat is eaten than the body uses
    c. too much carbohydrate is eaten
    d. lack of exercise
    e. don't know

25. If you were concerned about your health, which of the following would you use for pan-frying?

    a. vegetable oils
    b. margarine
    c. butter
    d. all of the above
    e. don't know

26. Which one of the following can decrease the level of fatty substances in your blood?

    a. cholestearic acid
    b. acetic acid
    c. lauric acid
    d. linoleic acid
    e. don't know

27. Carbohydrate foods

    a. supply energy to the body.
    b. interfere with the building of body tissues.
    c. increase the amount of calories stored in the body.
    d. all of the above.
    e. don't know.

28. Which of the following foods contain the <u>same</u> number of calories?

    a. a piece of cake and an apple
    b. a potato and a tomato
    c. a glass of whole milk and a glass of skim milk
    d. a teaspoon of butter and a teaspoon of margarine
    e. don't know

29. The safest way to lose weight is to

    a. eat a high protein diet
    b. drink liquid protein formulas
    c. eat a low carbohydrate diet
    d. eat less of all foods
    e. don't know

30. Which of the following statements is correct?

    a. Diets low in animal protein are associated with an increased risk of heart disease.
    b. A low carbohydrate diet is associated with a decreased risk of heart disease.
    c. The type of fat in the diet is associated with a decreased risk of heart disease.
    d. All of the above.
    e. Don't know.

Answers to Nutrition Questionnaire

1. (a) The meal consisting of the hamburger with the bun, coleslaw, and milk includes foods from all four food groups.

2. (c) Three of the four food groups are included in the breakfast consisting of fruit juice and a cheese sandwich. Only one or two food groups would be included in the other breakfasts.

3. (c) Contrary, to popular belief, adults as well as children need foods from the milk and milk products group. For adult males this is two servings.

5. (b) Cheese and other animal sources of protein contain all eight essential amino acids in the proportions required by the body for growth and maintenance. They are, therefore, sources of complete protein. The other foods which are vegetable sources of protein are lacking in or have lesser amounts of these amino acids. However, more than one vegetable protein can be combined to form a good source of amino acids.

6. (b) A variety of foods from all four food groups should be eaten to provide all nutrients in the amounts recommended. Some foods are better sources of certain nutrients than others.

7. (a) The amounts of energy provided by the following four components on a one gram basis are: carbohydrate - 4 kcal; protein - 4 kcal; fat - 9 kcal; and alcohol - 7 kcal. Vitamins, minerals and water do not provide energy.

8. (c) Buttermilk is cultured low fat milk and therefore has a similar amount of fat as skim milk. Deep fried fish is immersed in fat during cooking; oven baked fish is not. Ice cream has approximately twice as much fat as ice milk, however both provide similar amounts of food energy. Low calorie margarine has water added and thus less fat than regular margarine.

10. (d) Sunflower oil is a better source of the polyunsaturated fatty acid, linoleic acid, which is necessary in the diet.

11. (d) The four food groups are: milk and milk products, meat and alternates, fruits and vegetables, and bread and cereals.

12. (c) Research utilizing human subjects has shown that polyunsaturated fats have a cholesterol lowering effect in the blood.

13. (d) Contrary to popular belief, a negligible amount of energy is used for intellectual as compared to mechanical work.

14. (d) Protein is used to build and repair body tissues; fat supplies energy and aids in the absorption of fat soluble vitamins; carbohydrate supplies energy and assists in the utilization of fats; and water has several important functions in the body, for example temperature regulation.

15. (b) Soft margarine which is often purchased in plastic tubs contains more polyunsaturated fatty acids than butter or hard margarine.

16. (a) Epidemiological studies have shown that populations with low salt intakes have experienced a lower incidence of high blood pressure. The reduction of one's salt intake is a preventative measure towards high blood pressure.

17. (a) Broccoli and tomatoes are both good sources of Vitamin C. Data on the Vitamin C content of the foods listed is as follows:

1 stalk broccoli - 162 mg	2 large leaves lettuce - 9 mg
1 pod green pepper - 94 mg	1 medium-sized apple - 3 mg
1 medium-sized tomato - 34 mg	1 medium-sized orange - 66 mg

The recommended daily intake of Vitamin C for adults is 30 mg.

19. (b) Nutrient dense snack foods which contain a high proportion of nutrients in relation to the amount of energy provided can play an important part in meeting your body's nutrient needs if they are chosen wisely from the four food groups. Both nutritionally and dentally acceptable foods should be chosen for snacks.

20. (a) A wide variety of foods from the four food groups should be eaten in order to meet the body's nutrient requirements. Contrary to popular belief, more protein is not necessary. Energy is an important consideration for the athlete. Carbohydrate is a good choice to develop carbohydrate stores in the body.

21. (c) A variety of foods chosen from all four food groups and eaten in the required amounts will supply an adequate amount of all nutrients for most people. Certain food additives are used to fortify some food products. Specific vitamins or minerals should only be taken when a variety of foods from the four food groups is not eaten. In this latter case the diet may be deficient in certain nutrients.

22. (d) Fat functions in all three ways in the body.

23. (b) Cholesterol is a fatty substance made and used by both humans and animals. It is present in animal fat but not vegetable oils. There are normal physiological levels of cholesterol in the blood.

24. (d) Lack of exercise is the most common cause of weight gain in adults. The other alternatives are not entirely correct. It has been shown that caloric intake is not excessive in a segment of overweight persons. The caloric need for sedentary activity is lower than for higher levels of activity.

26. (d) Linoleic acid has a tendency to lower blood cholesterol levels. Acetic acid is vinegar. Lauric acid is not a polyunsaturated fatty acid. Cholestearic acid is not a fatty acid at all.

27. (a) Carbohydrate foods play an important role in providing energy to the body. The other two alternatives are false.

28. (d) Butter and margarine have the same percentage of fat and moisture and provide the same amount of calories. One tablespoon of each fat spread provides 100 kcal. The composition of the other foods listed is different.

29. (d) By eating less food, less total calories is consumed. A decrease in caloric intake of 500 kcal per day can lead to a weight loss of one pound in one week (3500 kcal).

30. (c) Saturated dietary fat is an important dietary component when one considers the risks of developing coronary heart disease. Diets high in saturated fats are associated with high levels of blood cholesterol and an increased risk of a heart attack. The fat in meat, butter, cheese, cream, whole milk, chocolate, powdered coffee creamers and many hydrogenated cooking fats are predominantly saturated.

APPENDIX B

RECOMMENDATIONS FOR PREVENTION PROGRAMS IN RELATION TO NUTRITION AND CARDIOVASCULAR DISEASE

RECOMMENDATIONS
FOR PREVENTION PROGRAMS
IN RELATION TO
NUTRITION AND CARDIOVASCULAR DISEASE

Source: Recommendations of the Committee on Diet and Cardiovascular Disease, as amended and adopted by Department of National Health and Welfare, June, 1977.

Bureau of Nutritional Sciences,
Health Protection Branch,
Department of National Health and Welfare

2/11/77

RECOMMENDATIONS FOR PREVENTION PROGRAMS IN RELATION TO NUTRITION AND CARDIOVASCULAR DISEASE

The evidence concerning the relationship between diet and cardiovascular disease has been reviewed by a special expert Committee established in 1973. The Report of this Committee was presented to the Minister of National Health and Welfare for study. As a result, the background documentation was accepted but several of the recommendations were amended for feasibility in implementation.

Canadians enjoy one of the highest standards of living in the world and life expectancy from birth of 69.3 years for men and 76 for women, which is similar to that of other Western nations and higher than that of less industrialized nations. However, in Canada, 50% of all deaths are related to atherosclerosis. This condition occurs not only in old age, but also affects significant numbers of Canadians in middle age. About one third of all deaths among people under age 65 are attributed to atherosclerosis. The risk factors usually associated with cardiovascular disease (elevated blood lipids, high blood pressure, smoking and diabetes) and those factors less closely associated (obesity, lack of physical fitness and immoderate alcohol consumption) suggest that cardiovascular disease is amendable to preventive action.

The dietary recommendations amended and adopted by the Department of National Health and Welfare, were designed to help in educating the public to select an appropriate diet, and thereby to take some responsibility for promoting personal health.

Canadians are advised to follow Canada's Food Guide and to avoid foods which provide calories without essential vitamins and minerals. They are advised also to practice moderation in the use of foods and beverages which tend to elevate blood fats. Evidence is mounting that dietary cholesterol may not be important to the great majority of people and that severe restrictions of cholesterol need only be applied to those genetically disposed toward hypercholesterolemia. Thus, a diet restricted in cholesterol would not be necessary for the general population. A recommendation to emphasize linoleic acid was adopted because linoleic acid is the polyunsaturated fatty acid which is involved in the control of serum cholesterol levels. Sources of dietary linoleic acid include salad and cooking oils made from safflower, sunflower, corn, cottonseed, soybean and peanut.

These recommendations should not be considered as a replacement for specific or therapeutic diets prescribed by a physician for treatment of a particular disease or condition. Rather, the recommendations are geared to preventive measures and programs for whole communities and populations.

RECOMMENDATIONS IN RELATION TO NUTRITION AND CARDIOVASCULAR DISEASE

1. Summary of Dietary Recommendations

a) The consumption of a nutritionally adequate diet, as outlined in Canada's Food Guide.

b) A reduction in calories from fat to 35% of total calories. Include a source of polyunsaturated fatty acid (linoleic acid) in the diet.

c) The consumption of a diet which emphasizes whole grain products and fruits and vegetables and minimizes alcohol, salt and refined sugars.

d) The prevention and control of obesity through reducing excess consumption of calories and increasing physical activity. Precautions should be taken that no deficiency of vitamins and minerals occurs when total calories are reduced.

11. Summary of Recommendations for Action by Government and the Food Industry

a) Active and continuous promotion of the recommendations for dietary changes.

b) The development and production of food products consistent with the above dietary recommendations and clearly labelled for adequate consumer information.

c) Encouragement and support for (i) research on the relationship of nutrition, environment, and life-style factors to cardiovascular disease, (ii) research directed at the most effective methods for dispersing essential knowledge to all citizens, (iii) increased research on, and production of, primary agriculture products for development of food items consistent with dietary recommendations.

Source: Recommendations of the Committee on Diet and Cardiovascular Disease as amended and adopted by Department of National Health and Welfare, June, 1977.

GUIDELINES FOR FOLLOWING DIETARY RECOMMENDATIONS FOR PREVENTION PROGRAMS

Canadians should observe the following:

a) consume a nutritionally adequate diet, as outlined in Canada's Food Guide.

b) avoid overweight through appropriate food selection and increased physical activity.

c) limit the total amount of fat, sugar, salt and alcohol in the diet.

d) increase intake of vegetables, fruits, and wholegrain cereals, and include sources of polyunsaturated fatty acid (linoleic acid).

GUIDELINES

Follow Canada's Food Guide, noting:

- no more than 35% of total calories as fat, including a source of polyunsaturated fatty acid (linoleic acid)
- at least 50% of calories as carbohydrate, reducing the intake of sugar and replacing with starches
- a reduction in the intake of salt.

To control calories

- limit intake of high caloric, high fat desserts such as pies, cookies, cakes and ice cream
- limit intake of high caloric snack foods such as potato chips, other deep-fried snacks, chocolate and other candies, and soft drinks
- limit intake of all forms of alcohol (spirits, wine and beer are high in calories). Do not use daily.

To control the amount and type of fat

- choose lean cuts of meat, trim off visible fat, discard fat which cooks out of meat and avoid gravy
- use fish or poultry at least four times a week for either of the two main meals
- avoid foods which are deep-fried
- use cooking methods which help to remove fat such as baking, broiling, boiling
- limit intake of cooking fats and oils and table fats; in any product replacement, choose those with a high content of polyunsaturated fatty acid (linoleic acid).
- avoid excessive use of high fat dairy products such as cream, cream cheese, ice cream, and use those with a lower fat content such as skim or 2% milk, cottage cheese and yoghurt.

To control salt

- reduce intake of salty foods
- limit the use of salt in cooking and at the table.

e: The above recommendations do not apply to infants, or to patients on therapeutic diets. Growing persons, pregnant women, nursing mothers, elderly and infirm persons should be particularly careful in their selection of foods to include essential nutrients. In growing children, caloric intake should be sufficient to ensure adequate growth.

APPENDIX C

DOCUMENTS USED TO PROCURE SAMPLE

Master's Thesis Project

Overall Objective:

To assess the influence of nutrition knowledge on food-related behaviors of young adult males employed in sedentary occupations.

Target Group:

Adult males of the ages 25-35 employed in sedentary occupations.

Research Instruments to be Employed:

1. Diary for recording food intake for 3 days.
2. Nutrition questionnaire consisting of 30 multiple choice items.
3. Personality scale containing 29 forced-choice items related to internal or external control of reinforcement.
4. Biographical and descriptive data to be obtained by using open-ended questions in a personal interview.

General Outline of Project:

Two interviews per subject will be conducted. Estimated time involvement for both interviews is 1 hour 30 minutes as indicated:

Interview	Brief Description of Interview	Time (minutes)	
I	- explanation of study	5	
	- instruction on the use of the food record	25	
	Subtotal =		30
II (to be held one week later)	- self-administered nutrition questionnaire	15	
	- self-administered internal-external control scale	10	
	- personal interview to obtain biographical data	15	
	- collection of food record	20	
	Subtotal =		60
	TOTAL =	1 hr.	30 min.

Location of Interviews: on company premises.

Scheduling: subjects' spare time - during lunch hours
- after working hours

Costs to be Incurred:

company: facilities - room set aside in which to conduct interviews

subjects: time - 1 1/2 hours of spare time at work
- required to record food intake for 3 days

researcher: time, skills, materials -- all research instruments will be provided.
- nutrition instruction will be available to subjects on request at the conclusion of the study.

Perceived Benefits:

For company:

For subjects: -opportunity to participate in a research project
-nutrition instruction available at the conclusion of the study.

For researcher: -opportunity to complete the requirements for the Masters of Science Degree in Community Nutrition, University of Manitoba.

Confidentiality:-names will not appear on any of the forms.
-confidentiality will be maintained by a code number on the forms.

THE UNIVERSITY OF MANITOBA
FACULTY OF HOME ECONOMICS
WINNIPEG, CANADA R3T 2N2
TELEPHONE 204
DEPARTMENT OF FOODS AND NUTRITION

Hi!

I am a graduate student in Community Nutrition at the University of Manitoba and presently I am working towards the Master of Science degree.

I am asking for your assistance with my thesis project which concerns the nutrition knowledge and eating practices of young adult males. There is little research in either Canada or the United States on the nutrition knowledge and eating practices of your population group. Therefore, my project is an attempt to gain a better understanding of these two variables.

Those persons who agree to participate in this project will be asked to complete the following:

1) a 30-item multiple choice nutrition test
2) a 29-item personality test
3) a 3-day food record

There will be two personal interviews. The time for the first interview will be 30 minutes; the second interview one week later will last 1 hour.

Personal nutrition instruction and information will be available free of charge for the participants at the conclusion of the project. A summary of the results can be made available to those interested participants.

I hope that you will be able to attend a meeting in which I can answer any of your questions that may affect your decision to participate in this project. Gary Wilton will be contacting you regarding the date and time of this meeting.

I will be looking forward to meeting with you.

Marlene Batt

Graduate Student

Subject Number _____

CONSENT FORM

The purpose of this project is to obtain a better understanding of the nutrition knowledge and eating practices of young adult males.

If you agree to participate in this project you will be required to complete the following:

1) a 3-day food record.
2) a 30 item multiple choice nutrition test
3) a 29 item personality test
4) a 13 item questionnaire requesting biographical and food habit information

A first interview (approximately 30 minutes) will be held in which you will receive instruction on how to record your food intake for three days. A second interview (approximately 1 hour) will follow one week later in which the food record will be collected and you will be required to fill out the questionnaires.

Names will not be included on any forms or in the data analysis. Identification of the personal data will only be available to the researchers.

I, _____ have had the project explained to me and agree to participate.

Signature: _____

Date: _____

If you have agreed to participate, please complete the following:

You have been given the following scale from 1 to 10 in order that you can evaluate yourself according to how much nutrition knowledge you think you have.

1 2 3 4 5 6 7 8 9 10

1 = no nutrition knowledge

10 = as much nutrition knowledge as professionals

Select the number that corresponds to your nutrition knowledge. Place the number in the space provided below.

My "Self-Evaluation of Nutrition Knowledge" number is (_____).

APPENDIX D

SAMPLE PAGES FROM THREE-DAY FOOD RECORD

DIRECTIONS FOR FOOD RECORD

The purpose of this study is to determine the eating practices of young adult males.

It is important that you record ALL foods and beverages -- from a full course dinner at home to a quick cup of coffee at work.

Before you begin to record in this booklet, please read the following directions and examine closely the sample day.

1

There is a section for each of the three days to be recorded.

Include 2 weekdays and 1 Saturday or 1 Sunday.

The day is broken into 6 consumption periods:
- morning meals
- midmorning snack
- midday meal
- afternoon snack
- evening meal
- evening snack

Write down in detail all food and drink taken each day for three days, including everything consumed away from home - at work, at a restaurant, or when visiting friends. It is important that you record your entries as soon as possible after eating.

Do not change your eating patterns during the course of the recording.

2

SAMPLE DAY *See last page of this record for suggested ways of measuring foods in the diet.

	Menu Item plus Additions or toppings	Amount	Method of Cooking	Description - Size - Flavor etc.
MORNING MEAL	Orange juice	6 oz.	—	frozen, reconstituted 3:1
	cake doughnuts	2	—	3 1/4" diam. 1" high
	coffee	1 cup	-	6 fld. oz.
	sugar	1 tsp	-	-
	cream	1 tsp	-	half 'n' half
	Multi-vitamin	1	-	One-A-Day

Location: at home

3

MIDMORNING SNACK				

Do not feel that you have to eat 6 times a day. Do not change your existing pattern of eating. If you never eat the morning meal, midday meal, etc. write "did not eat" in the space beside "Location".

Location: 4

	Menu Item plus Additions or toppings	Amount	Method of Cooking	Description - Size - Flavor etc.
MIDDAY MEAL	Ham & lettuce sandwich			
	-ham	1 oz.	-	cooked
	-bread	2 slices	toasted	rye
	-lettuce	1 leaf	-	5"x4 1/2"
	-butter	2 tsp	-	-
	-mustard	1 tsp	-	yellow, prepared
	Milk	1 cup	-	whole
	Banana	1	-	fresh, medium, 8 3/4" long

Location: at work 5

AFTERNOON SNACK	Danish pastry	1 piece	-	6 1/2" long, 2 3/4" wide, 3/4" high
	Chocolate drink	1 cup	-	made with whole milk
	French fries	20 sticks	deep fried	3 1/2" - 4" long
	Ketchup	1 packet	-	tomato, 1/2 oz. packet
	Vinegar	1 Tbsp	-	-

Location: at work 6

	Menu Item plus Additions or toppings	Amount	Method of Cooking	Description - Size - Flavor
EVENING MEAL	Fried Chicken	1 thigh	fried	—
		1 breast		
	Baked potato	1	baked	skins not eaten, 2 1/3" diam 4" long
	Sour Cream	2 Tbsp	—	—
	Dry red table wine	1 glass	—	wine glass (3 1/2 oz.)
	Apple pie	1 sector	-	3 1/2" arc ; 1/8 of 9" pie
	Vanilla ice-cream	1 slice	-	4 fld oz ; 1/8 of qt.

Location: at home 7

EVENING SNACK	Combination Pizza	4 sectors	baked	5 1/3" arcs ; 1/2 of 14" pizza
	-cheese			
	-salami			
	-green peppers			
	-onions			
	Parmesan cheese	1/2 Tbsp	-	grated
	Beer	2-12 oz bottles	-	"Coolspring" (lo-cal)
	Pretzels	10	-	pieces 3 1/8" long, 1/8" diam.

Location: at a restaurant 8

SAMPLE

* SUGGESTED WAY OF MEASURING FOODS IN THE DIET

FOOD	DESCRIPTION	MEASURE
milk, etc.	-whole, 2%, skim -in tea, coffee, on cereal	ounces, tablespoons(T.) 250 ml containers
cereals	-dry, cooked, presweetened	tablespoons(T.) or cups
potatoes	-mashed, boiled, fried, chips	cups, include dimensions, number
sugar	-in tea, coffee, on cereal	tablespoons(T.) or teaspoons(tsp.)
biscuits, buns rolls	-type: dinner, crusty, whole wheat, Danish	number and dimensions

37

condiments	-jam, jelly, peanut butter, mustard	teaspoons(tsp.)
meat	-type, method of cooking	slice, piece, ounce
fruit	-type: canned, fresh frozen	number and dimensions, cups
sweets	-type: chocolate, caramels, marshmallow, almond, etc.	number and cost or dimensions
beverages	-type: dry wine, rose, sweet, etc.	ounces

38

APPENDIX E

PERSONALITY TEST

Subject Number: _____

PART II

Instructions:

This is a questionnaire to find out the way in which certain important events in our society affect different people.

Each item consists of a pair of alternatives lettered 'a' or 'b'. Please select the ONE statement of each pair (and only one) which you more strongly BELIEVE to be the case as far as you're concerned.

Be sure to select the one you actually BELIEVE to be more true rather than the one you think you should choose or the one you would like to be true.

This is a matter of personal belief: obviously there are no right or wrong answers.

Please answer all items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice.

In some instances you may discover that you believe both statements or neither one. In such cases, be sure to select the ONE you more strongly believe to be the case as far as you're concerned. Also try to respond to each item INDEPENDENTLY when making your choice; do not be influenced by your previous choices.

PLACE A CIRCLE AROUND THE LETTER OF YOUR CHOICE.

1. a. Children get into trouble because their parents punish them too much.
   b. The trouble with most children nowadays is that their parents are too easy with them.

2. a. Many of the unhappy things in people's lives are partly due to bad luck.
   b. People's misfortunes result from the mistakes they make.

3. a. One of the major reasons why we have wars is because people don't take enough interest in politics.
   b. There will always be wars, no matter how hard people try to prevent them.

4. a. In the long run people get the respect they deserve in this world.
   b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

5. a. The idea that teachers are unfair to students is nonsense.
   b. Most students don't realize the extent to which their grades are influenced by accidental happenings.

6. a. Without the right breaks one cannot be an effective leader.
   b. Capable people who fail to become leaders have not taken advantage of their opportunities.

7. a. No matter how hard you try some people just don't like you.
   b. People who can't get others to like them don't understand how to get along with others.

8. a. Heredity plays the major role in determining one's personality.
   b. It is one's experiences in life which determine what they're like.

9. a. I have often found that what is going to happen will happen.
   b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

10. a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.
    b. Many times exam questions tend to be so unrelated to course work that studying is really useless.

11. a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.
    b. Getting a good job depends mainly on being in the right place at the right time.

12. a. The average citizen can have an influence in government decisions.
    b. This world is run by the few people in power, and there is not much the little guy can do about it.

13. a. When I make plans, I am almost certain that I can make them work.
    b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

14. a. There are certain people who are just no good.
    b. There is some good in everybody.

15. a. In my case getting what I want has little or nothing to do with luck.
    b. Many times we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
    b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
    b. By taking an active part in political and social affairs the people can control world events.

18. a. Most people don't realize the extent to which their lives are controlled by accidental happenings.
    b. There really is no such thing as "luck".

19. a. One should always be willing to admit mistakes.
    b. It is usually best to cover up one's mistakes.

20. a. It is hard to know whether or not a person really likes you.
    b. How many friends you have depends upon how nice a person you are.

21. a. In the long run the bad things that happen to us are balanced by the good ones.
    b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.

22. a. With enough effort we can wipe out political corruption.
    b. It is difficult for people to have much control over the things politicians do in office.

23. a. Sometimes I can't understand how teachers arrive at the grades they give.
    b. There is a direct connection between how hard I study and the grades I get.

24. a. A good leader expects people to decide for themselves what they should do.
    b. A good leader makes it clear to everybody what their jobs are.

25. a. Many times I feel that I have little influence over the things that happen to me.
    b. It is impossible for me to believe that chance or luck plays an important role in my life.

26. a. People are lonely because they don't try to be friendly.
    b. There's not much use in trying too hard to please people, if they like you, they like you.

27. a. There is too much emphasis on athletics in high school.
    b. Team sports are an excellent way to build character.

28. a. What happens to me is my own doing.
    b. Sometimes I feel that I don't have enough control over the direction my life is taking.

29. a. Most of the time I can't understand why politicians behave the way they do.
    b. In the long run the people are responsible for bad government on a national as well as on a local level.

APPENDIX F

BIOGRAPHICAL AND FOOD HABIT QUESTIONNAIRE

SECTION B PERSONAL INTERVIEW Subject Number 201

Instructions for Interviewer:

You are required to ask several questions both open- and closed-ended to each of your subjects. In some cases you will have to present a card to the subject. This is done to ease the tension that could be associated with some questions or to facilitate the answering of certain questions.

Your instructions for each question are typed in capital letters or are included in parenthesis ( ).

Do not show or read the alternatives to the subject, unless indicated, since this defeats the purpose of the open-ended method of questioning.

---

1. ASK: Are you presently on a special diet? (Check ONE.)

( ) yes; if yes ASK question 2 and continue
( ) no; if no, proceed to question 3 and continue to ask questions.

2. (If subject answered "yes" to question 1) ASK: What type of special diet are you on. (Check as many as apply.)

( ) weight loss diet; specify type _____

_____

( ) diet for an illness; specify _____

_____

( ) diet for an allergy; specify foods allergic to _____

_____

( ) other; specify _____

3. ASK: What is the highest level of formal education you now have? (Check ONE.)

( ) grade 0-9
( ) grade 10-11
( ) completed high school
( ) university courses and/or vocational training

4. ASK: Have you ever had instruction in nutrition at school, at work, or at some other location? (Check ONE.)

( ) yes; if yes, ASK questions 5 and 6 and continue.
( ) no; if no, proceed to question 7 and continue to ask questions.

5. (If subject answered "yes" to question 4) ASK: Where did you receive this nutrition instruction? (Check as many as apply.)

( ) elementary, junior or senior high school (If this is the only response given proceed to question 7 and continue.)

( ) university
( ) company-sponsored course
( ) adult or continuing education classes
( ) expectant parent's classes
( ) other; specify _____

6. (If subject received instruction outside of elementary, junior, or senior high school)

ASK: How many hours did this nutrition instruction continue? (Check ONE.)

( ) 1-5
( ) 6-10
( ) 11-15
( ) 16-20
( ) 21+
( ) do not know

7. ASK: What is your ONE most used human source of information for questions about foods or nutrition? (Check ONE.)

( ) wife
( ) mother
( ) friends or relatives (not in the following categories)
( ) personnel in health food, grocery, or drug stores
( ) physician or nurse
( ) dietitian, nutritionist, or home economist
( ) have not consulted any human sources of nutrition information
( ) other; specify _____

8. ASK: What is your ONE most used printed source of information for questions about foods or nutrition? (Check ONE.)

( ) Adelle Davis type books
( ) cookbooks and popular pocket books (besides Adelle Davis types)
( ) government publications
( ) newspapers and popular magazines
( ) health food store literature
( ) scientific books and journals
( ) have not used any printed sources of nutrition information
( ) other; specify _____

9. STATE: I am going to give you a card which has statements regarding one's role in meal planning and/or preparation. You will be asked to select the statement which best describes your role.

SHOW: CARD (9)

ASK: Which statement best describes your present role in meal planning and/or preparation? (Check ONE response below.)

a. ( ) sole planner and/or preparer of meals on a regular basis
b. ( ) sole planner and/or preparer of meals on an occasional basis
c. ( ) share responsibilities with other person(s)
d. ( ) no involvement in meal planning and/or preparation

10. STATE: I am going to give you a scale which extends from 1 which means "no influence on food choices" to 10 which means "a great deal of influence" on food choices.

I am going to read to you a list of influences on a person's food choices. After I read each item to you, you are required to score the item from 1 to 10 according to the scale. If the item is not applicable to you, state "N/A".

SHUFFLE: Shuffle the deck of cards which specify the influences on a person's food choices. This insures a random order of presentation.

SHOW: RATING SCALE CARD (10)

ASK: Considering the scale from 1 to 10 that I have just given to you, how much influence does (first influence) have on your food choices?

(Continue to ask this question until you have asked about all influences in the shuffled order.)

RECORD: Place the number of the rating in the space before each item. If an item is not applicable to the subject, write (N/A) in the space.

( ) personal preference
( ) personal health
( ) health of other household members
( ) wife's preference
( ) children's preference
( ) opinions of other relatives
( ) opinions of friends
( ) cost
( ) nutrition knowledge
( ) mass media - newspapers, T.V., advertisements
( ) convenience or habit
( ) taste or appearance of food
( ) weight control
( ) availability

1.

STATE: You will be given a card which concerns how often a person eats a particular food item. This frequency extends from "2-3 times a day" to "never eaten".

I am going to read to you a list of foods. After I read the name of each food to you, state the letter which corresponds to the frequency with which you eat the item.

SHOW: FREQUENCY OF CONSUMPTION CARD (11)

ASK: "How often do you eat (doughnuts or other deep fried breadstuffs)?

(Continue to ask this question until you have asked about all the foods on the list below.)

RECORD: Place the letter of the frequency in the space before each item.

KEY

3 times a day
ce a day
6 times a week
ce a week
2 times a month
less often
ver eaten

( ) doughnuts or other deep fried breadstuffs
( ) pastry including pies and Danish etc.
( ) potato chips, any flavor
( ) gravy
( ) cream in beverages, or on cereals, whipped, cream puffs etc.
( ) whole milk
( ) french fries, onion rings
( ) beer and alcoholic beverages
( ) cream cheese
( ) ice cream
( ) fried meats, fish, poultry or eggs
( ) butter
( ) salted chips, pretzels, peanuts, nuts

12. STATE: I am going to give you a card which contains statements regarding one's use of salt.

SHOW: CARD (12)

ASK: Which of the statements best describes your use of salt? (Check ONE response below.)

a. ( ) salt food at the table before tasting food
b. ( ) never use salt in food preparation or at the table
c. ( ) only add salt to food at the table if it is needed

ASK: What foods or supplements do you make a point of including in your diet.

STATE: This includes all foods, vitamin or mineral supplements, special food pills etc. (after subject states a particular item....)

ASK: Why do you include (item stated) in your diet?

RECORD: Record each item and the corresponding reason in the chart below. Write N/A if no items are stated by the subject.

m	Reasons

END

Please check that you have asked ALL questions and have checked off a response to each question. Thank subject again for his co-operation.

APPENDIX G

DOCUMENTS USED IN TRAINING SESSION FOR DIETARY INTERVIEWERS

APPOINTMENT SCHEDULE: INTERVIEW II

Interviewer's Initials _____

MONDAY November 27		TUESDAY November 28		WEDNESDAY November 29		THURSDAY November 30		FRIDAY December 1	
Time	Subject Number	Time	Subject Number	Time	Subject Number	Time	Subject Number	Time	Subject Number

December 4	December 5	December 6	December 7	December 8

Date: November 16, 1978 Time: 12:40-2:30 p.m. TRAINING SESSION Project Co-ordinator: Marlene Batt

Topic Covered	Objective	Instructor's Role	Trainee's Role	Props	Time(min
Purpose of project explained in general terms	To inform the interviewers about the purpose of the project	Explain the project	Listen Ask questions		5
Validity and reliability of research projects	To emphasize the need for validity and reliability in research projects To stress the importance of these concepts to the project to be undertaken	Explain in general what steps have been taken in developing the following instruments 1.Nutrition Questionnaire 2.Personality test 3.Biographical/Food Habit Questionnaire 4.Food Record Show each instrument briefly	Listen Look at the general format of the instuments Ask questions	Samples of the following: Nutrition Questionnaire, Personality Test, Biographical & Food Habit Questionnaire, Food Record. (completed beforehand)	10
General format of interviews	To familiarize the interviewers with the general format of the interviews	Cover format briefly while showing manual	Listen Look over Manual	Interviewer Manual	15
Interview I Role playing situation on the: 1.improper method 2.desired method of conducting the interview	To cover the specific details of Interview I To instruct as to the proper way of conducting the interview	Role-playing incident	Watch	Interviewer Manual Forms for Interview I Person to play role of interviewee	10
Interview II Role playing (as above)	(as above but for Interview II)	(as above)	Watch	(as above but for Interview II)	15
					10 break
Discussion of the preceding role playing incidents	To re-emphasize the concepts covered. To obtain feedback from the trainees	Lead discussion Answer questions	ASK questions Comment on interview procedures	Completed questionnaire Interviewer Quidelines	15
Collection of intake data with the 3-day Food Record.	To instruct on the correct methods of obtaining intake data with a 3-day Food Record	Instruct on the use of the Food Record	Check over Food Record Make notes	Food Record	20
General discussion and practice sessions	To cover any remaining issues	Lead Discussion and Practice Session	ASK questions	Interviewer Manual	10
				Total time:	1 hr.50

Interviewer Guidelines

ood Record

- food and beverages include "everything taken into the mouth and swallowed" except water (unless something is added to the water)
- check that Food Record number corresponds with Subject Number and write down the dates of the 3 days (Thurs. Nov. 23, Fri. Nov. 24 and Sat. Nov. 25)
- go over directions and sample day with subject
- for questions regarding the best way to record menu items, consult Agriculture Handbook No. 456 or project co-ordinator
- emphasize that if subject has trouble estimating sizes, have him at least record the item and you will help him in the second interview

elf-Administered Questionnaire (Section A)

Part I: Nutrition Questionnaire

- stress that there is ONE BEST answer to all questions
- emphasize that if subject does not know the answer, he should circle the "don't know" alternative rather than try to guess
- ALL questions are to be answered.

Part II: Personality Test

- instruct subject to read the instructions carefully
- subject is not to spend too much time answering this questionnaire
- ALL questions are to be answered.

ersonal Interview (Section B) Biographical and Food Habit Questionnaire

- an open-ended format is used in several questions
- DO NOT read the answers listed on the questionnaire since this defeats the purpose of the open-ended method of questionning
- after subject has given a response, check off or write in the letter of the appropriate alternative listed; if one is not listed, write in subject's response in space provided
- show cards: questions 9, 10, 11, 12
- shuffle cards listing influences on food choices for question 10
- specific questions: question 6: make sure the hours of nutrition instruction received in school are not considered

  questions 7, 8: make sure subject does not see alternatives listed

  question 13: record everything stated by subject even if this includes common foods like cheese, milk, vegetables etc.

- ALL questions are to be asked and answered.

Interview I Checklist

_____ Check that you have enough pre-coded forms for all subjects in your group

_____ Explain the purpose of the study in general terms. (Stress that only seriously interested subjects are wanted in the project).

_____ Check to see if they will be away at the Grey Cup since this will interfere with the Food Record.

_____ Obtain written consent (Consent Forms enclosed) and have "Self-Evaluation of Nutrition Knowledge" completed.

_____ Check to insure that you have the correct pre-coded forms and Food Record according to the subject number on Consent Form.

_____ Introduce Food Record to all subjects in your group.

_____ Note significance of study, confidentiality, the need to retain normal patterns and the need for immediacy of recordings. (We are not here to evaluate their food habits.) Begin the explanation with the Sample Day.

_____ Clarity of entry ... exactly what it is, ie., lean meat versus fat on, whole milk versus 2% etc.

_____ Accuracy of meal... include all items and additions of actual amounts eaten.

_____ Practice estimating ..

_____ Method ... draw to estimate and measure

_____ Importance of special menu items. Note special ingredients under "Notes" at end of each day.

_____ Write in dates of the 3 days to be recorded.

_____ Re-emphasize absolute need for usual patterns and accuracy.

_____ Inclusion of vitamin supplements by brand and dose.

_____ Confirm next interview on calendar for time and day next week after 3 days of recording. Record this date on Food Record.

_____ When subjects have left, complete Subject Code Sheet data for Interview I.

Forms: Interview I (Group)

(NOTE: Have enough pre-coded forms for all subjects in your group.)

Interview I Checklist

Subject Code Sheet

Consent Form

Food Record

General Format: Interview I

Time: 30 min.

1. Re-state purpose in general terms.
2. Obtain written consent.
3. Completion of "Self-Evaluation of Nutrition Knowledge" (on bottom half of Consent Form).
4. Food Record instruction.
5. Arrange next interview.

Subject Number 212

Interview II Checklist

_____ Check that you have the correctly coded forms.

_____ Have subject complete Nutrition Questionnaire and Personality Test.

_____ At the same time look through Food Record.

_____ Ask Biographical and Food Habit questions.

_____ Check Food Record for completeness: alcohol .... mix, salad...dressings, bread...butter, meat/chips.....gravy, hamburger.... condiments, etc.

_____ Vitamin pills, brand and dosage.

_____ Special food items - specific ingredients recorded under "Notes".

_____ Re. several items - question how much? how often? how many? extra serving?

_____ Check realism of portion sizes. (Don't be surprised at unusual sizes!)

_____ Cross check Food Record with Food Habit questions - frequency of foods and special health foods listed.

_____ Re-check to see if subject numbers of all forms used correspond.

_____ When subject has left, complete Subject Code Sheet data for Interview II.

_____ Collect together all forms for both interviews for each subject number.

Forms: Interview II (Personal)

(NOTE: Have enough pre-coded forms for all subjects to be interviewed that day.)

Interview II Checklist

Subject Code Sheet

Nutrition Questionnaire (Part I of Section A)

Personality Test (Part II of Section A)

Biographical and Food Habit Questionnaire (Section B, Personal Interview)

4 Index Cards (9, 10, 11, 12) for Personal Interview

14 Index Cards for question 10 regarding influences on food choices

General Format: Interview II

Time: 1 hr.

1. Have subject complete Nutrition Questionnaire and Personality Test.
2. At the same time, glance through Food Record.
3. Ask Biographical and Food Habit questions.
4. Check over Food Record for completeness.
5. Cross check Food Record with Food Habit information.
6. Make subjective evaluation of data collected (check appropriate box on Subject Code Sheet) and make sure all forms have been coded with the correct subject number.

Subject Number 214

Interviewer's Initials _____

Subject Code Sheet

Interview I

"Self-Evaluation of Nutrition Knowledge" number ( )
(Record number of rating.)

Arrangements for Interview II: Date _____

Time _____

Amount of time spent on Interview I: _____(min., hr.)

Interview II

Impression of subject data. Check ONE.

Include ( )
Questionable( )
Discard ( )

Subject requested results. Check ONE.

Yes ( )
No ( )

Subject requested nutrition instruction. Check ONE.

Yes ( )
No ( )

Amount of time spent on Interview II: _____ (min., hr.)

APPENDIX H

NUTRIENT DATA FROM THREE-DAY FOOD RECORDS

TABLE 1

PERCENT CONTRIBUTION OF 9 FOOD GROUPS TO THE ENERGY AND NUTRIENT INTAKES OF MALES 25-35 YRS.[1]

Nutrients	Fats and Oils	Fruits and Fruit Products	Grain and Grain Products	Nuts, Soybeans, and Misc. Seeds	Meat, Poultry, Fish and Eggs
Water	0.3	12.0	9.0	0.0	8.8
Energy	4.9	4.9	26.7	1.4	21.6
Protein	0.1	1.1	19.8	1.5	46.9
Fat	13.5	0.3	17.6	2.9	36.8
Carbohydrate	0.3	11.7	41.6	0.4	1.2
Fibre	0.3	14.6	27.8	3.1	1.9
Ash	2.8	4.9	27.9	1.4	21.0
Calcium	0.3	2.8	19.4	0.4	4.0
Phosphorus	0.2	2.0	21.1	1.6	27.2
Iron	0.2	5.4	31.5	0.8	36.8
Sodium	5.6	0.1	39.5	0.9	12.4
Potassium	0.3	13.8	15.7	1.6	14.7
Vitamin A	6.6	7.2	6.9	0.0	26.6
Thiamin	0.0	7.4	34.4	1.2	25.2
Riboflavin	0.1	1.9	23.0	0.3	26.8
Niacin	0.0	1.4	18.9	3.1	47.8
Ascorbic Acid	0.1	52.1	3.7	0.0	2.0
Pantothenic Acid	0.0	5.5	14.9	1.2	34.3
Vitamin B-6	0.0	8.7	11.9	1.4	31.2
Vitamin B-12	0.0	0.0	1.0	0.0	28.0
Vitamin A-Carotene	0.0	14.7	1.3	0.0	0.0
Vitamin A-Preformed	13.0	0.0	12.3	0.0	52.6
Vitamin A-Retinol	9.6	3.5	9.6	0.0	38.4
Free Folate	0.0	22.3	17.0	1.3	20.5
Total Folate	0.0	14.9	29.3	2.7	17.2

TABLE 1 continued

Nutrients	Milk and Milk Products	Sugars and Sweets	Vegetables	Miscellaneous	Total
Water	4.6	0.8	15.2	49.2	100%
Energy	11.9	3.4	9.2	16.0	100%
Protein	19.2	0.5	6.1	4.8	100%
Fat	15.3	0.8	8.7	4.1	100%
Carbohydrate	7.8	7.6	13.1	16.2	100%
Fibre	0.0	0.7	46.6	4.9	100%
Ash	7.4	0.7	19.7	14.2	100%
Calcium	60.3	0.7	5.6	6.5	100%
Phosphorus	27.1	0.4	9.0	11.3	100%
Iron	2.6	0.9	14.5	7.2	100%
Sodium	9.3	0.6	14.8	16.8	100%
Potassium	9.2	0.7	34.3	9.7	100%
Vitamin A	10.4	0.1	34.4	7.9	100%
Thiamin	10.5	0.2	15.7	5.4	100%
Riboflavin	32.2	0.5	6.5	8.7	100%
Niacin	12.1	0.1	7.9	8.7	100%
Ascorbic Acid	3.7	0.1	37.4	0.9	100%
Pantothenic Acid	20.0	0.4	16.7	7.0	100%
Vitamin B-6	9.0	0.2	21.5	16.0	100%
Vitamin B-12	70.3	0.2	0.0	0.5	100%
Vitamin A-Carotene	0.0	0.0	70.0	14.1	100%
Vitamin A-Preformed	20.5	0.2	0.0	1.3	100%
Vitamin A-Retinol	17.9	0.2	16.6	4.3	100%
Free Folate	13.8	0.2	23.9	1.1	100%
Total Folate	10.4	0.1	24.0	1.4	100%

[1] Results based on mean daily intake over 3 days for 37 males

TABLE 2

ENERGY AND NUTRIENT INTAKE OF MALES 25-35 YRS.[1]

Subject Number	Energy kcal	Protein g	Fat g	Carbo-hydrate g	Calcium mg	Phosphorus mg	Iron mg
001	2034	80	76	267	943	1218	14
002	2207	103	94	244	502	1203	18
003	2986	142	132	294	901	1625	21
004	2373	84	107	214	807	1365	10
005	2155	79	82	244	654	1103	12
006	2869	115	93	262	942	1782	21
007	1912	82	48	196	386	867	9
008	3856	139	157	275	640	1824	24
016	3243	116	120	387	787	1444	15
017	2777	91	116	347	1692	1434	23
018	2902	96	107	300	894	1487	13
019	2724	115	124	281	1294	1818	14
020	2411	104	138	173	1077	1991	18
031	3104	103	132	339	946	1816	16
032	2408	84	110	277	848	1274	12
033	2751	81	105	222	974	1486	11
034	1578	67	62	177	629	1034	11
035	2897	103	106	336	1436	1898	12
036	2706	90	91	396	1161	1719	22
037	3133	127	122	334	2532	2234	14
038	1691	70	78	175	619	1065	15
039	2895	116	115	345	1984	2211	14
040	2072	97	99	185	758	1287	13
041	2206	85	93	224	1449	1608	10
042	2821	120	102	352	1715	1363	17
043	2129	59	83	304	1374	947	11
044	2684	90	87	302	1505	1484	15
045	2571	99	126	243	747	1358	15
046	3210	119	118	320	1367	2164	17
047	--	--	--	--	--	--	--
048	2734	110	112	270	985	1679	19
049	2275	68	91	245	724	1139	15
050	3145	118	129	386	860	1430	19
051	2470	113	98	187	1195	1764	14
052	3097	120	151	289	847	1700	24
053	3305	151	121	406	1043	1586	18
054	2416	99	99	210	835	1664	17
055	2899	110	116	318	1235	1890	16
Mean Intakes	2639	101	106	279	1062	1540	16

-- data not available

[1] Results based on mean daily intake over 3 days

TABLE 2 continued

Thiamin mg	Ribo-flavin mg	Niacin NE	Ascorbic Acid mg	Vitamin B6 mg	Vitamin B_{12} mcg	Vitamin A R.E.	Free Folate mcg
1.4	1.7	28	306	1.3	6.7	986	183
1.3	1.5	43	151	2.2	9.4	898	102
1.6	2.7	59	122	1.2	16.8	925	137
1.0	1.6	34	66	1.4	13.4	449	56
0.9	1.4	31	69	0.9	9.2	437	63
1.1	5.3	59	92	2.6	40.6	5234	318
0.6	1.3	41	76	1.4	1.0	565	44
1.4	2.3	58	193	2.8	6.3	1535	148
1.5	2.2	53	135	2.3	2.4	556	90
2.3	5.1	45	163	1.1	1.2	1432	149
0.9	1.6	39	240	1.3	6.3	980	102
1.2	2.4	45	90	1.6	18.6	844	118
2.3	3.3	40	47	1.8	29.3	2940	113
1.1	2.1	40	46	2.0	12.9	1879	78
1.4	1.5	32	122	1.9	14.8	1533	99
1.2	2.1	38	36	1.9	9.4	821	52
0.7	1.2	26	54	1.1	3.6	1078	63
1.1	2.6	39	251	1.5	27.3	906	122
2.1	3.8	38	95	1.4	20.9	1483	91
1.5	3.5	42	185	1.5	21.1	1518	189
0.8	1.1	26	107	1.7	4.1	910	90
1.6	3.0	41	204	1.6	33.0	2317	165
1.4	1.5	38	30	1.1	15.3	490	63
1.0	2.0	30	119	1.2	26.1	1025	110
1.6	2.7	39	92	1.4	4.8	1680	101
0.6	1.8	15	100	0.9	1.9	1336	72
1.6	3.2	37	118	1.7	16.7	1569	110
1.5	1.5	35	51	1.3	3.9	1377	77
1.4	3.7	57	88	2.2	12.7	1284	101
--	--	--	--	--	--	--	--
1.7	3.0	45	62	1.8	38.0	1114	140
1.0	1.2	25	132	1.0	2.2	4997	98
1.6	2.0	43	73	1.4	7.4	1506	80
1.5	2.1	48	104	1.6	19.5	742	83
1.6	2.7	48	54	1.5	15.6	622	85
1.6	2.0	64	305	2.2	2.9	837	177
0.9	3.6	44	31	1.9	30.4	2693	176
1.2	2.6	45	124	2.5	22.2	1477	109
1.3	2.4	41	117	1.6	14.3	1432	112

TABLE 3

PERCENT DISTRIBUTION OF KILOCALORIES IN RELATION TO PROTEIN, FAT AND CARBOHYDRATE INTAKES[1]

Subject	Percentage			Difference[2]
	Protein	Fat	Carbohydrate	
001	16	34	53	+3
002	19	38	44	+1
003	19	40	39	-2
004	14	41	36	-9
005	15	34	45	-6
006	16	29	37	-18
007	17	23	41	-19
008	14	37	29	-20
016	14	33	48	-5
017	13	38	50	+1
018	13	33	41	-13
019	17	41	41	-1
020	17	52	29	-2
031	13	38	44	-5
032	14	41	46	+1
033	12	34	32	-22
034	17	35	45	-3
035	14	33	46	-7
036	13	30	59	+2
037	16	35	43	-6
038	17	42	41	0
039	16	36	48	0
040	19	43	36	-2
041	15	38	41	-6
042	17	32	50	-1
043	11	35	57	+3
044	13	29	45	-13
045	15	44	38	-3
046	15	33	40	-12
047	--	--	--	--
048	16	37	40	-7
049	12	36	43	-9
050	15	37	49	+1
051	18	36	30	-16
052	15	44	37	-4
053	18	33	49	0
054	16	37	35	-12
055	15	36	44	-5
Group Data	15	36	42	-7
Range	11 - 19	23 - 52	29 - 59	

-- data not available

[1] Results based on mean daily intake over 3 days

[2] The negative values could be partly accounted for by the intake of alcohol during the study period

APPENDIX I

STATISTICAL TABLES AND PROCEDURES

TABLE 1

KRUSKAL-WALLIS ANALYSIS OF VARIANCE BY RANKS

Treatment	Group [1]	n	Mean Rank [2]	Value of Test Statistic [3]	df	Probability
Nutrition Knowledge	1	7	30.86a	10.698	3	0.013
	2	6	11.92b			
	3	19	18.00ab			
	4	5	18.70ab			
Dietary Practices[4]	1	7	13.36a	5.451	3	0.142
	2	6	16.08a			
	3	19	22.82a			
	4	5	15.90a			
Dietary Practices[5]	1	7	17.57a	2.235	3	0.526
	2	6	17.33a			
	3	19	21.32a			
	4	5	14.20a			

[1] Group 1= sole planner and/or preparer of meals on a regular basis
Group 2= sole planner and/or preparer of meals on an occasional basis
Group 3= share responsibilities with others
Group 4= no involvement in these activities

[2] Any two groups not followed by the same letter are significantly different at the 5 percent level of significance

[3] Corrected for ties. For large sample sizes, the test statistic approximately follows a Chi-Square distribution (Hollander and Wolfe, 1973)

[4] Energy requirement 2840 kcal

[5] Energy requirement 2500 kcal

DISTRIBUTION FREE MULTIPLE COMPARISONS TEST
BASED ON KRUSKAL-WALLIS RANK SUMS[1]

$$T_{u.} \neq T_{v.} \quad \text{if} \quad \left|R_{\cdot u} - R_{\cdot v}\right| \geq Z\left(\alpha \Big/ \left[k\,(k-1)\right]\right)\left[\frac{N(N+1)}{12}\right]^{\frac{1}{2}}\left(\frac{1}{n_u} + \frac{1}{n_v}\right)^{\frac{1}{2}}$$

[1] Approximation made for large sample cases and valid for unequal sample sizes (cited in Hollander and Wolfe, 1973)

APPENDIX J

TIME COST INVOLVED IN DIETARY SURVEY

TABLE 1

TIME COST INVOLVED IN DIETARY SURVEY [1]

Time Cost	Total Person Hours	Hours per Subject
Collecting data: [2]		
Training of dietary interviewers	2.0	
Training of subjects [3]	5.0	0.5
Second interview with subjects [4]	19.0	0.5
Editing and coding data from food records:		
Transfer of data from booklet to code sheets; initial coding	342.0	9.0 (0.5 hrs. per meal times 6 meals per day for 3 days)
Final coding	5.0	
Checking of code sheets	1.0	
Transfer of data to computer code sheets	10.0	
Checking of code sheets	8.0	
Calculation of nutrient values:		
Professional key-punching of data	6.0	
Checking of computer cards	3.0	
Approximate total time cost	401.0	10.6

[1] Based on 3-day food records of 38 males, 25-35 yrs.; total number of days 114

[2] Excluding preparation and travel time

[3] Ten group meetings lasting 30 minutes each were held over 3 days

[4] Includes only the time allocated to the dietary part of the personal interview