A Rapid Assessment for the Fat Intake
of University Students
by
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INTAKE OF UNIVERSITY STUDENTS

by

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Committee Chairman: Ann A. Hertzler
Human Nutrition and Foods

(ABSTRACT)

Assessment methods are continually updated to adequately measure dietary
intakes. Rapid Assessment Methodologies, or RAMs are being developed to quickly
measure specific nutrients. Although no perfect measure of an individual’s diet
exists, diet records (DRs) are considered the most accurate assessment technique.

The goal of this research was to design a short form using frequency of
consumption to detect clientele with high dietary fat intake. A food frequency
questionnaire (FFQ) of 24 foods was developed based on data from national sources
and on data on college students. College student FFQ ratings were compared with
three day DRs to determine the foods predicting the fat in their diet.

Two RAMs, Fat Factor Short (FF Short) and Fat Factor Long (FF Long) were
designed: FF Short (a short list of six foods) and FF Long (a longer list of 12
foods). FF Short was the preferred predictor of students consuming a high fat diet.

Short food lists should be useful in predicting dietary fat intake and assist in
detecting individuals requiring further educational programs on reducing dietary fat.
ACKNOWLEDGEMENTS

I would like to acknowledge my family for giving me support all throughout my university career. Their support and assistance helped me make it through the rough times and many deadlines of graduate school.

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And to Wes, my husband, thank you for being there, whenever I needed anything! You’ve helped me to get through the busiest period of my life, and now you wait for me in paradise. I couldn’t have done it with out you.
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CHAPTER I
INTRODUCTION

As Americans become more nutrition and fitness conscious, they are diverting much time and energy to weight reducing diets and exercise plans. They may spend much time on these plans without realizing changes, if any, in their eating habits. Brief screening tools are necessary to quickly determine an individual’s eating habits. An evaluation can be performed by either the individual or a dietitian. However, such an evaluation is not accurate unless the screening tool lists foods that are likely to be significant contributors of the nutrient(s) under study. Such a screening tool could be used at any given time during nutrition intervention to enable nutrition education to focus on the food choices and other factors influencing the individual’s behavior. This process of creating a list of foods for a rapid assessment methodology (RAM), could be applied to other populations and the results utilized to create any number of screening tools for further nutrition education. The purpose of this study is to create and validate a short list of foods to predict dietary fat intake using dietary fat from food records as a standard for comparison.
CHAPTER II

REVIEW OF LITERATURE

American college and university students represent the future leaders and parents of the next generation. Working towards optimal nutritional health of today’s youth, both now and in the future, will help to assure that youth can perform well in all aspects. Many researchers have looked into the factors that influence the choices these young people make in their daily lives. Nutrition is no exception.

STUDENT NUTRITION EDUCATION

College Nutrition Education Courses Knowledge of nutrition can come from many sources, including school and courses taken in the community, the media, family, and many others (1). Students’ gain in nutrition knowledge from college nutrition courses has been reported recently by Skinner (2), Mitchell (3), and Hertzler and Frary (4). Skinner (2) felt that changing the behavior of students begins with the course, and hopefully continues at the end of the course.

Changes in food behavior have also been documented. Skinner (2) reported that women non-nutrition major (as a group) significantly decreased the grams of fat in their diet after taking an introductory nutrition course. Mitchell (3) and Hertzler and Frary (4), reported 45% (N = 159) and 50% (N = 212) of the undergraduate introductory nutrition students, respectively, made perceived improvements in their eating habits. Mitchell (3) measured change with a questionnaire given at the
beginning and end of the course. However, the only significant change she noted was the type of milk they drank; they switched to nonfat milk from whole milk. Mitchell observed that approximately 13% (N =182) of the students at the beginning of a basic nutrition course felt that reducing their fat and cholesterol intake was their top priority. A change to 23% at the end of the course was not significant (3).

Hertzler and Frary (4) noted that over-weight women more than any other group indicated improved diets after taking the introductory nutrition course. All of the students in the Mitchell (3) study stated in an end of the term survey that the greatest benefit of improving the diet was for better health in the future. None of the studies on changes from taking a nutrition course identified a quantitative change in any more than a few specific foods (example: milk), the food groups, or nutritional habits. A brief method to quickly and effectively screen would assist the instructor to identify nutrition education needs.

**DIETARY FAT INTAKE**

**Adolescents and College Students** Throughout the past 50 years, there has been much research regarding the eating habits of college students. As dietary assessment methods and computer analysis methods improve, analysis procedures have become more fine-tuned for specific features not previously considered. For example, in studies done more than 15 years ago, Huenemann et al. (5) and Jakobovitz et al. (6), did not quantify the grams of fat nor the percent contribution of fat in the diet. More recent reports (Table 1, page 5) contain specific dietary information on the percentage
contribution of dietary fat or the range of fat gram intake in the diets. Witschi et al. (7) had students in a boarding high school (mean age = 15) complete several weeks of food records for a nutrition segment in a science course. The authors did not state that the students ate primarily in the school’s dining rooms, although the students lived away from their parents.

Witschi et al. (7) also listed food groups contributing to total fat and the percent contribution for both males and females (Table 2, page 6). Dairy products provided the highest percentage of dietary fat for both girls and boys. However, the girls received the second highest percentage of fat from bakery products; the third from snack-type foods. The boys in the study received the second highest percentage of fat from meat, fish, poultry, and eggs; the third highest from bakery products. Witschi et al. (7) did not identify any significant differences between the fat in food choices of girls and boys. Hernon et al. (8) reported that men ate significantly more servings of fluid milk, meat, eggs, and bread than women.
Table 1
Student/Adolescent food record reports researching dietary fat

<table>
<thead>
<tr>
<th>Reference</th>
<th>Sample Gender</th>
<th>Size</th>
<th>Age (y)</th>
<th>% Fat Kcals</th>
<th>Fat g + SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beerman 1991 a1</td>
<td>F</td>
<td>422</td>
<td>-</td>
<td>-</td>
<td>85.3±3</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>271</td>
<td>-</td>
<td>-</td>
<td>108.4±6.4</td>
</tr>
<tr>
<td>Skinner 1991 a2</td>
<td>F</td>
<td>228</td>
<td>-</td>
<td>-</td>
<td>65. ±1</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>58</td>
<td>-</td>
<td>-</td>
<td>108. ±6</td>
</tr>
<tr>
<td>Witschi et al. 1990 a1</td>
<td>F</td>
<td>92</td>
<td>avg=15</td>
<td>34.5</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>108</td>
<td></td>
<td>34.4</td>
<td>-</td>
</tr>
<tr>
<td>Bailey &amp; Goldberg 1989 a2</td>
<td>F</td>
<td>62</td>
<td>18-21</td>
<td>-</td>
<td>53. ±24</td>
</tr>
<tr>
<td>Hernon et al. 1986 a2</td>
<td>F</td>
<td>245</td>
<td>19-22</td>
<td>34.</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>58</td>
<td></td>
<td>36.3</td>
<td>-</td>
</tr>
<tr>
<td>Vickery et al. 1985 a2</td>
<td>F</td>
<td>335</td>
<td>avg=20</td>
<td>-</td>
<td>10.±179</td>
</tr>
</tbody>
</table>

a = introductory nutrition students
b = advanced nutrition students
c = non-nutrition students
1 = on-campus only
2 = mixed living arrangements
- = data not given
Table 2
Percentage contribution of food groups to fat intake\(^1\)

<table>
<thead>
<tr>
<th>FOOD GROUP</th>
<th>TOTAL FAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males (sample size = 108)</td>
<td>--%--</td>
</tr>
<tr>
<td>dairy</td>
<td>21.6</td>
</tr>
<tr>
<td>meat, fish, poultry, eggs</td>
<td>21.3</td>
</tr>
<tr>
<td>bakery</td>
<td>14.7</td>
</tr>
<tr>
<td>additions to food</td>
<td>9.6</td>
</tr>
<tr>
<td>mixed dishes</td>
<td>9.1</td>
</tr>
<tr>
<td>snack-type foods</td>
<td>8.9</td>
</tr>
<tr>
<td>cooked starches</td>
<td>7.4</td>
</tr>
<tr>
<td>processed meats</td>
<td>4.1</td>
</tr>
<tr>
<td>cereals</td>
<td>1.5</td>
</tr>
<tr>
<td>soups</td>
<td>1.0</td>
</tr>
<tr>
<td>fruits, fruit juices</td>
<td>0.6</td>
</tr>
<tr>
<td>vegetables, salads</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Females (sample size = 92)

<table>
<thead>
<tr>
<th>FOOD GROUP</th>
<th>TOTAL FAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>dairy</td>
<td>21.5</td>
</tr>
<tr>
<td>bakery</td>
<td>20.4</td>
</tr>
<tr>
<td>snack-type foods</td>
<td>12.4</td>
</tr>
<tr>
<td>additions to food</td>
<td>10.9</td>
</tr>
<tr>
<td>meat, fish, poultry, eggs</td>
<td>10.4</td>
</tr>
<tr>
<td>cooked starches</td>
<td>7.3</td>
</tr>
<tr>
<td>mixed dishes</td>
<td>7.2</td>
</tr>
<tr>
<td>cereals</td>
<td>5.1</td>
</tr>
<tr>
<td>processed meats</td>
<td>3.0</td>
</tr>
<tr>
<td>fruits, fruit juices</td>
<td>0.9</td>
</tr>
<tr>
<td>soups</td>
<td>0.5</td>
</tr>
<tr>
<td>vegetables, salads</td>
<td>0.4</td>
</tr>
</tbody>
</table>

\(^1\) from student food records, Witschi et al., 1990
The range of fat intake was the most extreme for the students in the study by Vickery et al. (9). Unfortunately, the percent contribution of fat was not reported and the contribution could not be calculated from the data provided. The results for all of the studies analyzing diet records showed that the average student’s diet consisted of 33% or more kilocalories from fat. This is above the U.S. Dietary Guidelines recommendation of 30% of calories (10).

**Effect of Living Situation on College Students’ Diet**  
Research done by Beerman (11) shows that students living in fraternity or sorority houses providing room and board ate a diet significantly higher in fat, energy and sodium compared to those living either on or off-campus in single apartments. Though the nutrient data between on- and off-campus students were not significantly different, the means are at least 10 g apart, with the ranges both approximately ±6 g. None of the other studies in Table 1 categorized the students as to where they lived or if they had special dietary needs. Beerman (11) used both nutrition major and non-major students taking a nutrition course.

**Dining Out Practices of College Students**  
Hertzler and Frary (4) researched the dining out practices of college students. Forty-five percent of the students, especially men, ate at fast food restaurants at least weekly, and the authors noted that these practices were negatively related to most dietary guideline practices.

All of the studies reviewed, except those of Vickery et al. (9) and Jakobovitz et al. (6) were of students enrolled in nutrition courses. According to Beerman (11),
using students taking nutrition courses to describe the entire student population creates biases. Obviously, students enrolled in nutrition courses tend to become more motivated to eat a better diet as the course evolves.

**National Trends in Fat Consumption**  The tendency of Americans to eat an excessive amount of fat has been a topic of concern because of the many health risks associated with high fat consumption. The Joint Nutrition Monitoring Evaluation Committee (JNMEC) has recommended monitoring of fat, saturated fatty acids, and cholesterol (13). In the past 20 years, national food consumption data have been compiled in the National Health and Nutrition Examination Survey (NHANES) I (1971-75) and II (1976-80) reports as well as the last Continuing Survey of Food Intakes by Individuals (CSFII) in 1985-1986. Between 1987-88, a Nationwide Food Consumption Survey (NFCSII) was conducted; however, the low response rate (<50%) of all subjects to the survey makes the data questionable and not necessarily applicable to national trends (14). Nevertheless, the NFCSII reported that males (20-29 y) had a mean intake of 115 g of fat for a one day recall providing a mean of 36% of total energy (13). Females of the same age group in the CSFII one and four day surveys, had a mean intake of 68 g of fat; fat in both sets of food records provided 36% of energy.

Since the 1920's, the American public as a whole has slowly lowered the percentage of energy derived from fat. Stephen and Wald (15) completed a report on trends in U.S. fat and cholesterol consumption. The report included a broad analysis
of studies on American fat and cholesterol eating trends through the years. Using data available through 1985, the percentage of total kilocalories from fat has changed: 1960-69, Americans ate 39.9%; in 1970-79, 37.8%, and finally in 1980-85, 37.5%. However, Stephen and Wald did not classify specific age ranges--only three broad categories: children, adults and elderly. Behavioral changes and changes in the foods eaten by age groups have not been quantified. More specific research is therefore necessary on young adults.

The Bureau of the Census (16) reported recent trends towards choosing lower fat foods (Table 3, page 10). These changes in many high fat foods must be recognized when creating any type of dietary fat assessment.
Table 3
Per capita consumption of food commodities, 1987-89

<table>
<thead>
<tr>
<th>FOOD COMMODITY</th>
<th>1987</th>
<th>1988</th>
<th>1989</th>
</tr>
</thead>
<tbody>
<tr>
<td>(in pounds unless otherwise noted)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eggs&lt;sup&gt;a&lt;/sup&gt;</td>
<td>253.0</td>
<td>244.0</td>
<td>234.0</td>
</tr>
<tr>
<td>whole milk&lt;sup&gt;b&lt;/sup&gt;</td>
<td>111.4</td>
<td>105.2</td>
<td>95.3</td>
</tr>
<tr>
<td>lowfat milk&lt;sup&gt;b&lt;/sup&gt;</td>
<td>100.1</td>
<td>100.0</td>
<td>103.6</td>
</tr>
<tr>
<td>beef</td>
<td>69.2</td>
<td>68.2</td>
<td>65.0</td>
</tr>
<tr>
<td>chicken</td>
<td>43.2</td>
<td>44.5</td>
<td>47.0</td>
</tr>
<tr>
<td>ice cream</td>
<td>18.3</td>
<td>17.2</td>
<td>16.0</td>
</tr>
<tr>
<td>fish &amp; shellfish</td>
<td>15.5</td>
<td>15.0</td>
<td>15.7</td>
</tr>
<tr>
<td>skim milk&lt;sup&gt;b&lt;/sup&gt;</td>
<td>14.0</td>
<td>16.0</td>
<td>19.7</td>
</tr>
<tr>
<td>cheddar cheese</td>
<td>10.6</td>
<td>9.4</td>
<td>9.2</td>
</tr>
<tr>
<td>margarine</td>
<td>10.5</td>
<td>10.2</td>
<td>10.1</td>
</tr>
<tr>
<td>ice milk</td>
<td>7.4</td>
<td>7.9</td>
<td>8.3</td>
</tr>
<tr>
<td>butter</td>
<td>4.6</td>
<td>4.5</td>
<td>4.3</td>
</tr>
</tbody>
</table>

<sup>a</sup>=farmers’ count  
<sup>b</sup>=gallons  
<sup>i</sup>=U.S. Bureau of the Census, Statistical Abstract, 1991

DIETARY ASSESSMENT METHODS

Nutritionists have long been completing dietary assessments to study the relationship between diet and health. Rhodes (17) states that ideally we need dietary assessments to supply the average dietary intake over time to determine health risk factors. Block and Hartman (18) state that to be able to study this relationship with any statistical power, data on individuals are needed. Several comprehensive reviews on the history of such measures can be found, including that by Medlin and Skinner (19).
Four components of dietary assessments methods that must be researched to ensure the adequacy of the results are precision, classification, validity and reliability. Data must be precise, meaning the absolute value of the nutrient estimate represents the actual nutrient intake (18). Choosing the nutritional indicators which best fit the goals of the research allows for appropriate classification which means that the individuals studied fit into some percentile category describing their characteristics (20). A valid measure evaluates that which it is intended to; a reliable measure produces the same answer upon different applications to an identical or similar population (18). These components all work together to create a dietary intake measure that will create an accurate estimate, correctly classifying the individual in a manner that can be repeated over time (17).

Choosing a dietary assessment method for research depends on the research goals. In 1986, guidelines for use of dietary intake data were created by an ad hoc panel and described by Anderson (22). The panel developed both general and specific guidelines for dietary assessment research. To address the problem, four definitions are required before conducting the study:

1. characterize the event to be studied as completely as possible.
2. define the population.
3. determine the purpose of the data and the precision needed.
4. determine the adequacy of the data base.
The oldest method of dietary assessment, according to Medlin and Skinner (19) is the diet record, developed by Burke and Stuart in the 1930’s. The method requires that the subject write the foods down as they are eaten, and not rely on memory. Food frequency questionnaires (FFQs) were developed in the 1960’s to determine how often foods on a given list are consumed. Research continues to study the number and order of days necessary to create the typical diet. Recently, researchers have compiled brief lists of food to evaluate one or more nutrients for a given population (23, 24, 25, 26). When the tools include sections on self assessment, the tools are often called Rapid Assessment Methodologies, or RAMs. This type of dietary assessment method can be useful for daily guidance as well as a measure to evaluate dietary change.

**Diet Records** These records should list all of the foods consumed by the individual as she or he eats them. The data of one complete day’s record may not be adequate to precisely indicate the individuals’ usual diet. Chalmers’ et al. (27), one of the first studies measuring the consistency of students’ diets, determined that college students ate significantly different diets on the weekends as compared to weekdays. Todd et al. (28) also found that students ate a significantly different diet on week-ends. However, Pao et al. (29) compared one and three day records of the NFCS 1977-1978. The results showed little variation in the subjects’ macronutrient intake.

More recently Larkin et al. (30), determined that three non-consecutive diet records are preferable over one day diet records to describe the dietary intake of
individuals. However, in a group larger than 50, the differences in the calculated macronutrients between consecutive and random days becomes much smaller. Because this method relies on the accuracy of the individual completing the record, the only way to validate the record is for a researcher to measure, either directly or indirectly, the amount of food the individual eats. Gersovitz et al. (31) was able to compare a record of what subjects actually consumed (from measuring the foods available at a congregate meal site) to the food records estimated by 11 elderly people. These researchers found that the records were adequate to describe foods eaten only for the first two consecutive days; subsequent days had incomplete records.

In order to determine the best method of obtaining short term food intake, Todd et al. (28) instructed 18 graduate students to measure and record their intake over a 30 day period. The students recorded their intake using tape-recorders or written records. The researchers found that a one day dietary record estimated within 15% of usual energy and protein intake of the group.

Beaton et al. (33) determined that 10 days of food records for males and 16 days for females were necessary to precisely estimate the grams of fat in their diet. This was extrapolated from 6 nonconsecutive 24-hr recalls with 60 subjects (age range 25-44 years), equally divided between the sexes. However, James et al. (34) determined that males required nine days of dietary records and females six days to
correctly classify 80% of the subjects into one of three categories of dietary fat intake. James et al. (34) also used 60 subjects, equally divided between the sexes.

**Food Frequency Questionnaires** Food frequency questionnaires (FFQs) require the subject to remember the frequency of foods consumed and simple reading and writing skills. A distinct advantage of the FFQ over other dietary intake methods is that it can be administered by non-trained individuals (35). This method, documented first in 1962 by Stefanik and Trulson (19) indicates the usual diet, rather than the specific diet (18, 19, 35, 36). FFQs can be used for two purposes: to identify foods commonly eaten or to identify the foods contributing one nutrient in an individuals’ diet (21).

Foods that constitute the major component of a meal, such as meats are estimated with the greatest accuracy (37), although the definition of the word "meal" and its components are rapidly changing. Other researchers note that the FFQ will note the foods eaten most frequently and rarely (18, 24, 36). Also, FFQ’s are limited to use with the population for which it was designed (18, 21, 32).

The precision of a FFQ depends on the adequacy of the food list for the population tested. When targeting a specific nutrient, the food list used in the FFQ must reflect the population’s major source of the nutrient. Milk, for example, must be defined with respect to the percentage of calories from fat if determining contributors of fat in the total diet (18). Also, the serving sizes used must reflect commonly used sizes for the population tested (30, 38, 39). When Guthrie (38) tested
college students and university employees as to their concept of serving sizes, considerable variation was observed.

If a FFQ is to correctly classify an individual, the foods and the measurements used must be adequate for the population tested. Several researchers have approached this by comparing national food consumption survey results with a large test population. In order to classify subgroups in the population, FFQs can be used to describe the population’s distribution of intakes. However, in order to make associations applicable to individuals, data on individuals are needed (18).

Curtis, Musgrave, Klimis-Tavantzis (40) created a FFQ to screen fat, saturated fat, cholesterol, and energy. The researchers recommended three guidelines for developing FFQs.

1. use pilot studies to establish specific criteria for including food items on the questionnaire.

2. use average nutrient values for groups of items.

3. use the same database for the FFQ and DR because of significant differences between databases.

Axelson and Csernus (41) used a food frequency questionnaire with university graduate students to measure changes in food consumption between two periods of their lives. The authors’ created their FFQ using food groups and common household food measurements. The FFQ was found to be valid by comparing the student groups’ mean intake frequencies with those who were in the same age groups in two
NFCS studies (1965-66 and 1977-78). The correlation of the FFQ to the two NFCS surveys was approximately 79%. Axelson and Csernus (41) also indicated that a varied diet complicated the FFQ because individuals have difficulty quantifying food frequencies on a per week basis. Larkin et al. (30) also indicated that improving the accuracy in frequency estimation will increase validity in FFQs. Additional advantages of the FFQ assessment method, as noted by Axelson and Csernus (40), include simplicity and minimal expense.

Willett et al. (42) evaluated the validity and reliability of a 61 item FFQ to quantify one year's intake by comparing the results to four, one week diet records. The source of their food list, however was not indicated. The FFQ method of assessment was chosen because of its accuracy in epidemiologic research and ease of administration and quantification. Two administrations of the FFQs over the course of a year gave results within 12 g for the macronutrients when compared to four, one week diet records.

In the last decade, many researchers have noted a need for quick dietary assessment methods (23, 25, 26, 35, 40, 43, 44). The majority of recent research is for assessment methods easily and quickly scored by non-nutrition personnel. A brief and pertinent list of foods is desirable to minimize time considerations and insure the precision of the results.

**Rapid Assessment Methodologies** As mentioned before, RAMs are a recent addition to dietary assessment methods. They are brief assessment methods that can
be completed and scored by the individual in the population, allowing empowerment of the individual (45). At a global conference in 1990, three premises were agreed upon for the RAMs: the community or individuals to be evaluated is/are involved in data gathering or project design; the RAM itself combines several types of assessment methods; and the knowledge gained from the RAM is action oriented for the individual who completed it (45).

In the Women's Health Trial, (46) NHANES II data were used to determine the major contributors of fat in the diets of middle-aged women. The goal of the research was to develop a tool to identify women eating a high fat diet (defined as approximately 41% of energy from fat). In order to determine the contributors, food lists were prepared containing between 10 and 100 food items. The lists were then given to 29 women in the test population. The researchers found that 13 high fat foods or frequently eaten foods adequately indicated 85% of the fat in the subject's diets when they compared the brief screener to the full 100 item questionnaire (25). A second measure of the adequacy of the screener list was also done: women eating a 40% fat controlled diet completed the screener. The researchers found the 13 item list correctly identified 82% as eating a high fat diet (25).

Kristal et al. (26) determined a short list of 44 foods in a dietary questionnaire to quickly assess total fat, fiber, saturated fat, and percent of calories from fat in individuals diets. The list contained 23 foods providing fat was determined using step-wise multiple regression of a FFQ and four alternate one day diet records.
completed by 97 women representative of the study population. From the FFQ and the diet records, foods and food groups were chosen which provided a significant source of each nutrient. In their sample of 97 women, Kristal et al. (26) found that the correlation of the 23 item questionnaire with the 44 item FFQ and four-day diet records had a correlation coefficient of 0.64 for total dietary fat using cluster analysis.

Byers et al. (43) determined 17 high fat foods (from a FFQ of over 100 foods) would quantify 70% of fat in an individual’s diet. The authors used stepwise multiple regression to determine these foods. From this list, they chose the foods eaten most frequently by the study population which provided the highest percentage of fat.

Heller et al. (23) selected four dairy products, two meats, trimming visible fat from meat, and cooking methods (grilling, frying in vegetable oil, frying in lard) for an assessment tool to test English industrial workers in the Heart Disease Prevention Project. Several options were given for each food or cooking habit; the options providing the least saturated fat and cholesterol were scored the highest. The tool evaluated the efficacy of the nutrition education component of the program to reduce saturated fat and cholesterol in the diet. A significant correlation of -0.6 between dietary intake data and saturated fat intake indicated improvement.

**Portion Sizes** The issue of memory in the adequacy of the dietary assessment data must be accounted for (18). Dwyer et al. (47) noted a need to minimize or account for memory related errors in completing dietary recalls or records.
The precision of food records or 24 hour recalls depends on the portion size perception of the individual. To measure the effect of improving this perception, researchers have conducted training sessions to allow subjects to place portion sizes in the perspective of models (48, 49). There are many types of food models, both two-dimensional and three-dimensional. Also, household measures and tableware often are shown with specific measurements. Bolland et al. (49) tested the result of training 42 female college students enrolled in an introductory nutrition course. These students were divided into three groups: control; trained with household measures; and trained with plastic food models. The trained groups were allowed to interact with the food models in order to become familiar with the measurements and the shapes. All three groups then estimated the portions of food typically eaten during one day. Both methods of training significantly increased the accuracy of measuring. Training did not improve estimations of the amount of meats (pork chops and sliced chicken). The researchers concluded that training improves accuracy in obtaining consistent and correct estimates for some food items, but not for all.

Other food models have been tested for effectiveness in improving portion estimation size. Kirkcaldy-Hargreaves et al. (48) tested four different food models (plastic food models, life-size photographs, three dimensional abstract shapes and drawings of abstract shapes) on 60 adults. For all four models, estimation of portion sizes using the models were correct approximately 60% of the time. The authors caution, however, that the models used may affect the results and recommend abstract
shapes or a two-dimensional rendition of them. Posner et al. (50) also validated
drawings to size of abstract shapes as food models to assist in 24-hour recalls. Fifty-
ine adults (mean age = 47 yr) estimated portion size using plastic food models or
the drawings of abstract shapes for a 24-hour recall with a trained interviewer. The
mean nutrient intakes were very close for men and women when comparing the
recalls from using the two models; however, women ate a significantly higher
percentage of energy from protein than men. Results from these two studies confirm
that models do assist in the precision of the diet history method.

CONCLUSIONS

New dietary assessment methods are continually evolving to quickly and
adequately measure the eating habits of individuals. The accessibility of college
students and their future roles in society make them excellent subjects for research.
Studies have shown students eat diets averaging 33% or more calories from fat.
Young men and women have been shown to eat different foods contributing to fat.
Introductory nutrition courses have not shown significant changes in the eating habits
students.

In general, the American public is slowly decreasing the amount of fat in their
diet. Recently, however, there have not been any large surveys to identify the
specific changes in food choices.

Though there is no absolute measure of an individual’s diet, diet records and
FFQs are adequate tools for predicting dietary intake. The need for brief, precise
FFQ and self-scoring methodologies has led to the development of the RAM. To create RAMs, the list of foods for scoring can be generated by correlating FFQs and diet records. Between six and 23 foods or food groups were necessary to predict 60-85% of the total fat in the subjects’ diets from the literature reviewed. Finally, food models have been shown to increase an individual’s precision when completing a dietary assessment.

The purpose of this thesis is to develop and validate a list of foods to predict the dietary fat intake of students enrolled in an introductory college nutrition course.

**Objective 1.** Develop a food frequency questionnaire (FFQ) for daily fat intake based on national and local databases.

**Objective 2.** Determine mean grams of fat from diet records of students completing the FFQ.

**Objective 3.** Compare data from objectives 1 and 2 to generate a minimal list of foods for the Fat Factor assessment tool.

**Objective 4.** To validate the tool, compare grams of fat from the Fat Factor with grams of fat from diet records of students not completing the FFQ.
CHAPTER III

METHODS

Virginia Tech (VT) students enrolled in two sections of the Human Nutrition and Foods Introductory Nutrition course (HNF 1004) fall semester 1992 were studied. Demographic information was collected from the students to describe: gender, height (in inches), weight (in pounds), and their activity level [scale: 3) extremely active, 2) moderately active, 1) inactive].

The study protocol and consent form were submitted to and accepted by the Human Subject Review Board (Appendix A). All students were informed that completing the two research instruments would earn them extra credit towards their course grade.

INSTRUMENTS

Food Frequency Questionnaire The food frequency questionnaire (FFQ) was developed to predict fat intake from key foods. First, the number of foods to predict fat intake was decided. In a review of the literature based on previous research, the number of foods in a frequency list to typify $\geq 60\%$ of the dietary fat has ranged from six to 23. The lowest correlation ($r = -.6$, indicating diet change) was found when six foods and cooking methods were combined (23); the highest correlation ($r = .85$) was for a list of 13 foods (25). Based on this range, 12 foods was considered sufficient to find the fewest number of foods providing the majority of
dietary fat (23, 24, 43, 26). Twice the minimum number of 12 foods was included in the FFQ to account for possible substitution and replacement of foods for this population.

Utilizing databases from both national and local sources assured applicability of the foods to the student population tested. The foods on the FFQ (Appendix B) were selected following two parameters: the report of Block et al. (25) which used NHANES II data reporting the national consumption of foods providing fat; and results of research Hertzler and Webb (51) conducted on fat eating habits of VT students in an introductory nutrition course.

Before completing the FFQ, the students were given a brief training session following a training protocol to assist them in determining portion sizes. All of the items shown: monkey bowl, dinner plate, salad bowl, soup bowl, large dressing ladle, small dressing ladle, small serving spoon, and large serving spoon, were also labeled on self-standing 8.5" X 5.5" signs (Appendix C). Overheads of a slice of cake and an ounce of chocolate, both drawn to scale, were shown as the students completed the FFQ.

The FFQ was printed on a computer readable (op-scan) form. The FFQ choices for frequency were:

0. monthly or never
1. weekly
2. three or more times a week

23
3. once a day
4. two or more times a day

**Three Day Diet Records** Three day diet records (3DRs) were collected from the students as part of the course term project. Instructions for the completion of the 3DR form (Appendix D), were given during the second week of classes by the graduate teaching assistant (GTA): students recorded the food name, described the food preparation method, and indicated the amount eaten. Students’ course supplements had two dimensional abstractions of portion sizes as well as descriptions of serving sizes (Appendix E). All students had project instructions (Appendix F) and were advised to visit their GTA for assistance. The 3DRs were divided into two groups.

The 3DRs of students who completed the FFQ were coded by the researcher and a colleague, both HNF graduate students. Data were entered in the Nutritionist IV (53) computer software program to determine mean fat levels of the students. The coders followed a protocol for coding foods and portion sizes to ensure reliability of the information.

1) A code book was jointly kept to assure consistency in judgements of food descriptions for the same or similar foods (*e.g.* lasagna) (Appendix G). Recipes obtained from *Joy of Cooking* (54) were used for referencing mixed dishes which used fruits or vegetables for colleague’s research.
2) Diet records containing two or more inadequately described foods, beverages, portion sizes, or unknown foods (i.e. egg casserole) were discarded.

3) The coders tested reliability four times for foods and portion sizes. Each coder individually coded the same five 3DRs and compared the results against the other coder’s. The two equations below determined the reliability of the two coders:

1. Number of foods identically coded/number of foods X 100
   = Percent Reliability of Food Items Coded

2. Number of portion sizes identically coded/number of foods X 100
   = Percent Reliability of Portion Size Coded

The coders repeated the same reliability procedures after completing 25, 50, and 75 three day diet records.

The second set of 3DRs were student coded. Students who did not complete the FFQ determined the mean fat level of their 3DRs using the Diet Simple (52) computer software program accompanying their course textbooks.

**Short and Long Fat Factors** Data from the 3DRs which were analyzed by the coders were compared to the FFQs using stepwise multiple regression and an *ad hoc* method involving correlation coefficients. Two lists of foods predicting dietary fat intake were determined by each statistical method. The list resulting from the first method became the foods on the short Fat Factor (Appendix H); the list resulting
from the second method became the foods on the long Fat Factor (Appendix I). Both the short (FF Short) and long (FF Long) were on letter size (8.5" X 11") paper containing:

1. directions for completion of the FF tools
2. frequencies for estimating consumption of the foods (0 = never, 1 = weekly, 2 = two or more times/week, 3 = daily, 4 = 2 or more times/day)
3. Five two-dimensional abstractions of portion sizes
4. the list of foods from the comparison of the frequencies of the FFQ and the mean fat from the same students' 3DRs.
5. a scoring procedure.

The scoring procedure was based on the frequency of consumption of the listed foods by the student and a multiplier (M) for each food developed from the statistical process. The M represented the food's contribution of fat.

The creation of the list of foods for the short and long FF tools met the third objective of the research.

STATISTICAL ANALYSIS OF THE FAT FACTORS

The short and long Fat Factors were randomly administered to the students in both sections of the course. The results of FF Short and FF Long were compared to the mean dietary fat from the 3DRs of all the subjects, both those coded by the
students and those coded by the researchers. The Fat Factor with the highest correlation would be considered the better predictor.

Two way analysis of variance (ANOVA) and t-tests tested for differences in the predictive ability of the FF Short and FF Long. These statistical tests would indicated the Fat Factor which predicted fat intake closest to the mean fat determined from the 3DRs of all students.

SUMMARY

Undergraduate students in two sections of an introductory nutrition course were studied.

1. The Food Frequency Questionnaire (FFQ) with 24 foods was completed by 209 students.

2. Three day diet records (3DRs) were recorded by all students as part of their semester project. Dietary fat intake was estimated.

3. Grams of fat from the FFQs were compared to the grams of fat from the 3DRs coded by the researchers.

4. Created Short and Long Fat Factor tools using the result of the third step.

5. FF Short and FF Long tool cross-validated with fat levels to determine predictive ability.
CHAPTER IV

RESULTS

SAMPLE

Undergraduate students from the Fall 1992 VT introductory nutrition course were studied. Demographic data descriptive of the students completing the FFQ are reported in Table 4.

Table 4
Demographic data of students completing food frequency questionnaire

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Height (in.)</td>
<td>65</td>
<td>70</td>
</tr>
<tr>
<td>Mean Weight (lb.)</td>
<td>126</td>
<td>160</td>
</tr>
<tr>
<td>Activity Level 1</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Activity Level 2</td>
<td>71</td>
<td>48</td>
</tr>
<tr>
<td>Activity Level 3</td>
<td>22</td>
<td>46</td>
</tr>
<tr>
<td>Freshmen</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>Sophomore</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>Junior</td>
<td>32</td>
<td>24</td>
</tr>
<tr>
<td>Senior</td>
<td>14</td>
<td>26</td>
</tr>
</tbody>
</table>

Research by Hernon et al. (18) determined that female and male students ate a diet similar in nutrient density. Although the male and female students in the group had a wide range of height, weight and activity levels, they were compared together.

Table 5 outlines the dietary instruments used in the study and how each instrument was completed.
Table 5
Description of subjects

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Sample Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Frequency Questionnaire (FFQ)</td>
<td>209</td>
<td>students who attended class on day of FFQ administration</td>
</tr>
<tr>
<td>3 Day Diet Records (3DRs) Regression</td>
<td>209</td>
<td>records of students who completed FFQ, coded by researchers; students who completed these called regression students</td>
</tr>
<tr>
<td>Cross-validation</td>
<td>135</td>
<td>3 day diet records of students who did not complete FFQ, coded by students; the students who completed these called cross-validation students</td>
</tr>
<tr>
<td>Fat Factor Short</td>
<td>191</td>
<td>students randomly assigned to FF Short as available from both sections which contained the regression and cross-validation students</td>
</tr>
<tr>
<td>Fat Factor Long</td>
<td>150</td>
<td>students randomly assigned to FF Long as available from both sections which contained the regression and cross-validation students</td>
</tr>
</tbody>
</table>

**FOOD FREQUENCY QUESTIONNAIRE**

Students completing the FFQ did so within 12 to 15 minutes. The only question pertaining to the foods listed was asked by two students: should they consider skim milk (not listed on the FFQ) equivalent to two percent milk? The students were told to respond only if they consumed 2% milk.
The outcomes of the frequency of consumption of the 24 foods from the FFQ are indicated in Table 6. Bread was consumed the most often. The cumulative frequency for bread of all students who completed the FFQ was 685. In contrast, the cumulative frequency for pork chops, the food consumed least often on the FFQ, was 37. However, it should be noted that foods with the highest frequencies do not necessarily represent the foods providing the most fat in the students' total diets.
Table 6
Food consumption frequencies of food frequency questionnaire

<table>
<thead>
<tr>
<th>Food</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread</td>
<td>3.22</td>
<td>0.82</td>
</tr>
<tr>
<td>Cheese</td>
<td>2.20</td>
<td>1.04</td>
</tr>
<tr>
<td>2% Milk</td>
<td>1.15</td>
<td>1.39</td>
</tr>
<tr>
<td>Cookies</td>
<td>1.09</td>
<td>0.94</td>
</tr>
<tr>
<td>French Fries/Hash Browns</td>
<td>1.00</td>
<td>0.84</td>
</tr>
<tr>
<td>Mayonnaise</td>
<td>0.97</td>
<td>1.05</td>
</tr>
<tr>
<td>Meat/Vegetable Pizza</td>
<td>0.96</td>
<td>0.82</td>
</tr>
<tr>
<td>Chocolate</td>
<td>0.96</td>
<td>0.90</td>
</tr>
<tr>
<td>Creamy Salad Dressing</td>
<td>0.95</td>
<td>0.99</td>
</tr>
<tr>
<td>Margarine/Butter</td>
<td>0.90</td>
<td>1.23</td>
</tr>
<tr>
<td>Fried Chips</td>
<td>0.89</td>
<td>0.95</td>
</tr>
<tr>
<td>Hamburger</td>
<td>0.82</td>
<td>0.82</td>
</tr>
<tr>
<td>Peanut Butter</td>
<td>0.81</td>
<td>1.02</td>
</tr>
<tr>
<td>Eggs, Fried/Scrambled</td>
<td>0.55</td>
<td>0.80</td>
</tr>
<tr>
<td>Whole Milk</td>
<td>0.54</td>
<td>1.10</td>
</tr>
<tr>
<td>Soft Ice Milk</td>
<td>0.52</td>
<td>0.91</td>
</tr>
<tr>
<td>Frozen Yogurt</td>
<td>0.50</td>
<td>0.74</td>
</tr>
<tr>
<td>Fried Chicken</td>
<td>0.49</td>
<td>0.70</td>
</tr>
<tr>
<td>Hard Ice Cream</td>
<td>0.47</td>
<td>0.72</td>
</tr>
<tr>
<td>Iced Cake</td>
<td>0.36</td>
<td>0.61</td>
</tr>
<tr>
<td>Hot Dog</td>
<td>0.34</td>
<td>0.63</td>
</tr>
<tr>
<td>Roast Beef</td>
<td>0.31</td>
<td>0.61</td>
</tr>
<tr>
<td>Bacon/Sausage</td>
<td>0.24</td>
<td>0.53</td>
</tr>
<tr>
<td>Pork Chops</td>
<td>0.17</td>
<td>0.47</td>
</tr>
</tbody>
</table>

¹ scale on FFQ: 0 = monthly or never 1 = about once/week 2 = two or more times/week 3 = once/day 4 = two or more times/day.
THREE DAY DIET RECORD ANALYSES

The mean dietary fat intake was calculated for students who completed the FFQ (N = 211). The fat intakes for 209 students ranged from 11-297 g; the mean intake was 76. Two students reported 453 and 338 g fat and were deleted. This level was judged to be an error of calculation or a fat level of consumption for which the assessment tool is inappropriate. Reliability tests for consistency in coding and portion sizes were done between the two coders on four occasions. Results of 98-100% reliability indicated consistency in coding.

Fat intake data from the 3DRs of students who did not complete the FFQ were recorded. Based on GTA's grading for accuracy, 135 3DRs could be used.

DEVELOPMENT OF FAT FACTORS

Two methods of statistical analysis were performed to develop two food lists for two variations of the Fat Factor: FF Short and FF Long.

Development of the Short Fat Factor Stepwise multiple regression of the frequency of consumption of the 24 foods on the FFQs and the fat gram levels from the same students who completed the FFQ identified the six foods that most effectively predicted fat in the diet (Table 7). These foods were placed on the Short Fat Factor model (FF Short).
Table 7
Stepwise multiple regression results

<table>
<thead>
<tr>
<th>Food</th>
<th>Mean Regression Coefficient</th>
<th>SEM</th>
<th>t</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Dog</td>
<td>16.8</td>
<td>4.1</td>
<td>4.1</td>
<td>0.00</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>12.0</td>
<td>3.6</td>
<td>3.3</td>
<td>0.00</td>
</tr>
<tr>
<td>Roast Beef</td>
<td>8.6</td>
<td>4.1</td>
<td>2.1</td>
<td>0.04</td>
</tr>
<tr>
<td>Fried Chips</td>
<td>6.1</td>
<td>2.8</td>
<td>2.2</td>
<td>0.03</td>
</tr>
<tr>
<td>Cheese</td>
<td>4.8</td>
<td>2.4</td>
<td>2.0</td>
<td>0.04</td>
</tr>
<tr>
<td>Bacon/Sausage</td>
<td>9.7</td>
<td>4.8</td>
<td>2.0</td>
<td>0.04</td>
</tr>
<tr>
<td>(Intercept)</td>
<td>43.7</td>
<td>5.6</td>
<td>7.7</td>
<td>0.00</td>
</tr>
</tbody>
</table>

To score the short FF, students first indicated their frequency of consumption (F) for each food. Next, they multiplied the F by the multiplier (M). The multiplier determined from the stepwise multiple regression was listed for each food on the short form. Each M was rounded to the nearest whole number for ease of multiplication. Third, the students summed the (F × M) for all six foods. Finally, they added the intercept of the regression equation, 43.7, rounded to 44 for ease of addition. Therefore, a person who did not eat any of the six foods would have a value of 44 grams of fat when using the Short FF; the maximum value possible for the FF Short was 320 grams of fat.

**Development of the Long Fat Factor** Correlation coefficients (r) were also determined from comparing of the frequency of consumption of the 24 foods on the FFQs with the fat gram levels from the 3DRs of the students who completed the
Twelve foods of the 24 were correlated with fat from the 3DRs at levels of \( p \leq 0.01 \) (Table 8). The foods obtained from this method all had a medium fat content and were slightly to moderately correlated with fat intake. These foods in themselves accounted for a meaningful percentage of fat in the diet. The 12 foods were placed on the long Fat Factor (FF Long).

---

**Table 8**
Correlation coefficients\(^1\) between food frequencies and mean fat intake of students completing food frequency questionnaire

<table>
<thead>
<tr>
<th>Food</th>
<th>( r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Dog</td>
<td>0.42</td>
</tr>
<tr>
<td>Fried Chips</td>
<td>0.36</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>0.35</td>
</tr>
<tr>
<td>French Fries</td>
<td>0.32</td>
</tr>
<tr>
<td>Hamburger</td>
<td>0.31</td>
</tr>
<tr>
<td>Bacon(\backslash)Sausage</td>
<td>0.28</td>
</tr>
<tr>
<td>Eggs(^*)</td>
<td>0.26</td>
</tr>
<tr>
<td>Cheese</td>
<td>0.24</td>
</tr>
<tr>
<td>Roast Beef</td>
<td>0.23</td>
</tr>
<tr>
<td>Iced Cake</td>
<td>0.23</td>
</tr>
<tr>
<td>Whole Milk</td>
<td>0.20</td>
</tr>
<tr>
<td>Pizza(^b)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

\(^1\) = significant at \( p \leq .01 \)
\(^*\) = fried or scrambled
\(^b\) = meat and vegetable

---

A four step process was used to determine the multiplier for each food.

34
1. The fat grams per serving of the 12 foods were obtained from the USDA Home and Garden Bulletin #72 (55).

2. The fat grams in each food were multiplied by the frequencies rated in the FFQ and summed.

3. The mean fat grams from the 3DRs of the students who completed the FFQ were divided by the sum from step 2. The ratio was 0.677.

4. The ratio was multiplied by the fat grams per serving of each food. The product for each food was the M for each food.

The minimum predictive value of the FF Long was 0 g of fat; the maximum value was 432 g fat.

**CROSS-VALIDATION OF FAT FACTORS**

The short and long FFs were administered to all students in the two sections on December 4, 1992. Based on random assignment, regression and cross-validation students completed either the Short or Long Fat Factor. In both sections, the FFs were completed without additional questions, suggesting ease of understanding.

The results generated from the short and long FF models were compared to the mean fat determined from the 3DRs of the regression and cross-validation students to test the predictive ability of each Fat Factor. Responses of the regression students were expected to be similar to their earlier completion of the FFQs; comparisons with the cross-validation students would be better indicator of the predictability of the
two food lists. Both the short and long FFs were moderately correlated with fat intake from the 3DRs of the regression and cross-validation students (Table 9).

<table>
<thead>
<tr>
<th>Fat Factor</th>
<th>Students</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regression *</td>
<td>Cross-Validation b</td>
</tr>
<tr>
<td>Short</td>
<td>0.36 (N = 115)</td>
<td>0.46 (N = 76)</td>
</tr>
<tr>
<td>Long</td>
<td>0.55 (N = 91)</td>
<td>0.40 (N = 59)</td>
</tr>
</tbody>
</table>

* = students who completed FFQ  
\( b = \) students who did not complete FFQ

The best correlation \((r = 0.55)\) was between the FF Long and the regression students. The highest correlations were expected for students whose food information was used to create the tool. However, the lowest correlation, between the FF Short regression students, is an anomaly which cannot be explained. The FF Short had a higher correlation than the FF Long for the cross-validation group of students, implying that the short version was at least as good as the FF Long.

Statistical tests (\(t\)-tests and two-way analysis of variance) were calculated to determine if significant differences in predictability existed between the short and long FFs completed by either the regression or cross-validation students. To test how well the short and long FFs predicted fat intake, the mean absolute difference (MAD) or
absolute value of the difference of the fat g from the 3DRs of all students minus the results of the FF Short and FF Long was determined (mean fat intake from 3DR - mean fat from Fat Factor). The MAD represented the degree of error and measured how close (higher or lower) either FF came to predicting the fat intake from the 3DRs. A two-way ANOVA determined whether the differences between combinations of variables were significant (Table 10).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample Size</th>
<th>Mean Absolute Difference</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fat Factor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short (FF Short)(^1)</td>
<td>191</td>
<td>35.59</td>
<td>25.83</td>
</tr>
<tr>
<td>Long (FF Long)(^2)</td>
<td>150</td>
<td>40.37</td>
<td>33.51</td>
</tr>
<tr>
<td><strong>3 Day Diet Record</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regression (3DR-R)(^a)</td>
<td>135</td>
<td>33.87</td>
<td>26.74</td>
</tr>
<tr>
<td>Cross-Validation (3DR-CV)(^b)</td>
<td>206</td>
<td>43.51</td>
<td>32.55</td>
</tr>
<tr>
<td><strong>FF &amp; 3DR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FF Short &amp; 3DR-R</td>
<td>115</td>
<td>33.57</td>
<td>25.72</td>
</tr>
<tr>
<td>FF Short &amp; 3DR-CV</td>
<td>76</td>
<td>38.63</td>
<td>25.87</td>
</tr>
<tr>
<td>FF Long &amp; 3DR-R</td>
<td>91</td>
<td>34.25</td>
<td>28.11</td>
</tr>
<tr>
<td>FF Long &amp; 3DR-CV</td>
<td>59</td>
<td>49.90</td>
<td>38.86</td>
</tr>
</tbody>
</table>

\(^1\) = FF from stepwise multiple regression  
\(^2\) = FF from \textit{ad hoc} analysis  
\(^a\) = students who completed food frequency questionnaire  
\(^b\) = students who did not complete food frequency questionnaire
The long and short FFs completed by the regression students predicted fat intake significantly better than the short and long Fat Factors completed by the cross-validation students. However, there were no significant differences between the results from both FFs completed by the cross-validation and regression students. Shorter dietary assessment tools are preferred over longer tools for ease of completion. Therefore, similar to the results involving correlation coefficients, it was concluded that the FF Short was at least as effective as the FF Long and therefore preferable.

Even though there was no significant difference between the short and long FF, \( t \) tests were conducted to further evaluate the differences in the results of the short and long FF which were completed by the cross-validation and regression students (Table 11). The results of the FF Short completed by the cross-validation students approached a significant difference from the cross-validation students who completed the FF Long (\( p \leq 0.06 \)).
Table 11
Results of t tests to determine differences between Short and Long Fat Factors

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sample Size</th>
<th>Mean Absolute Difference</th>
<th>Probability &gt; t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression students(^a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FF Short(^1)</td>
<td>115</td>
<td>33.57</td>
<td>0.86</td>
</tr>
<tr>
<td>FF Long(^2)</td>
<td>91</td>
<td>33.25</td>
<td></td>
</tr>
<tr>
<td>Cross-Validation students(^b)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FF Short(^1)</td>
<td>76</td>
<td>38.63</td>
<td>0.06</td>
</tr>
<tr>
<td>FF Long(^2)</td>
<td>59</td>
<td>49.80</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) = FF determined by stepwise multiple regression  
\(^2\) = FF determined by ad hoc method  
\(^a\) = students who completed food frequency questionnaire  
\(^b\) = students who did not completed food frequency questionnaire

The difference, though not statistically significant, reaffirms that the stepwise multiple regression procedure to determine the foods for the FF Short, was consistently the better predictor of dietary fat for the cross-validation students.

The research results indicated that a tool with six foods is the preferred predictor of dietary fat for this student population. The six foods, correlated from a 24 item food frequency questionnaire and fat intake from 3DRs, along with a scoring method, represented a convenient indicator of dietary fat intake. The process developed a list of foods for a fat rapid assessment methodology. The process could be applied on any population.
The four objectives of the research were accomplished to meet the purpose of the research:

1. A 24 item food frequency questionnaire was developed using NHANES II and VT databases.

2. Three day diet records were collected from the students who completed the FFQ and the mean dietary fat was determined.

3. Data from objectives one and two were compared to generate two lists of six and 12 foods for the Fat Factor Short and Fat Factor Long tool.

4. The results of the short and long FFs were compared to the fat intake of the students who did not complete the FFQ to determine the better predictor of fat intake.
CHAPTER V
DISCUSSION

GOALS

The goal of this study was to develop a tool which could predict the dietary fat intake of the students. Comparing the average fat intake from 3DRs with the frequencies from a FFQ completed by the same students generated a list of six foods. These foods were placed on the short Fat Factor (FF Short) form. The results of the FF Short were compared to the fat analyzed from diet records to assess the predictive power of the FF Short. The FF Short list of six foods can predict fat intake with an average error of 39 ± 26 grams. For example, based on calculation of standard error of prediction, about two-thirds of individuals eating 76 g of fat would calculate between 45 and 107 g of fat from the FF. The prediction ability would range from 41% to 141% of actual intake. Although some students would be incorrectly classified, the FF Short still is a reliable way to quickly select students for further nutrition education. By the nature of the research, only individuals who eat at least one of the foods listed on the FF would benefit from the screener.

OTHER SCREENERS

The FF Short, and any tool developed using the same process, is limited to the population which was used to create it. Several other studies have reported procedures to generate short FFQs and rapid assessment methods (RAMs). Block et al. (25) developed a dietary assessment method with 13 foods which screened for
women eating a mean high fat diet. The correlation coefficient between the fat scored by the method and fat grams from a four day diet record was \( r = 0.58 \). The tool developed by Block et al. (25) identified 82% of the population as eating a high fat diet. The researchers did not indicate their method of validation.

Byers et al. (43) used a similar method involving stepwise multiple regression to identify foods providing the majority of dietary fat. The researchers found that 17 foods would indicate 90% of the variance of dietary fat. Excluding the five foods which provided the most fat in the diet would lower the predictive ability of the list to 52%. Unfortunately, the lists generated were not tested on the population to validate the process.

The six foods in the FF Short are compared to previous short screens for fat (Table 12); all lists share similar elements. In every instance, two of the top four foods were meats, and the majority were processed. Unfortunately, names such as snack foods were not always described.

According to Fleming et al. (56), primary sources of fat change with age, though the same foods tend to stay in the top positions. For example, milk is the primary contributor of fat in the first few years of life, but its’ contribution of fat to the diet decreases as individuals age. They stated that grain based foods (i.e. pizza) are the highest contributor of fat in 12-19 year olds. This seems to support sausage and cheese on the short FF because of their overwhelming fat contribution to pizza.
Table 12  
Comparison of the Short Fat Factor with other studies

<table>
<thead>
<tr>
<th>Short Fat Factor</th>
<th>Block et al. (25)</th>
<th>Byers et al. (43)</th>
</tr>
</thead>
<tbody>
<tr>
<td>hot dog</td>
<td>hamburgers</td>
<td>roast beef</td>
</tr>
<tr>
<td>ice cream</td>
<td>beef steaks</td>
<td>pies</td>
</tr>
<tr>
<td>bacon/sausage</td>
<td>pork</td>
<td>cookies</td>
</tr>
<tr>
<td>fried chips</td>
<td>hot dogs</td>
<td>pepperoni</td>
</tr>
<tr>
<td>cheese</td>
<td>ham/lunch meats</td>
<td>whole milk</td>
</tr>
<tr>
<td>roast beef</td>
<td>whole milk cheese</td>
<td>sausage</td>
</tr>
<tr>
<td></td>
<td>doughnuts/cookies/</td>
<td>peanuts</td>
</tr>
<tr>
<td></td>
<td>cake/pastries</td>
<td>steak</td>
</tr>
<tr>
<td></td>
<td>eggs</td>
<td>eggs</td>
</tr>
<tr>
<td></td>
<td>white bread/rolls</td>
<td>hamburger</td>
</tr>
<tr>
<td></td>
<td>margarine/butter</td>
<td>hard cheese</td>
</tr>
<tr>
<td></td>
<td>salad dressing/</td>
<td>cocoa</td>
</tr>
<tr>
<td></td>
<td>mayonnaise</td>
<td>cooked cereal</td>
</tr>
<tr>
<td></td>
<td>french fries/fried</td>
<td>salami</td>
</tr>
<tr>
<td>potatoes</td>
<td></td>
<td>potatoes</td>
</tr>
</tbody>
</table>

1 = foods in descending order

ADOLESCENT FAT INTAKE

Witschi et al. (7) determined fat intake of male adolescents as 115± 43 g fat; females as 79.4± 36 g fat. Block et al. (46) and Byers et al. (43) determined the percentage of calories from fat and did not indicate the mean fat intake. The 3DRs of both the regression and cross-validation subjects determined a mean fat intake of 69 ± 40 g fat; the FF Short measured a mean of 97 ± 28 g fat. No direct comparison
of the average fat intake levels and primary sources of fat is available for college students.

FAT SCREENER CONSIDERATIONS

Students were aware of portion sizing from the examples in their course supplement, from demonstration utensils and tableware during the FFQ administration, and from two-dimensional abstract pictures on the short FF. Portion size training has increased the accuracy of diet assessment tools (49). Although further study on training with models could be completed, the current procedure included models on portion sizing.

Chalmers et al. (27) noted college students ate significantly different diets on weekends. Students completed their 3DRs using one weekend day to increase the validity of the 3DRs to their actual food intake. Curtis, Musgrave and Klimis-Tavantzis (40), suggest using identical databases to assure consistency in the contribution of fat when correlating similar data. Both the foods on the FFQ and FF Short and FF Long were generated from databases which contained the same foods.

The foods chosen to be on the FFQ may not have represented the type of foods that the students were eating. The list of foods was limited by general food names (i.e. cheese, steak). Interpretations of the foods would be limited to the population and cultural choices.
IMPLICATIONS

The FF Short was developed to create a predictor of dietary fat. The tool would be useful in screening subjects for further nutrition education purposes. The FF Short serves the purpose of identifying clientele for further nutrition education. The process used to develop the FF Short appears to be effective and could be applied to other nutrients for short assessment tools, limited only by simple reading and math skills.

To make the tool useful, the fat predicted from the short FF can be interpreted by the use of charts and dietary guideline information. To interpret fat intake levels, fat intake alone is only part of the information needed. The client would need to compare fat intake to total kilocalorie intake and to activity patterns. For example, an intake of 90 g fat is high (≥ 30% of kcals) for a sedentary individual consuming 1,200-1,600 kcals. However, 90 g fat is adequate (≤ 30% of kcals) for individuals eating 2,600-3,200 kcals (57).

SUMMARY

The research developed a process for determining a food list and scoring system for a rapid assessment method for a single nutrient such as fat. By combining national research results on fat use with local food patterns, food lists can be generated to predict intake of a specific nutrient.
LITERATURE CITED


Appendix A

CERTIFICATION OF EXEMPTION OF PROJECTS INVOLVING HUMAN SUBJECTS

Principal Investigator: Virginia A. Veazey

Department: Human Nutrition and Foods

Project Title: Creation and Validation of a Fat RAW using VT

Undergraduate HNF 1004 Students

Source of Support: Departmental Research, Sponsored Research

1. The criteria for "exemption" from review by the IRB for a project involving the use of human subjects and with no risk to the subject is listed below. Please initial all applicable conditions and provide the substantiating statement of protocol.

X a. The research will be conducted in established or commonly established educational settings, involving normal education practices. For example:
1) Research on regular and special education instructional strategies;
2) Research on effectiveness of instructional techniques, curricula or classroom management techniques.

X b. The research involves survey or interview procedures, in which:
   1) Subjects cannot be identified directly or through identifiers with the information;
   X 2) Subjects responses, if known, will not place the subject at risk of criminal or civil liability or be damaging to the subject's financial standing or employability.
   3) The research does not deal with sensitive aspects of subject's own behavior (illegal conduct, drug use, sexual behavior or alcohol use);
   4) The research involves survey or interview procedures with elected or appointed public officials or candidates for public office.

2. I further certify that the project will not be changed to increase the risk or exceed exempt condition(s) without filing an additional certification or application for approval by the Human Subjects Review Board.

Virginia A. Veazey Oct 2, 1992

Signature: Principal Investigator, date

(Optional Approval) Signature: Board Chairman

Authorized Reviewer, date

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Appendix B
Food Frequency Questionnaire

I. Print your name above.
II. Code your social security number in the ID Number section.
III. Write your height in the COURSE section.
IV. Code your weight in pounds in the SEAT NO. section, begin with a 0 if you weigh less than 100 pounds.
V. Code an A in the FORM section if you are a woman; a B if you are a man.
VI. Which of the following best fits or describes your usual level of physical activity?
   Respond under GROUP (to the right of SEAT).
   1 = sedentary - a lot of studying/watching TV, driving not walking.
   2 = moderate activity - substantial walking, fairly regular non-strenuous sports/dancing.
   3 = high activity - frequent heavy exercise or work for an hour or more.
VII. Questions 1-24 are a list of foods. Please note the serving size beside each food (and use the model displays and the overheads). Tell how often you eat the following using these choices for frequency.
   1 = monthly or never
   2 = about once a week
   3 = two or more times a week
   4 = once a day
   5 = two or more times a day

FOODS
1 bacon or sausage: 3 strips, 1 patty
2 roast beef: 3 oz
3 bread: 2 slices, 1 roll, bun, or bagel
4 cake with icing: 1 1/2" slice
5 cheese: 1 oz slice or cube
6 chocolate: 1 oz
7 cookies: 2 med (typical bought cookie)
8 creamy salad dressing: 1 tablespoon
9 eggs, fried or scrambled: 2 med, 2/3 cup
10 french fries or hash browns: 1 med svg (fast food)
11 fried chicken: 1 breast piece, 2 legs or thighs, 3 wings
12 fried chips (potato, corn): 1 oz package
13 ice cream, hard: 1 cup
14 ice milk, dining hall soft serve: 1 cup
15 hamburger: 3 oz, cooked (1/4 pounder)
16 hot dog: 1 dog
17 margarine or butter: 1 teaspoon
18 mayonnaise: 1 tablespoon
19 milk, whole: 1 cup
20 milk, 2%: 1 cup
21 peanut butter: 2 tablespoons
22 pizza, meat and vegetable: 2 slice (from large)
23 frozen yogurt, medium size: 7 oz
24 pork chops: 3 oz
Appendix C
Signs and overheads from portion size training

SMALL BOWL

3/4 CUP
(TO RIM)

SMALL BOWL

1 CUP
(HEAPED)
SMALL LADLE
1 TABLESPOON

SMALL SPOON
1 TABLESPOON
SMALL LADLE
1 TABLESPOON

SMALL SPOON
1 TABLESPOON
LARGE LADLE
1 2/3 TABLESPOON

LARGE SPOON

3/4 CUP
1 ounce is approximately 2/3 of these candy bars.
# THREE DAY FOOD INTAKE RECORD

**NAME**  GHOOPIE WHOLDBERG                      **DATES OF FOOD INTAKE RECORDS:**

**CLASS TIME:**  □ 9:00 AM  □ 1:00 PM  □ 2:00 PM  **DAY 1  7/22**  **DAY 2  7/23**  **DAY 3  7/24**

<table>
<thead>
<tr>
<th>AMOUNT</th>
<th>ITEM NUMBER*</th>
<th>FOOD/DRINK</th>
<th>TOTAL NUMBER OF SERVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fruits  Leafy Vegetables  Breads/Carbohydrates  Milk/Milk Products  Meat/Meat Alternates  Limited Extras</td>
</tr>
<tr>
<td>Day 1</td>
<td>Day 2</td>
<td>Day 3</td>
<td>3 Day Total</td>
</tr>
<tr>
<td>2 oz</td>
<td>2 oz</td>
<td>2 oz</td>
<td>2 oz</td>
</tr>
<tr>
<td>1 oz</td>
<td>1 oz</td>
<td>1 oz</td>
<td>1 oz</td>
</tr>
<tr>
<td>1 oz</td>
<td>1 oz</td>
<td>1 oz</td>
<td>2 oz</td>
</tr>
<tr>
<td>1 T</td>
<td>1 T</td>
<td>2 T</td>
<td>2 T</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2 T</td>
<td>2 T</td>
<td>2 T</td>
<td>2 T</td>
</tr>
<tr>
<td>20 oz</td>
<td>8 oz</td>
<td>16 oz</td>
<td>24 oz</td>
</tr>
<tr>
<td></td>
<td>1 T</td>
<td>1 T</td>
<td>1 T</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>14 oz</td>
<td>10 oz</td>
<td>4 oz</td>
<td>18 oz</td>
</tr>
<tr>
<td>3 oz</td>
<td>2 oz</td>
<td>3 oz</td>
<td>4 oz</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>4 oz</td>
<td>4 oz</td>
<td>4 oz</td>
<td>4 oz</td>
</tr>
</tbody>
</table>

This "number" is from your **DIET RECORD FORM AND FOOD LIST** which comes with your textbook. Including this "number" is optional as you may fill the "number" from your **NET SIMPLE** software computer disk. Note: Do not use the numbers from the Appendix A in your text. These numbers are different from the software computer disk.
Appendix E
Two-dimensional food abstractions

Meat and Meat Alternates
Protein Foods
2 servings
One serving =
2 to 3 ounces of lean cooked meat, poultry, or fish—all without bone; 2 eggs, 1 cup cooked dry beans, dry peas, or lentils; 4 tablespoons peanut butter; 1/4 block tofu.

Breads and Cereals
B Vitamin Foods
4 servings
(enriched or whole grain)
One serving =
1 slice of bread; 1 ounce ready-to-eat cereal, 1/2 to 3/4 cup cooked cereal, cornmeal, grits, macaroni, noodles, rice, or spaghetti.
Fruits and Vegetables

Vitamin A & C Foods
4 servings
Include:
— a citrus fruit, papaya, or other vitamin C source daily.
— a dark-green or deep-yellow vegetable for vitamin A at least every other day.
— other vegetables and fruits, including potatoes.

Milk Foods

Calcium Foods
Children 2 to 3 servings
Adults 2 servings
Pregnancy 3 servings
One serving =
8 oz. milk (whole, 2%, buttermilk or skim), 4 oz. evaporated milk, 2 one-inch cubes or 2 oz. of cheese, 1 1/2 cups cottage cheese, 1 1/2 cups ice cream, 1/2 block tofu, 8 oz. yogurt.

1 Tablespoon
(15 ml.)
Appendix F

DIRECTIONS FOR ACTIVITIES RECORD AND THREE DAY FOOD INTAKE RECORD

A. Activities Record (Note: Example on page 4)

1. Record all of your activities for one 24 hour week day beginning when you get up in the morning until the same time the next day. Do not record activities for a weekend day, i.e. Saturday or Sunday. Use the Activities Record sheet on page 5.

2. Select your activities from the list on page 6. Any activity not included on this list should be matched as close as you can to an activity that is on the list (in other words, an activity that you think most resembles your activity). For example, not many people go disco dancing anymore, but any activity resembling vigorous dancing could fall under this category.

3. Try to be as accurate as possible in recording your beginning and ending times. If an activity is repeated, you will not have to summarize before entering it on the computer (see page 13 for computer availability).

4. Your total minutes for the 24 hours should be 1440 minutes.

B. Three Day Food Intake Record (Note: Example on pages 7-8)

1. Using the Three Day Food Intake Record sheets on pages 9-10, record everything you eat or drink (except water) for 3 consecutive days including one weekend day (Saturday or Sunday). Include gum, candies, snacks, etc., from getting up to going to bed (6 a.m. to 6 a.m. the next day). If you consume processed foods (e.g. cake mix, canned beef stew, pop tarts), keep the package so you can use the label to assist in identifying the food item or a similar item on the computer software - see page 13 for computer availability.

2. In the amount columns, indicate the total quantity of each food eaten for each day. Estimate as accurately as possible in cups, teaspoons, tablespoons, grams, ounces, slices (bread), etc. for recording purposes. If the dish includes more than one ingredient, break it down. Examples: spaghetti sauce, noodles, meat, cheese. (Conversion tables for different volumes and other measurements are found on pages 11-12.) Calculate your three day total for each item and record in the appropriate column.

3. Record the number of servings for each food/drink you've listed under the appropriate column. If your food/drink doesn't fit under one of the five food groups, place a (X) under the Limited Extras column. To determine the appropriate food group and serving size see page 46 of your textbook and pages 12-13 of your HNP 1004 Supplement.

4. Try to eat what you would ordinarily eat. Knowing you have to record the food will undoubtedly make some difference in your choices. Try to keep this effect to a minimum. Remember, you will NEVER be graded on what or how much you eat.

5. It is easier to record the food you eat as you eat it or immediately after. This is so you don't forget the little things like margarine, salad dressing, sugar, beverages, etc.

6. This food intake record is to give you an idea of your usual daily intake. It will be the basis for your term project, which will be explained in class.
7. If you take any vitamin or mineral supplements, record the brand name and amount (e.g. dosage such as mg.) of each of the indicated vitamins/minerals and check (√) the day you took the supplement.

C. Your activities record and three day food intake record are due September 9, 1992. Make certain you have completed the information at the top of each page (name, class time, and date). Your records will be checked and returned to you at a later date for your use in the term project. Specifically you may pick up your "checked" Food Intake Record and Activities Record on September 28 from Room 339 Wallace. Remember, points will be taken off for each day it is late, excluding weekends.
### APPENDIX G
Ambiguous Food and Beverage Items

**Recorded by Student**
- beans
- beer
- bread
- burrito
- canned fruit
- carrots/broccoli/spinach
- peas/beans

- cereal
- cheese
- chicken
- cookie
- crackers
- cream cheese "cover bagel"
- dip/vegetable dip
- dogs
- dressing/salad dressing
- egg
- french fries
- fried chicken
- fruit juices

- hamburger/ground beef
- ice cream
- juice
- Kool-aid or punch
- lemonade

- lunch meat
- meatballs
- milk
- noodles/pasta without
- spaghetti or tomato
- sauce listed
- peas
- pie, apple

**Coded by Investigator**
- cooked frozen green beans
- regular beer
- enriched white bread
- beef burrito
- canned fruit in heavy syrup
- assumed cooked unless adjacent
- items included salad dressing or vegetable dip
- Kellogg’s bran flakes cereal
- American cheese
- roasted, all parts
- chocolate chip, baked from mix
- Keebler club crackers
- 1 tsp. regular cream cheese

- French onion dip
- fast food hot dog with bun
- French dressing
- boiled egg, 50 grams
- McDonald’s medium french fries
- batter-dipped, fried all parts
- reconstituted from frozen concentrate
- fried ground beef, medium fat
- chocolate ice cream, 10% milk fat
- frozen reconstituted orange juice
- powdered, reconstituted fruit punch
- powdered lemonade, reconstituted with water
- boiled ham
- meatloaf
- whole milk
- enriched cooked macaroni

- green peas, cooked from frozen home recipe
pizza
popcorn
potato
roast beef
salad
soda
spaghetti
spaghetti sauce
steak
tuna fish
turkey
yogurt
white rice/rice

cheese pizza
Pop Secret, butter flavor
medium baked potato
bottom, lean/fat
from recipe
regular cola
enriched cooked spaghetti
Prego, regular
broiled sirloin steak, lean and fat
oil-packed tuna fish
turkey roll, light and dark
mixed fruit, custard style
white long-grain rice
Appendix H
Short Fat Factor

Name____________________________________  SS#____________________

Step 1. In the F column below fill in the corresponding number to how often you eat each food. Use the illustrations to help determine your serving size.

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = never</td>
<td></td>
</tr>
<tr>
<td>1 = weekly</td>
<td></td>
</tr>
<tr>
<td>2 = two or more times a week</td>
<td></td>
</tr>
<tr>
<td>3 = daily</td>
<td></td>
</tr>
<tr>
<td>4 = 2 or more times a day</td>
<td></td>
</tr>
</tbody>
</table>

1 oz. cheese or luncheon meat

3 oz. roast beef, hamburger

1 slice this thick
2 slices this thick
3 oz. meat

1 oz. cube = 1 oz. cheese

Hot Dog (1 link) F X 17 =
Ice Cream (1 cup) F X 12 =
Bacon/Sausage (3 stripes/1 patty) F X 10 =
Roast Beef (3 oz. lean and fat) F X 9 =
Chips (1 oz. corn or potato) F X 6 =
Cheese (1 oz) F X 5 =

F X 44 +

Total Score

Step 2. Multiply your F number times the number to get each food’s score.

Step 3. Add all of the foods’ scores.

Step 4. Add 44 to get your Total Score.
Appendix I
Long Fat Factor

Name _______________________________ SS# _______________________________

Step 1. In the F column below, fill in the number corresponding to how often you eat each food. Use the illustrations to help determine your serving sizes.

<table>
<thead>
<tr>
<th></th>
<th>0 = never</th>
<th>1 = weekly</th>
<th>2 = two or more times a week</th>
<th>3 = daily</th>
<th>4 = 2 or more times a day</th>
</tr>
</thead>
</table>

- 1 oz. cheese or luncheon meat
- 3 oz. roast beef, hamburger
- 1" cube = 1 oz. cheese

1 slice this thick
2 slices this thick

<table>
<thead>
<tr>
<th>Food</th>
<th>F</th>
<th>1 slice Cake (1.5&quot;)</th>
<th>1 oz. Cheese</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hot Dog Link</td>
<td></td>
<td></td>
<td>X 6 =</td>
</tr>
<tr>
<td>2 Fried/Scrambled Eggs</td>
<td></td>
<td></td>
<td>X 6 =</td>
</tr>
<tr>
<td>3 Bacon strips/1 Sausage patty</td>
<td></td>
<td></td>
<td>X 6 =</td>
</tr>
<tr>
<td>1 med order of French Fries</td>
<td></td>
<td></td>
<td>X 10 =</td>
</tr>
<tr>
<td>1 oz. Corn/Potato Chips</td>
<td></td>
<td></td>
<td>X 12 =</td>
</tr>
<tr>
<td>2 slices Meat &amp; Vegetable Pizza</td>
<td></td>
<td></td>
<td>X 15 =</td>
</tr>
<tr>
<td>1 cup Ice Cream</td>
<td></td>
<td></td>
<td>X 6 =</td>
</tr>
<tr>
<td>3 oz. Roast Beef</td>
<td></td>
<td></td>
<td>X 6 =</td>
</tr>
<tr>
<td>3 oz. Hamburger</td>
<td></td>
<td></td>
<td>X 6 =</td>
</tr>
<tr>
<td>1 cup Whole Milk</td>
<td></td>
<td></td>
<td>X 6 =</td>
</tr>
<tr>
<td>1 oz. Cheese</td>
<td></td>
<td></td>
<td>X 6 =</td>
</tr>
</tbody>
</table>

SUBTOTAL ______________________ SUBTOTAL ______________________

Step 2. Multiply your F number times the number to the right of each food to get each food score.

Step 3. Add the 2 columns' SUBTOTALS: ____ + _____ = _______ your GRAND TOTAL.
VITA

Virginia Veazey was born in Bethesda, MD in March of 1966. She graduated from King George High School in June, 1984. The fall of that year, she attended James Madison University and graduated in May, 1988 with a B.S. in nutrition and dietetics. During the spring of 1990, she began her masters degree work part-time at the Northern VA campus of VA Tech, intent on completing a masters degree in nutrition. During the spring semester of 1991, she transferred to Blacksburg and continued her class work, concentrating on community nutrition. After completing her degree, she joined her best friend and husband, Wes Geertsema in Hawaii where they started their lives together in paradise.

Virginia A. Veazey