FITNESS LEVELS AND EATING HABITS IN YOUNG COLLEGE WOMEN

by

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INTRODUCTION

Nutrition is an important part of total wellness. In keeping with this philosophy, several major health organizations and governmental agencies have, in the last decade, suggested modifications for the average American diet. These include the U.S. Dietary Goals (1), Toward Healthful Diets (2), Dietary Guidelines for Americans (3), and recommendations set forth by the American Heart Association (4), and the National Cancer Institute (5). The basic messages imparted by these suggestions are that Americans should consume a variety of foods, including more complex carbohydrates, and limit consumption of dietary fat, refined and processed sugar, cholesterol, and sodium. In addition, Americans are advised to avoid being overweight.

Even though there are numerous studies on eating habits of athletes involved in various sports (6-10), there is little information on eating habits of individuals who are fitness-oriented but not necessarily involved in competition. One might anticipate that individuals who exercise regularly are also likely to adopt eating habits which they believe will contribute to a healthy lifestyle. On the other hand, food habits may be influenced by time constraints imposed by exercise, availability of food at

gymnasiums and fitness centers, or the attitude that "because I exercise I can eat anything I want".

Consequently, the objective of the following study was to examine the relationship between cardiovascular fitness and eating habits in young college women. College women were selected because of their availability and the belief that they would be particularly susceptible to fad diets and other unsound eating practices.

REVIEW OF LITERATURE

I. Physical Assessment of Individuals

Physical Fitness. Today's American adult is generally concerned about his or her physical fitness and is reasonably convinced that regular exercise is necessary for a healthy lifestlye (11). During the past decade, Americans in all age groups have increased their athletic participation. Seventeen million children and adolescents are participating in community-based, youth sports programs. Adults of all ages are becoming involved in many forms of recreational sports and competitive athletic programs. About 25 million individuals regularly participate in recreational distance running. Twenty to thirty million adults play tennis on a regular basis (12).

According to the Prevention Profile (excerpted from Health, United States, 1983), 35% of Americans 18-65 years of age participate in regular exercise (13). Other surveys show somewhat different statistics. The 1983 Readers Digest /Gallup Survey based on personal interviews with 1574 Americans 18 years and older, showed that 77% of American adults engage in some kind of physical exercise or sport, and 47% do so daily (14). This study also showed that college graduates were more likely to work out daily than those with less than a high school education, 55%

compared to 30%. A third study, The Prevention Index: A Report Card on the Nation's Health (1254 people), showed that 34% of Americans exercise strenuously three or more days a week. The groups most likely to get this level of exercise were under 30 years of age, college graduates, and considered themselves in excellent health (15).

Body Fat. Body composition is a good indicator of fitness. Skinfold measurements make it possible to estimate the percentage of the body that is comprised of fat. Some individuals who possess muscular body types have been shown to be overweight when compared to norms in height-weight charts, yet they have very little body fat. Because the amount of body fat, not the amount of weight, is the important factor in living a healthy life it is wise to use "overfatness" rather than "overweightness" as the measure (16).

Authorities are not in complete agreement with regards to the ideal amount of body fat. It is generally accepted that non-athletic males should carry 16% or less total fat and females about 23% or less total fat (17). Zuti and Corbin (18) tested over 3000 subjects between 17-20 years of age to develop fitness standards. They found that the amount of body fat of college freshman females (23%) corresponded closely with similar populations in

other studies. When comparing athletes to the average American, the athletes have lower levels of fatness (12).

Weight Control. Exercise is a valuable aid in weight control. Fifty-seven percent of adults who never exercise strenuously are overweight. Significantly fewer (40%) people who exercise strenuously three or more days a week are overweight (15).

An increase in physical activity enables an individual to maintain desirable weight or to reduce obesity. Exercise will help maintain a balance between energy intake and energy output.

II. National Nutrition Involvement

Nutrition is an important part of an individual's health habits. Over the last 10 years an increased interest in better nutrition resulted in efforts of various groups and governmental agencies to make suggested changes for the American diets. One guideline designed to assist in planning a healthy diet is the U.S. Dietary Goals, proposed in 1977 by the Senate Select Committee on Nutrition on Human Needs (1). The U.S. Department of Agriculture and U.S. Department Health, Education, and Welfare have also established (seven) guidelines as the basis for dietary guidance for the general public (3). The 1980 report Toward Healthful Diets from the Food and Nutrition Board

of the National Academy of Sciences urged Americans to consume a varied diet in moderation (2). The basic messages disclosed by these suggestions are that Americans should consume a variety of foods, including more complex carbohydrates, and limit consumption of dietary fat, refined and processed sugar, cholesterol, and sodium. Also, Americans are urged to avoid becoming overweight.

III. Nutritional Requirements of Fitness-Oriented Individuals

Nutrition is very important in athletic performance. The nutritional habits of individuals may either improve or interfere with performance. Most authorities agree that there is no basic difference in feeding an athlete and a nonathlete. The fundamental nutritional principles apply to both, but the athlete may need to vary energy intake depending on the demands of the sport (19). Manjarrez and Birrer (20) define the athlete's diet as one that is normal with regular meals, ample fluids, a variety of foods, and calorie intake sufficient to meet the demands of energy expenditure for the particular sport. McCutcheon (21) defines an optimal diet for athletes as one made up of a variety of foods from each of the four basic food groups (dairy products, meats, vegetables and fruits, and grains and cereals). The American Dietetic Association (22) considers a nutritionally adequate diet as one that provides

sufficient nutrients and energy to meet the metabolic needs for optimal functioning of the body. The Recommended Dietary Allowances for each age and sex category affords a margin of safety for most individuals and will furnish the needs of a person on a physical fitness program (23). In general, an ideal training diet should maintain energy balance and provide 10 to 15% of energy as protein, 30% as fat and 55 to 60% as carbohydrate (24).

Energy Needs. The most important part of an athlete's diet is caloric content (20). The most frequently encountered nutritional problem among athletes is failure to consume enough food energy. This results in involuntary weight loss and poor athletic performance (12). It is difficult to determine individual energy requirements because caloric needs involve a number of variables including body size, age, level of activity and basal metabolic rate. Adjustments may need to be made by athletes to maintain their weight. The American Dietetic Association (22) recommends that the athlete meet the increased caloric needs by selecting more "calories-plus-nutrients" foods. The increased caloric intake is best provided by foods high in complex carbohydrates such as bread, cereal, potatoes, rice, and pasta. High fat foods should be minimized.

Protein Needs. The Recommended Dietary Allowance for protein is 0.8 grams per kilogram of body weight (23). Most American diets contain excess protein; the average adult American consumes about 80 to 110 grams of protein daily (20). By measuring the urinary nitrogen, an estimate of protein metabolism can be made. Because urinary nitrogen increases very little with exercise under normal conditions, it is not considered an important source of energy. Only under conditions of starvation, when carbohydrates and fats have been completely utilized, is the protein utilized for energy (25). When an athlete is in hard training his protein needs will increase slightly. An endurance athlete training hard for an hour each day should obtain 1.0 to 1.2 g/kg/day and there are some estimates that the power athlete increasing bulk should get 1.3 to 1.6 g/kg/day (24). Because most Americans consume more protein than they require, and athletes in particular consume more calories, an increase in dietary protein is usually not warranted.

Carbohydrate Needs. Carbohydrates are the most efficient fuels for muscles during vigorous activity (22). A high-carbohydrate diet (55-70% of total daily calories) is needed to replace the glycogen used during physical activity (20). It has been shown that glycogen restoration

following exhaustive exercise is dependent on the carbohydrate content of the diet. When the diet is low in carbohydrates, or during starvation, restoration is extremely slow, and normal glycogen levels may not be regained within a week (24). Glycogen stores in the muscle and liver play an important part in the athletes ability to participate in prolonged activity or endurance sports (20). Sports activities place a high demand on the body's carbohydrate stores and the content of these stores is a major limiting factor for prolonged exercise (24). Complex carbohydrates should be eaten to replenish these glycogen stores rather than simple carbohydrates which may cause delayed fatigue (22) and are typically associated with lower levels of other nutrients.

In 1939, Christensen and Hansen reported that endurance was greatly enhanced by a diet rich in carbohydrates, but reduced after a diet of protein and fat (26). A number of recent studies support this report. Following a carbohydrate diet, long distance cyclists were found to cycle further (27), long distance cross country skiers have raced faster (28), and long distance canoeists have paddled faster (29).

Fat Needs. Fats have a high energy value but are low in density so they are considered a concentrated source

of energy. When an athlete is trying to reduce body fat, calorie intake should be limited by a reduction in calories, particularly dietary fat. A diet containing many high-fat foods may place the athlete at a greater risk for early cardiovascular diseases (20). Ideally the fat content of the diet should contain not more than 30% of the total daily calories (1). For endurance athletes, fat intake may need to be increased slightly to consume sufficient calories (24).

Vitamins, Minerals, and Electrolyte Requirements. In general, if a wide variety of fresh foods are eaten, the high energy intakes associated with sports activity will insure a proportional supply of all vitamins, minerals, and electrolytes. There is no direct evidence of an increased utilization, destruction, or excretion of vitamins associated with sports activities. There have been no reports of impaired health or performance due to a relative vitamin deficiency in athletes eating normal diets (24). This suggests that athlete's physiological requirements for vitamins are not greater than can be obtained from the food consumed.

Athletes do, however, require higher amounts of B vitamins as a result of hard exercise (30), but these are proportional to energy expenditure. As a result the

recommended dietary allowances for thiamine, riboflavin, and niacin are based on caloric intake (23).

Sodium, potassium, magnesium, and chloride are all lost in sweat in significant amounts. A mixed diet generally supplies sufficient amounts of electrolytes and losses can usually be replaced by normal food intake alone (20). The daily requirements for sodium and chloride have not been determined, but estimates have been established that are considered safe and adequate (23).

Iron is the only mineral commonly lacking in the diets of athletes. Seventy-five to ninety percent of female athletes do not meet the recommended dietary allowances for iron (30). Endurance runners are at a particularly high risk (24). Sweating and increased red blood cell mass and plasma volume during training contribue to iron loss. Iron deficiency limits exercise capacity because of its function in hemoglobin, myoglobin, and iron-containing oxidative enzymes (12). Iron supplementation is suggested for female athletes and male endurance runners (20, 30).

Fluid Requirements. Fluid intake is of primary concern to the athlete. With prolonged exercise, as much as two to four liters of sweat per hour may be lost (20). Maintaining an optimal amount of body water is essential

to cool the body and prevent heat injuries. Losses of as little as 2 or 3% of total body weight as body water will result in increased body temperature and pulse rate, and may increase fatigue (12).

Plain cold water is the ideal beverage for athletes. Dehydration during exercise should be prevented by drinking about 500 ml (about 18 oz.) of water 10 to 15 minutes before training or competition. Small amounts of water should be drunk throughout the event. After training or competition, athletes are advised to drink to replace sweat losses rather than satisfying their thirst (24). The correct way to replace water losses and maintain normal body temperature is to replace with water, the weight lost during exercise. A weigh-in before and after exercise is important for estimating sweat losses (21).

IV. Eating Habits of Fitness-Oriented Individuals

Despite the concern with nutrition for athletes, very few formal studies of the dietary intake and eating habits of athletes have been published.

Ferro-Luzzi et al (32) conducted a study in 1972 on diets of 425 Italian athletes who had applied for participation in the 1972 Munich Olympic Games. The athletes were men from a variety of sports. Dietary intakes were examined and compared to the average Italian diet. The

Italian athletes had higher protein intakes, especially from meat, than the average Italian. The Italian athletes also had high carbohydrate intakes but ate less bread, rice, and pasta and more sweetened foods than the average Italian.

Short and Short (8) analyzed diets of sample populations from men's and women's Syracuse University athletic teams from spring 1978 through fall 1981. Twenty-four hour recalls of a typical training day were recorded and starting in spring 1979, three-day records were kept. The wrestling team members recorded their diets over a two-week period. Vitamin, mineral, and other supplements were noted but not included in the diet analysis.

Analysis of the diets revealed a difference in caloric, protein, fat, and carbohydrate intakes with the various sports. The mean maximum caloric intake was 5,270 kcal for football players. The minimum was very low (400 kcal) for wrestling and gymnastic teams. Protein intakes varied from 15% to 20% of total energy. Endurance athletes had intakes of 15%, while some of the power and strength athletes had intakes of 20%. The percent of kilocalories consumed as fat ranged from means of 30-40% for both men and women. The carbohydrate intake from total energy ranged from 43-55% with track and field athletes consuming

the higheat percent of their diet from carbohydrates. Low intakes of vitamin A and low potassium levels were found and the women's teams also had low iron intakes. The authors found little usage of nutritional supplements among the athletes.

A recent study by Hickson et al (33) compared the diets of two groups of female athletes for intakes of energy and nutrients. The 24-hour recall method was used to examine dietary intakes of female basketball and gynmastics athletes. Three recalls were taken and analyzed for energy and selected nutrient contents. The mean energy intake was higher in basketball players than gymnasts. There were no significant differences between teams for intake of any nutrient. The mean intakes of vitamin B-6, iron, magnesium, and zinc were less than 70% of the RDA's. The overall mean intakes of protein, calcium, and vitamins A, B-2, B-12, C, and niacin met or exceeded the RDA's.

A study by Blair et al (34) compared nutrient intake in middle-aged men and women runners with sedentary controls. Three-day food diary forms were completed by the runners and controls to record customary diet habits. Lipoprotein measurements and height and weight were also obtained. The results found runners to have higher energy intakes, but were leaner than the sedentary controls.

The runners reported eating more total fat and carbohydrates than the controls. After adjustment for differences in caloric intake, percentages of total calories from fats and carbohydrates were similar in the runners and controls. Protein intake was significantly less in the runners. When comparing sources of carbohydrate intakes,the runners ate less starch and more glucose, fructose, and lactose.

Other studies have been published which examine food preferences and eating habits of certain populations. Cinciripini (35) compared the food preferences and eating behaviors of lean, normal, and obese subjects in a university cafeteria setting. After observing 705 individuals over an eight-week period, he found lean females ate less regular dairy but more fruit and dessert calories than normal females. Obese females exhibited similar patterns as female leans. Activity was not a factor measured in this study, but it was observed that the lean females engaged in significantly more noneating activities than the normal and obese females.

A 12-month study by Kim et al (36) examined self-selected diets of adults (20-53 years). The mean daily caloric and 19 selected nutrient intakes of the subject met or exceeded the 1980 Recommended Dietary Allowances except for iron and calcium for females. The percentage

of total energy from protein, carbohydrates, and fats were 15%, 47%, and 38%, respectively.

Hernon et al (37) studied food consumption patterns of college students, divided into subgroups of: 1) men, 2) women with mean energy intakes less than 1,200 kcal, and 3) women consuming more than 1,200 kcal. A three-day food record was used to analyze their diets. Patterns of nutrient intakes, eating frequency, and types of food eaten differed among subgroups. Women who consumed less than 1,200 kcal had lower intakes of protein, carbohydrates, fat, calcium, iron, thiamin, riboflavin, and niacin; they ate less frequently; and ate less meat and eggs, legumes, bread, cooked starchy vegetables, milk products, desserts, added fat, and added sugar than did men and women whose mean energy intakes exceeded 1,200 kcal. Lifestyle and activity patterns were not considered in this study.

V. Nutritional Knowledge and Attitudes of Fitness-Oriented Individuals

Useful information about the eating habits of athletes can be obtained by assessing their nutritional knowledge and attitudes. In 1975, Cho and Fryer (38,39) examined nutritional knowledge of university physical education (PE) majors and basic nutrition students. They found that PE majors scored only an average 40% on a test of nutrition knowledge and the basic nutrition students scored 74%

correct responses. The basic nutrition students were better informed about nutrition but both groups had some incorrect nutritional concepts. PE students were more prone to recommend honey, wheat germ, gelatin, and Gatorade as food for athletes. When test scores were compared to sports participation, no significant differences were found.

Werblow et al (9) surveyed university women athletes on their nutritional knowledge, attitudes, and food preferences. The athletes scored higher on the "nutrition for the athlete" knowledge questions than on those relating to "general nutrition". The athletes tended to be least knowledgeable about general nutrition concepts. As the athlete's nutrition knowledge increased, better eating habits, better health, and healthier food patterns were found.

A study conducted by Perron and Endres (10) found similar results. The relationship between the nutrition knowledge and attitudes of adolescent female athletes were positively correlated. No significant correlation was found between nutrition knowledge or attitudes and dietary intake. Analysis of the data indicate that nutrition attitudes were not good predictors of dietary practices, suggesting that the subjects' attitudes were not reflected in the foods eaten. Since 73% of the subjects wanted to

lose weight, their food choices may have been prompted by an eagerness to be thin.

Another study analyzing the nutrition knowledge of high school athletes was done by Douglas and Douglas (7). The data showed that female athletes had better nutrition knowledge, but poorer food practices than the male athletes. There was a positive relationship between the number of sports seasons of participation and nutrition knowledge and food practice score. This may indicate that sports participation is an incentive for learning about nutrition and optimal diet.

In 1982, Parr et al (40) surveyed athletes, coaches, and athletic trainers about their nutrition knowledge and practices. The athletes were asked about their knowledge, understanding, and use of the basic four food groups and U.S. Dietary Goals. Sixty-eight percent of the athletes were familiar with the basic four food groups, 71% used them, and 67% of the athletes were not familiar with the dietary goals.

VI. Food Fads, Fallacies, and Myths

Special foods and diets seem to be the center of many myths and fallacies in athletics. Proper nutrition is often lost to food fads, quackery, and superstition that promise to improve performance. Athletes practice these

food fads and fallacies to achieve the "competitive edge". They have many beliefs that certain foods either help or hurt their athletic performance (38,39). Many coaches and trainers give advice to athletes that is a mixture of tradition, superstition, and science. Often food fads are more beneficial psychologically than physiologically. Common practices are consumption of high protein diets, vitamins and minerals in excess of the Recommended Dietary Allowances, and the avoidance of milk before competition. No evidence has been documented that these practices improve performance (20).

High Protein Diets. Manjarrez and Birrier (20) found the dietary myth most difficult to dispel is the belief that a substantial amount of protein is needed to meet the extra energy demands, improve athletic performances, and increase muscle mass. This belief is more common in strength and power athletes who are apt to consume large quantities of high protein foods or supplements. Many coaches emphasize the consumption of large amounts of meat in belief that it replaces muscle protein lost during activity (41). When Utah coaches were asked to rate the pre-game meal in the order of elemental composition (carbohydrate, protein, or fat), protein was listed either first or second most often (42).

The major dietary need for athletes is calories, not protein. There is no evidence that additional protein to an average diet improves performance. A high protein diet does not build more muscle. Muscle mass is increased only by appropriate exercise (20). Brooke et al (27) found no increase in urinary nitrogen excretion during exercise, which suggests that protein does not usually contribute additional energy for physical work. Although research has shown that high carbohydrate diets produce the best physical performance (42) coaches and trainers continue to recommend high protein diets

Dietary Supplements. According to Hamilton and Whitney (30), 75% of American households use vitamin supplements resulting in a 100 million dollar business in the United States. The use of dietary supplements, particularly multi-vitamins, minerals, and protein without medical indication of their need is widespread among athletes (8,38).

A survey conducted of the Big Ten conference coaches demonstrated that 35% recommended vitamin supplements to their players (20). Other studies also show similar findings. In a study of selected nutritional opinions and practices of Utah coaches, 50% of them recommended food supplements of one kind or another. Comments indicated that a majority of the remaining 50% would have also

recommended supplements if they had felt that good supplements were available to their players (42). Another study conducted by Parr et al (40) revealed that 44% of the 2977 high school and college athletes questioned take vitamin supplements, 13% take mineral supplements, and 9% take protein supplements. They found male athletes more likely to take the supplements than female athletes.

Is dietary supplementation beneficial? Dietary supplementation may be beneficial if the subject is actually deficient and the supplementation can restore them to normal nutrition (24). However there is little evidence to support the use of food supplements where adequate diets are consumed and most athlete's diets are quite adequate (42). When taken in excess of the recommended allowances, vitamins have no clearly demonstrated advantages and some may have significant disadvantages. Excess fat-soluble vitamins A and D are stored in body adipose tissue. An excess of vitamin A can increase intracranial pressure. An excess of vitamin D increases serum calcium levels which may lead to renal stones and increased blood pressure. Excess water-soluble vitamins are somewhat more safe because excess amounts are eliminated in the urine (30).

Fluids and Electrolytes. Body water is essential for many functions that have direct effect on the ability

to perform work and engage in physical competition (12). Many athletes become vulnerable to commercially-prepared electrolyte supplements such as powders, tablets, beverages, and special foods to replace sweat losses. Sodium and chlorine are the principal electrolytes that must be replaced after profuse sweating (20). A mixed diet generally supplies salts and electrolytes in levels adequate to replenish sweat losses. Salt tablets and electrolyte beverages are usually not necessary (12). Plain cold water is the ideal beverage to replace the sweat losses.

Carbohydrate Loading. Glycogen stores in the muscle and liver play an important part in the athlete's ability to withstand prolonged activity or endurance sports. Carbohydrate loading is a way to increase glycogen stores. Above normal levels can enhance endurance. Astrand (43) developed a three phase carbohydrate loading regimen.

The first phase of the regimen begins one week before the endurance event. Muscles are depleted of glycogen by exercising to exhaustion the specific muscles to be used. This is typically a long run or other endurance exercise bout.

The second phase consists of consuming a high-protein, high-fat, low carbohydrate (100g) diet for three days.

The third phase involves consuming a moderate-protein,

low-fat, high carbohydrate (250-525g) diet for three days prior to the events. The muscles become supersaturated with glycogen.

Because no data are available on the possible long term effects of carbohydrate loading, the full sequence should not be done more than two or three times a year (20). There may be disadvantages to the athlete during this regimen. During the depletion phase, many athletes appear unable to maintain an adequate energy intake and have mental and exercise fatigue. Other side effects include weight gain after depletion phase, muscle stiffness, and a feeling of heaviness (24).

The American Dietetic Association (22) recommends a high carbohydrate intake prior to endurance events but it has no advantage to the athlete in short-time, high intensity competition.

Consumption of Milk. There have been claims that milk adversely affects sports performance because it increases the secretion of mucus, forms excess gas in the stomach, cuts down on wind, causes cottonmouth, and slows the performer down (42,44).

Milk contains nutrients that are necessary for athletic performance. It is an excellent source of calcium, high quality protein, and vitamins. There is no solid evidence

that milk affects physiological changes which occur during exercise (44). A study on 24 Utah State University athletes who consumed various diets including (a) no milk, (b) one quart per day, and (c) two quarts per day, revealed no significant difference in performance in the three controlled diets (42). Researchers at Michigan State University revealed similar results. They found that drinking milk during training and before competitive trials does not cause "cotton" or dry mouth or excessive gas formation (45).

Milk doesn't create the negative respiratory and digestive conditions found in competitive situations. If the athlete likes milk, there is no apparent reason why it shouldn't be included in the pre-game meal (42).

"Quick-Energy" Foods. In the above mentioned study of Utah coaches, "quick-energy" foods most often used were: oranges, Dextrose, honey, vitamin C tablets, and chocolate (42). The American Dietetic Association (22) found wheat germ, wheat germ oil, vitamin E, and bee pollen to be used as "quick-energy" foods. Those who use these products expect the fuel derived from the foods to contribute to improved performance immediately. Most evidence contrasts with this reasoning (22,42). The athlete's body nearly always has fuel available for activity.

Studies indicate that long endurance performances might benefit by "quick-energy" foods, but most sports are of too short of duration (39).

MATERIALS AND METHODS

Subjects

The subjects were a subsample of students enrolled in an introductory nutrition class (for non-majors) at Kansas State University during the fall 1985 semester. Of this class, only white, single women ages 18-25 years were used for the study resulting in a rather homogeneous population of 90 young college women. Prior to the study the subjects signed a consent form in which the procedures, risks, and benefits were explained as required by the Subcommitte on Research Involving Human Subjects, Kansas State University, Manhattan. Copies of the application and approval letters are in Appendices A and B respectively.

The overall objective of this study was to investigate the relationship between cardiovascular fitness levels, assessed by a standardized three-minute step test, and eating habits recorded in a self-report questionnaire. Percentile rankings obtained from the step test were correlated with the eating habits.

Anthropometric Measurements

Each student was measured individually in a private 10-minute session by a trained examiner. Measurements taken were height (without shoes), weight (in light

clothing), triceps and suprailium skinfolds, and mid-arm circumference. A Detecto sliding-weight balance (Detecto Scales, Inc.,Brooklyn, NY) was used to measure body weights. Skinfold measurements were taken with a Lange skinfold caliper (Cambridge Scientific Industries, Cambridge, MD). These measurement procedures are outlined in the 1971-74 Health and Nutrition Examination Survey (46) and have been previously used by the investigators. Per cent body fat was calculated using the triceps and suprailiac skinfold measurements as indicated for young women by the equation developed by Sloan and de Weir (47). A nomogram of this equation is shown in Appendix C. Anthropometric measurements were conducted in the afternoon hours and completed within one week for all 90 students.

Assessment of cardiovascular fitness

A standardized three-minute step test published by McArdle et al (48) for young college women was used to evaluate cardiovascular fitness. Before each individual test, the student was given a demonstration and allowed to practice stepping to the required cadence for 15 seconds. In the test the student stepped up and down from a 16.25 inch high step for three minutes to a tape recorded cadence of 22 beats per minute. At the end of the step test, the student remained standing while the test administrator

counted her pulse at the carotid artery for 15 seconds beginning five seconds after the end of stepping. The recovery heart rate was converted to beats per minute, and was compared to the published percentile norms for recovery heart rate following the three-minute step test (48). The three-minute step test was used because it was a practical, convenient, and fairly valid means for assessing cardiovascular fitness of a large number of subjects. Table 1 shows the percentile rankings corresponding to the 15-second heart rates following the three-minute step test for young women. The more complete original table is in Appendix D.

Self-report Questionnaire

Prior to the anthropometric measurement session the women received a seven-page self-report questionnaire and were told to answer the questions based on the previous month. The questionnaire was comprised of items from several different areas, each of which is reported in a separate table in the results section. A copy of the questionnaire is in Appendix E.

In an effort to determine the women's exercise habits or sports participation, the women were presented with a list of 14 different sports or activities and asked to indicate the number of times per week they performed the

Table 1. Percentile rankings for 15-second heart rates following the 3-minute step test

FEMALE		MALE	
H.R.	Percentile	H.R.	Percentile
32	100	30	100
33	99	31	95
34	97	32	90
35	95	33	88
36	93	34	85
37	90	35	80
38	85	36	75
39	80	37	70
40	70	38	60
41	55	39	50
42	45	40	45
43	30	41	35
44	25	42	25
45	20	43	20
46	10	44	15
47	8	45	8
48	6	46	5
49	5		

*Adapted from McArdle, WD, GS Pechar, FI Katch and JR Magel. 1973. Percentile norms for a valid step test in college women. Res Quart Sport Exer. 44(4):498-500; and McArdle, WD, FI Katch, GS Pechar, L Jacobson, and S Ruck. 1972. Reliability and inter-relationships between maximal oxygen intake, physical work capacity and step-test scores in college women. Med Sci Sports Exer. 4(4):182-186.

Cited in McArdle, WD, FI Katch, and VL Katch. 1981. Exercise Physiology. Lea & Febiger:Philadelphia, PA. p. 149.

activities. They could include each activity only if it was performed for at least 20 minutes without stopping. Subjects were not asked the duration of each activity.

The women were also asked to rate their adherence to the 1985 Dietary Guidelines (3) on a scale of 1 to 5 where 1 = almost never and 5 = almost always for each of the seven guidelines. The college women indicated their frequency of meal eating, snacking behavior, and eating food from vending machines, fast food places, or restaurants (not fast food places) on a 5-point scale where 1 = less than once a week, 2 = once a week, 3 = 2-3 times per week, 4 = 4-6 times per week, 5 = once a day, and 6 = more than once a day.

Lastly, the women completed a food frequency checklist in which they indicated how frequently they consumed each of 95 different foods. These foods were previously found to be the most frequently consumed foods in the 1971-74 Health and Nutrition Examination Survey (46). Frequency of consumption was converted to times per week for each food. Nutrient analyses were calculated using a computer program based on data in the USDA Agricultural Handbook 8.

Prior to use in the study, the questionnaire had been pilot-tested by 30 women of similar ages enrolled in two

other undergraduate nutrition courses.

Statistical analyses

Spearmans test (50) was used to correlate the percentile rankings from the step test with the other variables. Correlation coefficients are shown in data tables and a significance level of $p<0.05$ was used. Significant correlations were entered at $p<0.15$ into a backwards stepwise regression procedure. Significant variables, $p<0.06$, from the stepwise procedure were entered into the regression equation (51,52).

RESULTS

Subjects

The subjects selected for this study were 90 white, single, non-pregnant women 18-25 years of age. As shown in Table 2, the average woman in this group was 19.9 years of age, 65.1 inches tall, weighed 140.0 pounds, and was 23.9 percent fat. Cardiovascular fitness was negatively correlated with percent body fat and suprailiac skinfold measurement, but was not correlated with age, height, weight, tricepa skinfold meaaurement, arm circumference, or arm muscle diameter.

The women were also asked where most of their meals had been prepared during the previous month (data not shown). The largest group of women, 42%, ate food prepared at their apartment or home off campus, 30% cited residence halls, 20% had most of their meals at a sorority or fraternity, and the remaining 8% cited other places such as boyfriend's house, military base, cooperative house, etc.

Frequency of exercise

The women were asked how frequently they performed 14 different physical activities per week. They could include only those activities that lasted at least 20 minutes without stopping. Because very few women participated in skating, soccer, football, or golf, those

Table 2. Physical characteristics and correlation with cardiovascular fitness in 90 young college women

characteristic	mean ± SD	correlation coefficient
age (yrs)	19.9 ± 1.3	-0.03
height (in)	65.1 ± 2.1	0.05
weight (lb)	140.0 ±24.7	-0.11
triceps skinfold (mm)	21.5 ± 7.0	-0.20
suprailiac skinfold (mm)	17.6 ± 7.8	-0.28**
arm circumference (cm)	28.3 ± 3.7	-0.19
arm muscle diameter (mm)	68.7 ± 7.8	-0.12
body fat (%)	23.9 ± 5.0	-0.25*
step test (percentile ranking)	75.2 ±28.9	----

*p < 0.05, **p < .01 using Spearmans test.

Table 3. Correlation between activity frequencies and cardiovascular fitness in 90 young college women

activity+	times/week	correlation coefficient
running	0.9 ±1.4	0.43***
cycling	0.4 ±1.0	0.16
walking	2.9 ±2.8	-0.18
dancing	0.9 ±1.6	0.06
swimming	0.2 ±0.6	0.32**
weightlifting	0.4 ±1.0	-0.06
calisthenics	0.2 ±0.6	-0.03
basketball	0.1 ±0.4	-0.01
racket sports	0.2 ±0.9	0.16
other (skating, golf, soccer, football, etc.)	0.4 ±1.0	0.07

*p < 0.05, **p < .01, ***p < .001, using Spearmans test.
+Subjects could not enumerate activities lasting less than 20 minutes duration.

activities were merged into one category for the analysis. The most frequently listed activities for the college women were walking, followed by dancing, and running. Twenty-four percent of the women reported that they ran at least twice a week and running was strongly correlated with cardiovascular fitness. The only other activity that was correlated with cardiovascular fitness was swimming, but only 8% of the women (n=7) swam at least twice a week.

General eating habits

Cardiovascular fitness was correlated with reported adherence to each of the seven 1985 Dietary Guidelines (49) (Table 4). The women were asked to indicate how well they followed each guideline on a 5-point scale where 1 = almost never and 5 = almost always. Only 16% reported that they "almost always" ate a variety of foods, 11% maintained a desirable weight for her height, 3% almost always avoided eating foods high in fat, saturated fat and cholesterol, 10% ate foods high in starch and fiber, 28% minimized salt intake, and 71% drank less than 1-2 alcoholic beverages per day. None of the seven guidelines, as reportedly practiced by the women, was correlated with their cardiovascular fitness.

Meal eating and snacking behavior was also studied (Table 5). Meal skipping was common, especially for

Table 4. Correlation between adherence to Dietary Guidelines (1985) and cardiovascular fitness in 90 young college women

guideline	adherence score*	correlation coefficient
I eat a variety of foods	3.2 ±1.1	-0.01
I maintain a desirable weight for my height	2.8 ±1.3	0.10
I avoid eating foods high in fat & cholesterol	2.6 ±1.0	0.18
I eat foods high in starch and fiber	3.3 ±0.9	-0.03
I minimize high sugar intake	3.1 ±1.2	-0.05
I minimize high salt intake	3.1 ±1.5	-0.20
I drink less than 1-2 alcoholic drinks per day**	4.6 ±0.7	-0.10

* Response is mean ± standard deviation to a 5-point scale where 1=almost never and 5=almost always.

** The original guideline is worded "If you drink alcoholic beverages, do so in moderation". To clarify the term" moderation", we substituted "less than 1-2 alcoholic drinks per day", because these were the amounts cited to cause no harm in normal, healthly non-pregnant adults (49). Students were told to consider one drink equivalent to about 12 oz. beer, 5 oz. wine, or 1 mixed drink.

Table 5. Correlation between eating habits and cardiovascular fitness in 90 young college women

eating habit	frequency score*	correlation coefficient
how often do you eat breakfast?	3.3 ±1.4	0.30**
how often do you eat lunch?	4.2 ±1.0	-0.12
how often do you eat dinner (supper)?	4.5 ±0.7	-0.15
how often do you snack in between meals?	3.6 ±1.3	0.14
how often do you eat food from vending machines?	1.7 ±1.0	-0.00
how often do you eat food in fast food places?	2.0 ±0.9	-0.04
how often do you eat food in restaurants? (not including fast food places)	1.3 ±0.6	-0.05

**p < 0.01 using Spearmans test.
*Response is mean ± standard deviation to a 5-point scale where 1=less than once/week, 2=once/week, 3=2-3 times/week, 4=4-6 times/week, 5=once/day, and 6=more than once /day.

breakfast. Only 29% of the women ate breakfast every day compared to 51% who ate lunch, and 63% for dinner. The only meal that was positively correlated with cardiovascular fitness was breakfast. One quarter of the women reported that they snacked in between meals at least once a day, but only 1% said that they ate foods from vending machines on a daily basis. The women did not eat very frequently in fast food places or restaurants. Only 30% of the women ate in fast food establishments more than once a week and only 3% said they ate in restaurants more than once weekly. Snacking behavior and eating foods from vending machines, fast food places, or restaurants were not correlated with cardiovascular fitness.

Food frequency checklist

Items from the food frequency checklist are shown in Table 6, and are categorized as: 1) dairy products or eggs, 2) fruits and vegetables, 3) meat, poultry, or fish, and 4) breads and cereals. Data are reported as frequency of consumption in times per week and correlation coefficients between each food item and cardiovascular fitness are shown. Of the fluid milk products, skim milk was most frequently consumed and it was the only dairy product that was significantly positively correlated with cardiovascular fitness. Cardiovascular

Table 6. Frequency of food consumption and correlation with cardiovascular fitness in 90 young college women

food	consumption times/wk	correlation coefficient
DAIRY PRODUCTS OR EGGS		
skim milk or skim milk drinks	4.1 ±6.3†	0.23*
low-fat or low-fat milk drinks	3.7 ±4.4	-0.27**
whole milk or whole milk drinks	1.7 ±3.9	0.07
cottage cheese or ricotta cheese	2.0 ±3.2	0.14
other cheeses such as American, cheddar Swiss, or mozzarella	4.0 ±3.2	0.05
yogurt	0.6 ±0.9	0.10
ice cream	1.5 ±1.9	-0.04
sour cream or cream cheese	0.7 ±0.7	0.02
butter or margarine	8.7 ±6.1	-0.01
eggs	1.6 ±1.8	0.10
FRUITS AND VEGETABLES		
corn	1.3 ±1.0	0.24*
brussel sprouts or cabbage	0.3 ±0.4	0.22*
squash, zucchini, or eggplant	0.2 ±0.5	0.20
cauliflower	0.7 ±1.2	0.24*
broccoli	0.9 ±1.3	0.23*
carrots	1.8 ±2.4	0.28**
tomatoes	1.6 ±1.7	0.18
lettuce	3.9 ±3.0	0.24*
spinach or other greens	0.8 ±1.3	0.31**
green peas	0.9 ±1.1	0.27**
green or yellow beans	1.4 ±1.2	0.11
dry beans, peas, or lentils	0.3 ±0.8	0.08
other vegetables such as mushrooms, peppers, turnips, or beets	1.1 ±1.4	0.09
citrus fruits	2.0 ±2.9	0.24*
apples or pears	2.2 ±2.6	0.21*
peaches or plums	0.7 ±0.8	0.20
cherries or berries	0.5 ±0.6	0.07
bananas	1.2 ±1.0	0.22
melons	0.5 ±0.7	0.35***
raisins or other dried fruit	0.7 ±1.2	0.15
other fruits such as fruit cocktail, pineapple, apricots or nectarines	1.1 ±1.3	0.25*
MEAT, POULTRY, OR FISH		
hamburger	2.7 ±2.6	-0.04
hot dogs or sausage	0.7 ±0.9	0.22*
luncheon meats (bologna, salami, or chicken/turkey roll)	1.4 ±1.5	0.18
beef or steak	1.8 ±2.4	-0.02
pork or ham	1.1 ±0.8	0.01
bacon	0.6 ±0.7	0.04
liver	0.1 ±0.1	-0.04
other meats (veal, lamb, or venison)	0.1 ±0.3	-0.05
fried poultry	0.8 ±0.9	0.08
baked or boiled poultry	0.7 ±0.8	0.13
canned fish (tuna, salmon, or sardines)	0.7 ±0.8	0.16
fried fish	0.2 ±0.3	0.14
baked, broiled, or cooked fish	0.3 ±0.5	0.13
raw shellfish	0.1 ±0.2	0.04
fried shellfish	0.1 ±0.2	0.03
baked, broiled, or cooked shellfish	0.2 ±0.4	-0.02
BREADS, CEREALS, BAKING, AND RELATED PRODUCTS		
cooked breakfast cereals	0.4 ±0.7	0.02
ready-to-eat breakfast cereals	2.7 ±2.5	0.13
waffles, pancakes, or French toast	0.7 ±0.8	0.29**
breads, rolls, muffins, and biscuits	10.0 ±8.2	0.04
rice	1.0 ±1.0	0.23*
pasta, macaroni, noodles, or tortilla	1.7 ±1.1	0.06
fried potatoes	1.1 ±1.1	-0.04
boiled or baked potatoes	1.3 ±0.9	0.00
nuts	0.6 ±1.0	0.13
crackers	2.4 ±2.8	0.12
potato chips or corn chips	1.7 ±1.5	-0.11
other snacks such as popcorn or pretzels	1.9 ±2.2	0.13

† Each value is mean ±SD.
*p<.05, **p<.01, ***p<.001 using Spearman's test.

fitness was negatively correlated with consumption of low fat milk and was not significantly associated with any of the other dairy products tested or consumption or eggs.

Few items in the meat, poultry, or fish category were correlated with cardiovascular fitness, although women who were more fit ate more hot dogs or saugages. The most frequently consumed food in this category was hamburger, which the average woman ate 4.7 times per week. Other popular items were beef or steak which they consumed 1.8 times per week, and luncheon meats which were eaten 1.4 times per week.

Only two items from the breads, cereals, grains, and related products list were correlated with cardiovascular fitness. Waffles, pancakes, and French toast were more frequently eaten by the more fit women, and a positive correlation was also shown for the consumption of rice.

Perhaps the most striking observation in this study was the more frequent consumption of fruits and vegetables by the more physically fit women. Of the 21 food choices in this category, there was a significant positive correlation shown for 12 items. Cardiovascular fitness was positively correlated with how frequently the women consumed corn, brussel sprouts or cabbage, cauliflower, broccoli, carrots, lettuce, spinach or other greens, green

peas, citrus fruits, apples or pears, bananas, melons, or other fruits. The most frequently consumed vegetable was lettuce which the women ate an average 3.9 times a week.

Students were also asked their consumption of other foods not shown in Table 6, but there were no significant correlations between those foods and cardiovascular fitness. Those foods include: candies; cakes; peanut butter; sugar or honey added to food; soups; condiments such as ketchup, mayonnaise, and mustard; soft drinks; coffee or tea; beer; wine; or liquor.

Calculated nutrient intakes based on the food frequency checklist are shown in Table 7. The average daily caloric intake of the women was 2042 calories, but it was not significantly correlated with cardiovascular fitness. However, a positive correlation was shown between cardiovascular fitness and percent of calories obtained from carbohydrates. Fitness levels were also positively correlated with a greater intake of vitamin A, ascorbic acid, and thiamin relative to their calculated RDA's. No significant correlations were shown between cardiovascular fitness and intakes of saturated fat, cholesterol, sodium or potassium. Of the nutrients tested, women were least likely to obtain their RDA for iron.

Table 7. Nutrient intakes and correlation with cardiovascular fitness in 90 young college women

nutrient	amount of nutrient consumed+	correlation coefficient
caloric intake (kcal)	2042 ± 643	0.11
protein (% of kcal)	16 ± 3	0.05
fat (% of kcal)	35 ± 4	-0.12
carbohydrate (% of kcal)	47 ± 6	0.26*
saturated fat (g)	29 ± 10	0.03
cholesterol (mg)	288 ± 128	0.05
sodium (mg)	3489 ±1127	0.18
potassium (mg)	2830 ±1025	0.17
vitamin and mineral intake (% of RDA)		
vitamin A	188 ± 94	0.30*
ascorbic acid	258 ± 157	0.26*
thiamin	134 ± 47	0.21*
riboflavin	165 ± 66	0.08
niacin	143 ± 46	0.15
calcium	122 ± 58	0.06
phosphorous	182 ± 66	0.08
iron	76 ± 26	0.17

*p < 0.05 using Spearmans test.
+Mean ± standard deviation.

We also attempted to identify determinants of cardiovascular fitness by entering all significant ($p<0.15$) variables from the correlaton procedure into a stepwise backwards procedure. Significant ($p<0.05$) determinants from the final model selected were then entered into a regression procedure. The outcome of this analysis showed that percent body fat was a negative determinant of cardiovascular fitness, and frequency of running was a positive determinant. None of the eating habits or food frequency data were determinants of cardiovascular fitness.

We also correlated our variables with percent body fat to rule out the possibility that our observations were attributed to body fat. However, we found that body fat was associated with different eating patterns than for those for high cardiovascular fitness.

DISCUSSION

Several studies have shown that women engaged in aerobic exercise exhibit a reduction in body fat (53-56). This is supported by our findings which show that cardiovascular fitness was negatively correlated with percent body fat and positively correlated with their frequency of running or swimming.

However, the main objective of this study was to see whether cardiovascular fitness was related to specific eating habits. We found that their cardiovascular fitness levels were not correlated with their reported adherence to any of the 1985 U.S. Dietary Guidelines, e.g., consumption of fat, saturated fat, cholesterol, starch, fiber, sugar, salt, or alcohol. But when they were asked to complete the food frequency checklist, the more fit women consumed fruits and vegetables, rice, and waffles, pancakes, or French toast more often.

The more frequent consumption of those foods seems to follow recent dietary recommendations to increase consumption of complex carbohydrates (1,3,5,57). Furthermore, a high carbohydrate diet has been considered particularly beneficial for those involved in endurance exercise (58-60) for adequate replacement of glycogen stores. Fruits and vegetables are notable sources of

potassium which is lost in sweat during exercise. Consumption of citrus fruits, carotene-rich, and cruciferous vegetables has been associated with a lower incidence and risk to certain cancers (57).

Many health authorities also suggest restrictions in dietary fat (1,3,4,5,57). But in our study cardiovascular fitness was not significantly correlated with how often they consumed butter or margarine, eggs, ice cream, and most meat, poultry, and fish products. In fact, the more fit women ate hot dogs or sausage more frequently. But cardiovascular fitness was positively correlated with the number of times they drank skim milk and negatively correlated with their consumption of lowfat milk. These data suggest that the women who are fit may reduce their intake of fat through altered selection of some, but not all, foods or food choices. It is also possible that food choices were limited for some students. Half of the students reported that most of their food was prepared in campus residence halls or cafeterias, and sorority or fraternity houses, where several milk products are dispensed freely, but eggs, ice cream,and meat products are offered on a restricted basis.

Physically-fit women were also more likely to eat breakfast than less fit women, but no correlations were

observed for consumption of lunch or dinner. Eating breakfast is considered to be a desirable health habit because studies have shown that individuals who eat breakfast are more likely to obtain adequate daily intakes of several nutrients than those who do not eat breakfast (61). Additionally, studies on school children have shown that their maximum work output and maximum work rates were greater when they ate breakfast than when they skipped breakfaat (62).

In summary, our study involving 90 young college women showed that women exhibiting higher levels of cardiovascular fitness were more likely to exhibit several dietary habits consistent with good health practices. Those practices were eating breakfast and more frequent consumption of certain higher carbohydrate foods.

ACKNOWLEDGMENTS

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Thanks are also extended to Dr. Carol Ann Holcomb and Dr. Meredith Smith, members of the graduate committe, for the advice and recommendations during the study and writing of this manuscript.

A special thanks is dedicated to my family, especially to my mother, for their support and never ending encouragement. Many thanks are also expressed to my friends for their continual support throughout this research.

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APPENDICES

APPENDIX A

Application for approval to use human subjects

KSU
KANSAS STATE UNIVERSITY

Department of Foods and Nutrition

Justin Hall
Manhattan, Kansas 66506
913-532-5508

September 18, 1985

TO: Robert D. Reeves, Ph.D., Human Subjects Committee

FROM: Kathy Grunewald, Ph.D., R.D.

RE: Application for approval to use human subjects.
Project entitled "Do Physically Fit College Students Have Different Eating Habits?"

Your approval is requested to conduct a research study which will examine the relationship between level of cardiovascular fitness and eating habits in young college students. This research will be used for Diane McCann's M.S. thesis. Diane has a B.S. in physical education.

The population to be studied is Basic Nutrition (FN 132), which is a predominantly young, female population. All students will have the opportunity to participate. The study will take place during the Fall 1985 semester.

Attached is a copy of the questionnaire (yellow). Dr. Meredith Smith and Dr. Carol Ann Holcomb have already reviewed the questionnaire and offered their comments. An anthropometric measurement session will be conducted for the students followed by a standard 3-minute step test to assess level of cardiovascular fitness. The orange cover sheet, which is also the informed subject consent form, describes the procedures, risks, and benefits. The pink sheets describe the background and rationale for the study as it was initiated earlier this year.

Students will receive Extra Credit for participating in the study, and can learn if desired, their per cent body fat, level of cardiovascular fitness, and analysis of their diet. If students choose not to participate, they can do so without negative effects on their grade; course grades are based on total points accumulated and are not curved. If they do participate, extra credit points will be superimposed on their coursework scores.

Students have always been positive about the research projects they've been involved with in the past and we are looking forward to this one.

I hope this meets with your approval.

Sincerely,

Katharine K. Grunewald
Associate professor
Dept. Foods and Nutrition

College of Home Economics

APPLICATION FOR APPROVAL TO USE HUMAN SUBJECTS

1. ACTIVITY OR PROJECT TITLE: "Do Physically Fit College Students Have Different Eating Habits?"

2. PROPOSED SPONSOR: (IF ANY):

3. Kathy K. Grunewald, Ph.D., R.D. (NAME (applicant must be faculty member)) Foods and Nutrition (DEPARTMENT) 532-5508 (PHONE)

4. RISK

A. Are there risks to human subjects? X yes _____ no

If yes, briefly describe. (See definition of risk, page 2 of the Handbook.) We will be performing a 3-minute step test to assess cardiovascular fitness. It is possible that some subjects have compromised cardiovascular status. However the first page of the questionnaire contains questions which help us assess their risk. We have also been corresponding with Tony Wilcox (PEDLS) who has had much experience with the test. However, the vast majority of students will be young women, who are at low risk for cardiovascular problems.

B. Describe the benefits of the research

a) to the subjects: The subjects may, if they request, receive a computerized diet analysis based on the food frequency chart in their questionnaire. In addition, they can learn their per cent body fat, and percentile ranking for cardiovascular fitness.

b) to the discipline/profession: The major thrust of the study is to find out whether physically fit college students consume different diets than those who are less fit.

5. INFORMED CONSENT: General informed consent requirements are described on pages 3 and 4 of the Handbook. The written informed consent document must include the following: (1) a fair explanation of procedures to be followed, (2) description of discomforts and risks, (3) description of benefits, (4) disclosure of appropriate alternatives available, (5) an offer to answer inquiries, and (6) instructions that the subject is free to withdraw consent and participation at any time. Special informed consent policies relative to questionnaire/survey studies are described in the "Handbook Supplement" dated July, 1977.

On what page(s) of the proposal are your informed consent procedure and/or forms described? (If not a part of your proposal, the procedures and informed consent document must accompany this application.)

All information is on the orange cover sheet that will be on top of the yellow questionnaire when given to the students.

(OVER)

6. EMERGENCIES

A. Are any possible emergencies anticipated? _____yes ___X___no

If yes, describe briefly or give the page of the proposal where these are described.

B. Describe procedures for dealing with emergencies, or give the page of the proposal on which these descriptions may be found.

7. PRIVACY: On what page of the proposal do you discuss procedures for keeping research data private? cover sheet This should include procedures for maintaining anonymity of subjects. Supplemental information concerning privacy of data may be discussed below. (See page 3 of the Handbook on "Safeguarding Information.")

8. STATEMENT OF AGREEMENT: The below named individual certifies that he/she has read and is willing to conduct these activities in accordance with the Handbook for Research, Development, Demonstration, or Other Activities Involving Human Subjects. Further, the below named individual certifies that any changes in procedures from those outlined above or in the attached proposal will be cleared through Committee 8:90, The Committee on Research Involving Human Subjects via the College of Home Economics Subcommittee.

Signed _____ Date September 20, 1985
(Applicant)

Send applications to:

Robert D. Reeves
Dept. Foods and Nutrition
Justin Hall
Kansas State University
Manhattan, KS 66506

APPENDIX B

Approval letter to use human subjects

KSU
KANSAS STATE UNIVERSITY

Department of Foods and Nutrition

Justin Hall
Manhattan, Kansas 66506
913-532-5508

September 26, 1985

TITLE: Do Physically Fit College Students Have Different Eating Habits

PRINCIPAL INVESTIGATOR: Katharine Grunewald Ph.D.
Foods & Nutrition

Research activities involving no more than minimal risk and in which the only involvement of human subjects is within selected categories may be reviewed by the expedited review procedure authorized in 45CFR46:110 #3. The proposal is recommended for approval for a period of 12 months. If this proposal extends beyond 12 months from its date of approval, the proposal must again be reviewed by the subcommittee. Request for an extension of approval is the responsibility of the principal investigator. Any substantial revision in this study relative to human subjects should be reviewed again by the college subcommittee.

Robert D. Reeves

Robert D. Reeves, Ph.D.
Chairman
Subcommittee on Research Involving Human Subjects

APPENDIX C

Nomogram for prediction of body density and total body fat from skinfold measurements

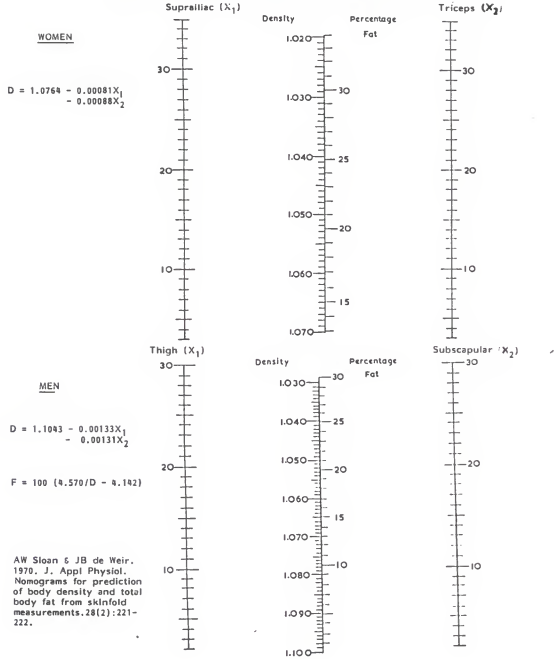

TABLE 11-5. *Percentile rankings for recovery heart rate (HR) and predicted maximal oxygen consumption for male and female college students*

PERCENTILE RANKING	RECOVERY HR, FEMALE	PREDICTED MAX VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	RECOVERY HR, MALE	PREDICTED MAX VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)
100	128	42.2	120	60.9
95	140	40.0	124	59.3
90	148	38.5	128	57.6
85	152	37.7	136	54.2
80	156	37.0	140	52.5
75	158	36.6	144	50.9
70	160	36.3	148	49.2
65	162	35.9	149	48.8
60	163	35.7	152	47.5
55	164	35.5	154	46.7
50	166	35.1	156	45.8
45	168	34.8	160	44.1
40	170	34.4	162	43.3
35	171	34.2	164	42.5
30	172	34.0	166	41.6
25	176	33.3	168	40.8
20	180	32.6	172	39.1
15	182	32.2	176	37.4
10	184	31.8	178	36.6
5	196	29.6	184	34.1

From McArdle, W.D., et al.: Percentile norms for a valid step test in college women. Res Q Am Assoc Health Phys Educ, *44(4)* 498, 1973

APPENDIX E

Self-reported questionnaire and food frequency checklist

Extra credit
(20 points)
NOTE THE DUE DATES

DIETARY SELECTION AND FITNESS LEVEL IN YOUNG COLLEGE STUDENTS

INSTRUCTIONS: For extra credit you can participate in a large research study on involving fitness level (cardiovascular) and food selection in college students. The purpose of the study is to see whether people with different levels of cardiovascular fitness also have different eating habits. The project is comprised of a short physical assessment session (10 minutes), and a two-part questionnaire.

The time schedule and description of each section follows. You need to do ALL of them to get the 20 extra credit points.

1. Part I of the questionnaire is the yellow and green section attached to this orange cover sheet. It includes risk factors to cardiovascular disease, general health and eating habits, and personal history. Take it home and fill it out as accurately as you can and bring it to your scheduled physical assessment session. Be sure to sign the bottom of this page first. (It will probably take you about 30 minutes to complete).

2. Physical Assessment Session. Is a 10-minute session you sign up for to be held during the week of Mon. Oct. 14 through Fri. Oct. 18 in the afternoon hours. It will be held in Dickens Hall, rm 10 which is a short, old building just to the west of Justin Hall, or between Justin Hall and the Farrell Library. It will have signs on the outside doors saying "BASIC NUTRITION". I will measure for each of you (in private) your height, weight, arm circumference and two skinfold measurements. For the women I'll measure the triceps (back of the arm) and suprailiac (side of the waist). For the men I'll measure the subscapular (back) and thigh (front). None of these measurements should cause you any discomfort and I'll do them in private for each of you. Please wear clothing which would make it easy for you for me to take these measurements. In addition, a graduate student, Diane McCann, will have you do a 3-minute step test unless there is a medical reason why you cannot do the test. In this test you step up and down from a 16" box for 3 minutes (22 steps/minute) and then Diane will take your pulse at the side of the neck to determine your level of cardiovascular fitness. If you like, I can tell you your percentile ranking for cardiovascular fitness, and also your % body fat.

3. Part II of the Questionnaire you will receive at the physical assessment session (pink sheets). It is a food frequency chart which asks you how often you eat various foods (it will take about 15-20 minutes). From it we can do a complete computerized diet analysis on you, which tells calories, % fat in your diet, vitamins, minerals, etc. and compares them to your RDA. If you would like a copy for yourself, just make a note at the top of page 1 (instructor's copy and include your spring address (or your parents address) in case we don't get the diet analysis finished by the end of this semester and can mail it to you. Part II of the questionnaire is due Monday, Oct. 21, IN CLASS.

You need to make an appointment for the 10-minute physical assessment session by signing your name on the clipboard on the table at the front of the class. There is one clipboard for each day so make sure you sign up for the right day and time. Fill in your Date and Time below as a reminder for yourself:

Date:_____ Time:_____ Please be on time

When answering the questionnaire, please be as honest as possible. Do not worry about whether your answers are "right" from a nutritional point of view (you will not be "graded" on them). I am far more interested in your actual practices.

You may choose to terminate your participation at any point in the study, however you need to complete both parts of the questionnaire, and the anthropometric measurements to get the full 20 extra credit points. (We need all sections to make a complete assessment). The information obtained from you will be held confidential, and will be stored on computer disk by an arbitrary ID number, and will be destroyed at the end of the study. If you have any questions about the study, you can call me at the office (532-5568) or home (529-7070), or call Diane McCann at home (776-6237).

This project has been approved by the campus committee for research involving human subjects. If you would like to participate, sign the INFORMED CONSENT below.

***

INFORMED SUBJECT CONSENT

I have read and understand the instructions given above. As indicated by my signature below, I do hereby voluntarily consent to serve as a subject in the project explained above, "Dietary Selection and Fitness Level in Young College Students", dated October, 1985, and agree to provide information that is accurate to the best of my knowledge.

Name (printed) Last, First _____ Age _____ Signature _____ Date _____

BRING THIS SECTION (orange, yellow, green) TO YOUR MEASUREMENT SESSION. OTHERWISE WE CANNOT PROCEED.

Extra credit
(20 points)
NOTE THE DUE DATES

DIETARY SELECTION AND FITNESS LEVEL IN YOUNG COLLEGE STUDENTS

INSTRUCTIONS: For extra credit you can participate in a large research study on involving fitness level (cardiovascular) and food selection in college students. The purpose of the study is to see whether people with different levels of cardiovascular fitness also have different eating habits. The project is comprised of a short physical assessment session (10 minutes), and a two-part questionnaire.

The time schedule and description of each section follows. You need to do ALL of them to get the 20 extra credit points.

1. Part I of the questionnaire is the yellow and green section attached to this orange cover sheet. It includes risk factors to cardiovascular disease, general health and eating habits, and personal history. Take it home and fill it out as accurately as you can and bring it to your scheduled physical assessment session. Be sure to sign the bottom of this page first. (It will probably take you about 30 minutes to complete).

2. Physical Assessment Session. Is a 10-minute session you sign up for to be held during the week of Mon. Oct. 14 through Fri. Oct. 18 in the afternoon hours. It will be held in Dickens Hall, rm 10 which is a short, old building just to the west of Justin Hall, or between Justin Hall and the Farrell Library. It will have signs on the outside doors saying "BASIC NUTRITION". I will measure for each of you (in private) your height, weight, are circumference and two skinfold measurements. For the women I'll measure the triceps (back of the arm) and suprailiac (side of the waist). For the men I'll measure the subscapular (back) and thigh (front). None of these measurements should cause you any discomfort and I'll do them in private for each of you. Please wear clothing which would make it easy for you for me to take these measurements. In addition, a graduate student, Diane McCann, will have you do a 3-minute step test (22 steps/minute) and then Diane will take your pulse at the side of the neck to determine your level of cardiovascular fitness. If you like, I can tell you your percentile ranking for cardiovascular fitness, and also your % body fat. unless there is a medical reason why you cannot do the test. In this test you step up and down from a 16" box for 3 minutes

3. Part II of the Questionnaire you will receive at the physical assessment session (bank sheets). It is a food frequency chart which asks you how often you eat various foods (it will take about 15-20 minutes). From it we can do a complete computerized diet analysis on you, which tells calories, % fat in your diet, vitamins, minerals, etc. and compares them to your RDA. If you would like a copy for yourself, just make a note at the top of page 8 (instructor's copy and include your spring address for your parents address) in case we don't get the diet analysis finished by the end of this semester and can mail it to you. Part II of the questionnaire is due Monday, Oct. 21, IN CLASS.

You need to make an appointment for the 10-minute physical assessment session by signing your name on the clipboard on the table at the front of the class. There is one clipboard for each day so make sure you sign up for the right day and time. Fill in your Date and Time below as a reminder for yourself:

Date:_____ Time:_____ Please be on time

When answering the questionnaire, please be as honest as possible. Do not worry about whether your answers are "right" from a nutritional point of view (you will not be graded on them). I am far more interested in your actual practices.

You may choose to terminate your participation at any point in the study, however you need to complete both parts of the questionnaire, and the anthropometric measurements to get the full 20 extra credit points. (We need all sections to make a complete assessment). The information obtained from you will be held confidential, and will be stored on computer disk by an arbitrary ID number, and will be destroyed at the end of the study. If you have any questions about the study, you can call me at the office (532-5508) or home (539-7070), or call Diane McCann at home (776-6291).

This project has been approved by the campus committee for research involving human subjects. If you would like to participate, sign the INFORMED CONSENT below.

***

INFORMED SUBJECT CONSENT

I have read and understand the instructions given above. As indicated by my signature below, I do hereby voluntarily consent to serve as a subject in the project explained above, "Dietary Selection and Fitness Level in Young College Students", dated October, 1985, and agree to provide information that is accurate to the best of my knowledge.

Name (printed) Last, First _____ Age _____ Signature _____ Date

BRING THIS SECTION (orange, yellow, green) TO YOUR MEASUREMENT SESSION. OTHERWISE WE CANNOT PROCEED.

Name_____
LAST FIRST

Student Number_____

PHYSICAL ASSESSMENT (Students do not fill in)		
		ID _ _ _
Height without shoes (in)		_ _
Weight in light clothing (lb)		_ _ _
Skinfolds (mm)		
	WOMEN Triceps	MEN Subscapular _ _
	Suprailiac	Thigh _ _
Arm circumference (cm)		_ _
3-Minute Step (H.R. in beats/min)		_ _ _

BACKGROUND

Circle each answer or fill in the blank as indicated. (computer scoring only)

1. Age (at last birthday): _____years _ _

2. Gender: 1. male 2. female _ /

3. How would you describe your present state of health?
1. poor 2. fair 3. good 4. very good 5. excellent _

4. WOMEN ONLY (Men leave this one blank). Are you pregnant? 1. yes 2. no _

5. WOMEN ONLY (Men leave this one blank). Are you currently taking birth control pills? 1. yes 2. no _ /

6. Have you ever had heart disease? 1. yes 2. no _

If so when was that?_____

7. Have you experienced pain in your chest or heart, episodes of rapid heart rates, difficulty in breathing, or a diagnosis of an abnormal electrocardiogram (EKG)? 1. yes 2. no _

If so which one(s)_____

8. Has anyone in your immediate family had heart disease after the age of 50? 1. yes 2. no _ /

9. Has anyone in your immediate family had heart disease before the age of 50? 1. yes 2. no _

10. Do you have consistently high blood pressure? 1. yes 2. no _

If so, what is the usual reading? (if you can remember)_____

11. Has your physician ever told you that you had hypoglycemia? 1. yes 2. no _ /

12. Has a physician ever told you that you had diabetes? 1. yes 2. no _

13. Do you presently smoke cigarettes? 1. yes 2. no _

If so, how many cigarettes a day do you smoke a day? _____cigarettes

14. Which of the following best characterizes your usual tension/anxiety level within the last MONTH?
1. No tension, very relaxed
2. Slight tension
3. Moderate tension
4. High tension
5. Very tense, "high strung" _ /

15. Are you presently taking any prescription or over-the-counter drugs or medication? Do NOT include birth control pills or vitamins
1. yes 2. no _

If so, what is the medication called?_____

Why do you take the medication?_____

16. Do you have allergies or any other medical reason that prevents you from eating certain foods?
1. yes 2. no _

If so, what is the food you can't eat and explain why you can't eat it_____

(computer scoring only)

17. Marital Status: 1. single, separated, divorced or widowed 2. married —

18. Race/Origin (optional)
1. White (Non-Hispanic) 4. American Indian
2. Black 5. Hispanic
3. Asian or Pacific 6. Other (specify)_____ —

19. In what state have you lived MOST of your life? _____ state — /

20. What religion do you currently practice?
1. Roman Catholic 4. Jewish
2. Protestant (such as Methodist, Baptist, Presbyterian, Lutheran, etc.) 5. Buddist
3. Moslem 6. Other (specify)
7. I do not currently practice any religion —

21. Does your religion specify any dietary restrictions? 1. yes 2. no —
If so, what are they?_____

22. Academic classification: 1. Freshman 2. Sophomore 3. Junior 4. Senior 5. Other — /

23. College major (at the present time)
1. Agriculture 5. Education
2. Architecure 6. Engineering
3. Arts & Sciences 7. Home Economics
4. Business Administration 8. Veterinary Science —

24. In what type of housing do you presently live?
1. Residence halls 3. Apt./Room/House off campus
2. Sorority or Fraternity house 4. Other (specify)_____ —

25. Where is most of your food prepared?
1. In my room 4. Sorority or Fraternity house — /
2. Residence halls or campus cafeteria 5. Off-campus restaurant or fast food place
3 Apartment/room/house off campus 6. Other (specify)_____

26. Before taking this class or any other organized nutrition class, where did you get MOST of your nutrition information? Select only ONE source. —
1. Magazines, newspapers, or books 6. Dietitian
2. Friends or relatives 7. Health food store personnel
3. H.S. or college teachers or professors (not in nutrition) 8. Organized weight loss programs (such as Weight Watchers Diet Center, etc.)
4. Athletic coach or trainer 9. Television or radio
5. Physicians 10. Labels on food products
11. Other (specify)_____

GENERAL HEALTH PRACTICES based on the last MONTH

For each of the following, mark an "I" in the appropriate colum indicating how often you practiced each based on the LAST MONTH.

	(1) Almost Never	(2) Occasionally	(3) Frequently	(4) Very Frequently	(5) Almost Always	
27. I eat a variety of foods and choose food from the Four Food Groups						—
28. I maintain a desirable weight for my height and frame.						— /
29. I avoid eating foods high in fat, saturated fat, and cholesterol.						—
30. I eat foods that have adequate starch and fiber in them						—
31. I avoid adding sugar to my food and minimize my intake of high-sugared foods						— /
32. I minimize my salt intake						—
33. I drink more than 1-2 alcoholic drinks a day. (Consider one drink equivalent to about 12 oz beer, 5 oz wine, or 1 mixed drink).						—

34. How often did you take nutritional supplements (eg vitamin pills, iron, vitamin C, etc) based on the last MONTH.

1. Less than once a week
2. 1-2 times a week
3. 3-4 times a week
4. 5-6 times a week
5. Daily or usually every day

35. If you took nutritional supplements, which kind did you take? (circle all that apply based on the last MONTH)

1. Multiple supplement with vitamins and/or minerals (Mult)
2. Iron (Fe)
3. Calcium (Cal)
4. Vitamin A (A)
5. Vitamin B complex (B)
6. Vitamin C (C)
7. Vitamin E (E)
8. Other (specify)_____ (Other)

36. During the past month were you a vegetarian or did you practice vegetarianism?

1. no
2. yes If so, what animal foods did you OMIT? _____

37. During the last MONTH how often did you get vigorous continuous exercise lasting at least 20 minutes at a time? Examples of vigorous continuous exercise are: running, fast cycling, swimming, jumping rope, dancing, racketball or tennis. They must be at least 20 minutes without stopping to count.

1. Less than once a week
2. 1-2 times a week
3. 3-4 times a week
4. 5-6 times a week
5. Daily or almost daily

38. The objective of the following is to determine which activities you were involved in, based on the last MONTH. For each of the following, fill in the blanks indicating the average number of times per week you did them. Include only exercise that lasted at least 20 minutes without stopping. Others do not count.

1. Running or Jogging ___ (Remember: fill in times/week)
2. Cycling ___
3. Walking ___
4. Dancing (Aerobic, jazz, country, etc) ___
5. Skating ___
6. Swimming ___
7. Weight lifting ___
8. Calisthenics ___ (Remember: fill in times/week)
9. Ballet ___
10. Basketball ___
11. Soccer ___
12. Football ___
13. Racket sports ___
14. Golf ___
15. Other (specify)_____and times a week ___.

39. EATING PATTERNS. Below is a list of food practices. Indicate with an "I" how often you practice each of the following. Please be honest and do not worry about whether your practices are "nutritional" or not. Your answers should be based on the last MONTH. Just ignore the numbers at the top of each column, they are for computer scoring.

	(1) Less than once a week	(2) Once a week	(3) 2-3 times a week	(4) 4-6 times a week	(5) Once a day	(6) More than once a day
How often did you eat breakfast?						---
How often did you eat lunch?						---
How often did you eat dinner (supper)?						---
How often did you snack in between meals?						
How often did you eat food from vending machines?						
How often did you eat food in fast food places?						
How often did you eat food in restaurants? (not including fast food places)						

Name _____ LAST _____ FIRST _____

DO NOT FILL IN	
ID	_ _ _
Age	_ _
Sex (M or F)	_
Preg or Lac	_
Wt (kg)	_ _ . _
Date	_ _ / _ _

ACTIVITY LEVEL (based on the last MONTH)

The purpose of this section is to get a rough approximation of how many calories you expend in an average day. This is important because the need for some vitamins is based on your caloric expenditure. Below, you will see that all activities are divided into 5 categories or "levels" with Level 1 being the lightest activity level and Level 5 being the highest activity level. FOR EACH LEVEL FILL IN THE TOTAL NUMBER OF HOURS a DAY (column 4). If you spend alot of time doing something that is not listed below (eg dressing or getting ready), find an activity level in the table that you think it is closest to, and count it as part of that activity level. All 5 levels should add up to 24 hours a day and represent your lifestyle during the last MONTH.

	EXAMPLES	* FILL IN NO. OF HOURS a DAY	(computer scoring only) Do not fill in
1	SLEEPING or RECLINING	_____	_ _
2	LIGHT ACTIVITY Most desk jobs, typing, standing, driving an auto, sewing, light dusting, and vacumming (Most people average their largest number of hours at this level)	_____	_ _
3	MODERATE ACTIVITY Walking (2 1/2 to 3 mph), doing carpentry or restaurant work, playing ping-pong or volleyball, washing windows, and scrubbing or waxing floors. (Many people average a few hours at this level).	_____	_ _
4	VERY ACTIVE Walking briskly (3 1/2 to 4 mph), weeding and hoeing, dancing, playing strenous tennis, skiing or biking rapidly. (A few people average some some time at this level).	_____	_ _
5	EXCEPTIONALLY ACTIVE Contant lap swimming, playing a vigorous basketball or football game or jogging. (Very few people average any time at this level).	24 hrs	_ _

STUDENTS: Make sure that your activities add up to 24 hours a day. If they do not, adjust the calculations (hours) as accurately as you can to make sure that they add up to 24 hours.

DIET ANALYSIS (based on the last MONTH)

INSTRUCTIONS: For each group of foods, circle the number of times you consume the food and ALSO the time unit for that consumption. For example, if you consumed skim milk or skim milk drinks 3 times a day, you'd circle a "3" for the number of times, and a "D" for the time unit. If you consumed this group only once a week, you'd circle a "1" for the number of times and a "W" for the time unit. This should reflect your eating habits during the last MONTH.

1. MILK OR MILK DRINKS
(including hot chocolate, milk shakes, chocolate milk drinks)

	Never	No. of times								Per: Day	Week	Month	Year	(computer scoring only)
Skim milk or skim milk drinks (including reconstituted dry milk)	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Low-fat or low-fat milk drinks	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Whole milk or whole milk drinks	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _

	Never	No. of times									Per Day	Per Week	Per Month	Per Year	
2. CHEESE OR COTTAGE CHEESE															
Cottage cheese or ricotta cheese	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Other cheeses such as American, Swiss, Cheddar, or Mozzarella	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
3. OTHER DAIRY PRODUCTS															
Yogurt	0	1	2	3	4	5	6	7	8	9	Day D	Week W	Month M	Year Y	_ _ _
Pudding	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Ice Cream	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Sour Cream or Cream Cheese	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Butter or Margarine	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Eggs	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
4. MEAT															
Hamburger	0	1	2	3	4	5	6	7	8	9	Day D	Week W	Month M	Year Y	_ _ _
Hot dogs or Sausage	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Luncheon meats (bologna, salami, or chicken/turkey roll)	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Beef or steak	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Pork or ham	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Bacon	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Liver	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Other meats (veal, lamb, or venison)	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
5. POULTRY (chicken, turkey, or duck)															
Fried poultry	0	1	2	3	4	5	6	7	8	9	Day D	Week W	Month M	Year Y	_ _ _
Baked or broiled poultry	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
6. FISH (other than shellfish)															
Canned fish (tuna, salmon, or sardines)	0	1	2	3	4	5	6	7	8	9	Day D	Week W	Month M	Year Y	_ _ _
Fried fish	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Baked, broiled, or cooked fish	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
7. SHELLFISH (shrimp, crab, or oysters)															
Raw shellfish	0	1	2	3	4	5	6	7	8	9	Day D	Week W	Month M	Year Y	_ _ _
Fried shellfish	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Baked, broiled, or cooked shellfish	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
8. CEREALS, BREADS, PASTA or STARCHES											Day	Week	Month	Year	
Cooked breakfast cereals	0	1	2	3	4	5	6	7	8	9	0	W	M	Y	_ _ _
Ready-to-eat breakfast cereals	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Waffles, pancakes, or French toast (sum of these)	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	_ _ _
Breads, rolls, muffins, and biscuits, white or whole grain (sum of these)	0	1	2	3	4	5	6	7	8	9	0	W	M	Y	_ _ _

	Never	No. of times									Per Day	Per Week	Per Month	Per Year	computer scoring only
Rice	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Pasta, macaroni, noodles, or tortilla	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	
Fried potatoes	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Boiled or baked potatoes	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

9. VEGETABLES (canned, fresh, or frozen, including juices)

											Day	Week	Month	Year	
Yams or sweet potatoes	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Corn	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Brussel sprouts or cabbage	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Squash, zucchini, or eggplant	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Cauliflower	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Broccoli	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Carrots	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Tomatoes	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Olives	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Lettuce	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Spinach or other greens	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Green peas	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Green or yellow beans	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Dry Beans, peas, or lentils	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Soybeans or soybean products such as tofu or textured vegetable protein	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Other vegetables such as mushrooms, peppers, turnips, or beets	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

10. FRUIT (fresh, frozen or canned but NOT juice)

											Day	Week	Month	Year	
Citrus fruits	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Apples or pears	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Peaches or plums	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Cherries or Berries	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Bananas	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Melons	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Raisins or other dried fruit	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Mixed fruits or other fruits such as fruit cocktail, grapes, pineapple, or nectarines)	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

11. Miscellaneous Foods

											Day	Week	Month	Year	
Peanut butter	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Jams and jellies	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Pancake syrup	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Sugar or honey added to food	D	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Pizza	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

	Never	No. of times									Per Day	Per Week	Per Month	Per Year	computer scoring only
Soups such as broth, consume, or bouillon	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Other soups	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Meat gravies	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
White or cheese sauce	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Tomato sauce or Ketchup	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Mayonnaise	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Low-cal salad dressing	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Regular salad dressing	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Mustard - condiments	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

12. NUTS AND SNACKS

Nuts	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Crackers	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Potato chips or corn chips	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Other snacks such as popcorn or pretzels	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

13. CANDIES OR SWEET DESSERTS

											Day	Week	Month	Year	
Candies	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Other sweets such as cookies, cakes, pies, donuts, danish, or pastries	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Cake icing	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Chocolate syrup	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Sherbert	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

14. NON-ALCOHOLIC BEVERAGES

											Day	Week	Month	Year	
Fruit or vegetable juices	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Fruit drinks (such as lemonade or Hawaiian Punch)	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Low-cal carbonated soft drinks (such as TAB or Diet Pepsi)	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Regular carbonated soft drinks (such as Coke or Pepsi)	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Beverage mixes	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Coffee or tea (sum if you drink both)	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Coffee or tea with sugar added	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

Do you usually add:

non-dairy creamers ( ) yes ( ) no _

milk or cream ( ) yes ( ) no _

15. ALCOHOLIC BEVERAGES

											Day	Week	Month	Year	
Beer	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Wine	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___
Liquor or liqueur	0	1	2	3	4	5	6	7	8	9	D	W	M	Y	___

APPENDIX F

Computer program used for data analysis

```
//MCCANN    JOB (33333J5934,XXXXXXXX,,9),'DIANE',TIME=(5,59)
/*REGION        500K
// EXEC SAS
//DD1 DD DSN=DSE62.FOOD,DISP=SHR
//SYSIN DD *
DATA ONE;
INPUT (ID HEIGHT WEIGHT TRICEPS SUPRAIL ARMCIRC STEPTEST AGE SEX
    HEALTH PREGNANT OCA MARITAL RACE STATE RELIGION RESTRICT YEAR
    MAJOR HOUSING PREPARED INFORM VARIETY DESIRABL FATFOODS CARBOHY
    SWEETS SALT BOOZE VITPILLS MULTIPLE IRON CALCIUM VITAMINA
    VITAMINB VITAMINC VITAMINE OTHER VEGETAR EXERCISE RUNNING
    CYCLING WALKING DANCING SKATING SWIMMING WEIGHTS CALITH BALLET
    BASKET SOCCER FOOTBALL RACKET GOLF WHATELSE BREAKF LUNCH DINNER
    SNACKING VENDING FASTFOOD RESTAUR SMOKE)(3. 2. 3. 3*2. 3. 2. 55*1.);
DENSITY=(1.0754-(0.00031*SUPRAIL)-(0.00056*TRICEPS));
FATPER=100*((4.570/DENSITY)-4.142);
ARMUDIAM=((ARMCIRC/.31415)-TRICEPS);
ARMUCIRC=(ARMCIRC-(TRICEPS*.31415));
IF STEPTEST<90 THEN FITNESS=1; IF STEPTEST=90 OR STEPTEST>90 THEN
     FITNESS=2;
IF FATPER>30 THEN OBESE=1; IF FATPER=30 OR FATPER<30 THEN OBESE=2;
CARDS;
$ADD 0001FONT*DIANE.DAT
PROC SORT; BY ID;
DATA TWO;
INFILE DD1;
ARRAY FOODREC (J) FDR1-FDR95;
ARRAY AMOUNT (J) AMNT1-AMNT95;
INPUT @6 ID 5-6;
INPUT @6 DATE $8.;
INPUT COMP $12. @;
DO J=1 TO 10;
INPUT +2 FOODREC 4.   AMOUNT 5.3 @ ;
END;
JSTRT=11;
DO I=1 TO 3;
JSTP=JSTRT+10;
INPUT;
INPUT  @2  CHECK $5. @1 @;
IF CHECK='FOODS' THEN GO TO S2;
DO J=JSTRT TO JSTP;
INPUT +2 FOODREC 4. AMOUNT 6.3 @;
IF FOODREC=. THEN GO TO S1;
END;
JSTRT=JSTP+1;
END;
S1:
INPUT;
S2:INPUT;NUMFDS=J-1;
INPUT;
INPUT @11 ENERGY 7.2 @19 PROT 5.2 @25 VITA 8.2 @33 VITE 8.2
@41 ASCOR 7.2 @48 THIAM 7.2 @55 RIBO 7.2 @62 NIACIN 7.2 @69 VITB6 7.2
@76 FOLIC 7.2 @83 VITB12 7.2 @90 CA 6.2 @96 PHOS 8.2 @106 MG 7.2
@113 FE 7.2 @120 ZINC 6.2;
INPUT;
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INPUT @15  ENERGYR PROTR VITAR VITER ASCORR THIAMR RIBOR NIACINR VITB6R
FOLICR VITB12R CALCIUMR PHOSR MGR IRONR ZINCR;
INPUT;
INPUT;
INPUT @11 PORTION H2O FAT CARBO FIBER ASH 44-49 1 SODIUM 50-56 2 POTAS 57-63 2
SATUR MUFA PUFA CHOLE REFUS ENERGYD DFIBER CU MN PANTA;
INPUT @33 CHOP 4.1 @50 FATP 4.1 @71 PROTP 4.1;
DO J=1 TO NUMFDS;
FOODID=FOODREC;
FOODAMT=AMOUNT;
OUTPUT;
END;
DROP FOR1-FOR95 AMNT1-AMNT95 JSTRT JSTP NUMFDS COMP I J CHECK;
PROC SORT; BY ID;
DATA THREE;
SET;
BY ID;
DROP FOODID FOODAMT;
ARRAY FOOD SKIMMLK LOFATMLK WHOLEMLK CCHEESE RCHEESE YOGHURT PUDDING
      ICECREAM SOURCRM BUTTER EGGS HAMBURG HOTDOGS LUNCHMTS BEEF PORK
      BACON LIVER OTHERMTS FRYPOULT BAKPOULT CANFISH FRYFISH COOKFISH
      RAWSHELL FRYSHELL CKSHELL CKCEREAL RTCEREAL WAFFLES BREADS
      RICE PASTA FRYPOTA BOILPOTA YAMS CORN BRUSSEL SQUASH CAULIF
      BROCCOLI CARROTS TOMATOES OLIVES LETTUCE SPINACH GRPEAS GRBEANS
      DRYBEANS SOYBEANS OTHERVEG CITRUS APPLES PEACHES CHERRIES
      BANANAS MELONS RAISINS OTHERFRT PEANUTS JAMS SYRUP SUGAR PIZZA
      BROTH OTHERSP GRAVY SAUCE KETCHUP MAYONN OSSALAD REGSALAD MUSTARD
      NUTS CRACKERS CHIPS OTHERSNK CANDY CAKE ICING CHOCSYRP SHERBERT
      FRJUICE FRDRINKS LSOFTDR RSOFTDR BEVERAGE RCOFFEE ICOFFEE SCOFFEE
      NONDAIRY CREAM BEER WINE LIQUOR;
RETAIN SKIMMLK--LIQUOR;
IF FIRST.ID THEN DO OVER FOOD;
      FOOD=0;
      END;
IF FOODID=5591 THEN SKIMMLK=FOODAMT;    IF FOODID=5191 THEN LOFATMLK=FOODAMT;
IF FOODID=6755 THEN WHOLEMLK=FOODAMT;   IF FOODID=2430 THEN CCHEESE=FOODAMT;
IF FOODID=5102 THEN RCHEESE=FOODAMT;    IF FOODID=6793 THEN YOGHURT=FOODAMT;
IF FOODID=5021 THEN PUDDING=FOODAMT;    IF FOODID=3019 THEN ICECREAM=FOODAMT;
IF FOODID=5919 THEN SOURCRM=FOODAMT;    IF FOODID=1053 THEN BUTTER=FOODAMT;
IF FOODID=2625 THEN EGGS=FOODAMT;       IF FOODID=2991 THEN HAMBURG=FOODAMT;
IF FOODID=3012 THEN HOTDOGS=FOODAMT;    IF FOODID=3236 THEN LUNCHMTS=FOODAMT;
IF FOODID=0754 THEN BEEF=FOODAMT;       IF FOODID=4543 THEN PORK=FOODAMT;
IF FOODID=0594 THEN BACON=FOODAMT;      IF FOODID=3171 THEN LIVER=FOODAMT;
IF FOODID=5663 THEN OTHERMTS=FOODAMT;   IF FOODID=2613 THEN FRYPOULT=FOODAMT;
IF FOODID=0597 THEN BAKPOULT=FOODAMT;   IF FOODID=1339 THEN CANFISH=FOODAMT;
IF FOODID=2814 THEN FRYFISH=FOODAMT;    IF FOODID=2251 THEN COOKFISH=FOODAMT;
IF FOODID=5100 THEN RAWSHELL=FOODAMT;   IF FOODID=2817 THEN FRYSHELL=FOODAMT;
IF FOODID=2252 THEN CKSHELL=FOODAMT;    IF FOODID=2250 THEN CKCEREAL=FOODAMT;
IF FOODID=5190 THEN RTCEREAL=FOODAMT;   IF FOODID=6713 THEN WAFFLES=FOODAMT;
IF FOODID=0981 THEN BREADS=FOODAMT;     IF FOODID=5103 THEN RICE=FOODAMT;
IF FOODID=3907 THEN PASTA=FOODAMT;      IF FOODID=2615 THEN FRYPOTA=FOODAMT;
IF FOODID=0929 THEN BOILPOTA=FOODAMT;   IF FOODID=6732 THEN YAMS=FOODAMT;
IF FOODID=2291 THEN CORN=FOODAMT;       IF FOODID=1024 THEN BRUSSEL=FOODAMT;
IF FOODID=6168 THEN SQUASH=FOODAMT;     IF FOODID=1421 THEN CAULIF=FOODAMT;
IF FOODID=0991 THEN BROCCOLI=FOODAMT;   IF FOODID=1430 THEN CARROTS=FOODAMT;
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IF FOODID=6358 THEN TOMATOES=FOODAMT; IF FOODID=3807 THEN OLIVES=FOODAMT;
IF FOODID=3154 THEN LETTUCE=FOODAMT;  IF FOODID=5054 THEN SPINACH=FOODAMT;
IF FOODID=2978 THEN GRPEAS=FOODAMT;   IF FOODID=2977 THEN GRBEANS=FOODAMT;
IF FOODID=0748 THEN DRYBEANS=FOODAMT; IF FOODID=5931 THEN SOYBEANS=FOODAMT;
IF FOODID=3866 THEN OTHERVEG=FOODAMT; IF FOODID=2215 THEN CITRUS=FOODAMT;
IF FOODID=0058 THEN APPLES=FOODAMT;   IF FOODID=3919 THEN PEACHES=FOODAMT;
IF FOODID=1858 THEN CHERRIES=FOODAMT; IF FOODID=0632 THEN BANANAS=FOODAMT;
IF FOODID=3861 THEN MELONS=FOODAMT;   IF FOODID=5037 THEN RAISINS=FOODAMT;
IF FOODID=3852 THEN OTHERFRT=FOODAMT; IF FOODID=3943 THEN PEANUTS=FOODAMT;
IF FOODID=3033 THEN JAMS=FOODAMT;     IF FOODID=3877 THEN SYRUP=FOODAMT;
IF FOODID=6193 THEN SUGAR=FOODAMT;    IF FOODID=4473 THEN PIZZA=FOODAMT;
IF FOODID=1016 THEN BROTH=FOODAMT;    IF FOODID=3865 THEN OTHERSP=FOODAMT;
IF FOODID=3379 THEN GRAVY=FOODAMT;    IF FOODID=5764 THEN SAUCE=FOODAMT;
IF FOODID=6355 THEN KETCHUP=FOODAMT;  IF FOODID=3356 THEN MAYONN=FOODAMT;
IF FOODID=3193 THEN LCSALAD=FOODAMT;  IF FOODID=5104 THEN REGSALAD=FOODAMT;
IF FOODID=3512 THEN MUSTARD=FOODAMT;  IF FOODID=3543 THEN NUTS=FOODAMT;
IF FOODID=2456 THEN CRACKERS=FOODAMT; IF FOODID=2192 THEN CHIPS=FOODAMT;
IF FOODID=3864 THEN OTHERSNK=FOODAMT; IF FOODID=1333 THEN CANDY=FOODAMT;
IF FOODID=1336 THEN CAKE=FOODAMT;     IF FOODID=1103 THEN ICING=FOODAMT;
IF FOODID=2198 THEN CHOCSYRP=FOODAMT; IF FOODID=3530 THEN SHERBERT=FOODAMT;
IF FOODID=2931 THEN FRJUICE=FOODAMT;  IF FOODID=2930 THEN FRDRINKS=FOODAMT;
IF FOODID=3192 THEN LSOFTDR=FOODAMT;  IF FOODID=5103 THEN RSOFTDR=FOODAMT;
IF FOODID=0871 THEN BEVERAGE=FOODAMT; IF FOODID=2229 THEN RCOFFEE=FOODAMT;
IF FOODID=3032 THEN ICOFFEE=FOODAMT;  IF FOODID=2230 THEN SCOFFEE=FOODAMT;
IF FOODID=3539 THEN NONDAIRY=FOODAMT; IF FOODID=2492 THEN CREAM=FOODAMT;
IF FOODID=0848 THEN BEER=FOODAMT;     IF FOODID=6767 THEN WINE=FOODAMT;
IF FOODID=3168 THEN LIQUOR=FOODAMT;
IF LAST.ID THEN OUTPUT;
DATA FOUR; MERGE ONE THREE; BY ID;
MILK=SKIMMLK+LOFATMLK+WHOLEMLK;
CHEESE=CCHEESE+RCHEESE;
OTHDAIRY=YOGHURT+PUDDING+ICECREAM+SOURCRM+BUTTER;
MEAT=HAMBURG+HOTDOGS+LUNCHMTS+BEEF+PORK+BACON+LIVER+OTHERMTS;
POULTRY=FRYPOULT+BAKPOULT;
FISH=CANFISH+FRYFISH+COOKFISH;
SHELLFSH=RAWSHELL+FRYSHELL+CKSHELL;
MEATALL=MEAT+POULTRY+FISH+SHELLFSH;
STARCHES=CKCEREAL+RTCEREAL+WAFFLES+BREADS+RICE+PASTA+FRYPOTA+BOILPOTA;
VEGGIES=YAMS+CORN+BRUSSEL+SQUASH+CAULIF+BROCCOLI+CARROTS+TOMATOES+
    OLIVES+LETTUCE+SPINACH+GRPEAS+GRBEANS+DRYBEANS+SOYBEANS+OTHERVEG;
FRUITS=CITRUS+APPLES+PEACHES+CHERRIES+BANANAS+MELONS+RAISINS+OTHERFRT;
MISCELL=PEANUTS+JAMS+SYRUP+SUGAR+PIZZA+BROTH+OTHERSP+GRAVY+SAUCE+
    KETCHUP+MAYONN+LCSALAD+REGSALAD+MUSTARD;
SNACKS=NUTS+CRACKERS+CHIPS+OTHERSNK;
SWEETS=CANDY+CAKE+ICING+CHOCSYRP+SHERBERT;
DRINKS=FRJUICE+FRDRINKS+LSOFTDR+RSOFTDR+BEVERAGE+RCOFFEE+ICOFFEE;
ALCOHOL=BEER+WINE+LIQUOR;
IF AGE<20 THEN SKIMML1=SKIMMLK/.403;    ELSE SKIMML1=SKIMMLK/.306;
IF AGE<20 THEN LOFATML1=LOFATMLK/.364;  ELSE LOFATML1=LOFATMLK/.377;
IF AGE<20 THEN WHOLEML1=WHOLEMLK/.335;  ELSE WHOLEML1=WHOLEMLK/.339;
IF AGE<20 THEN CCHEESE1=CCHEESE/.140;   ELSE CCHEESE1=CCHEESE/.137;
IF AGE<20 THEN RCHEESE1=RCHEESE/.046;   ELSE RCHEESE1=RCHEESE/.045;
IF AGE<20 THEN YOGURT1=YOGHURT/.259;    ELSE YOGURT1=YOGHURT/.255;
IF AGE<20 THEN PUDDING1=PUDDING/.133;   ELSE PUDDING1=PUDDING/.177;
IF AGE<20 THEN ICECREA1=ICECREAM/.133;  ELSE ICECREA1=ICECREAM/.113;
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IF AGE<20 THEN SOURCR1=SOURCRM/.029;     ELSE SOURCR1=SOURCRM/.029;
IF AGE<20 THEN BUTTER1=BUTTER/.012;      ELSE BUTTER1=BUTTER/.011;
IF AGE<20 THEN EGGS1=EGGS/.107;          ELSE EGGS1=EGGS/.102;
IF AGE<20 THEN HAMBURG1=HAMBURG/.143;    ELSE HAMBURG1=HAMBURG/.147;
IF AGE<20 THEN HOTDOG1=HOTDOGS/.079;     ELSE HOTDOG1=HOTDOGS/.034;
IF AGE<20 THEN LUNCHMT1=LUNCHMTS/.070;   ELSE LUNCHMT1=LUNCHMTS/.070;
IF AGE<20 THEN BEEF1=BEEF/.169;          ELSE BEEF1=BEEF/.155;
IF AGE<20 THEN PORK1=PORK/.130;          ELSE PORK1=PORK/.105;
IF AGE<20 THEN BACON1=BACON/.019;        ELSE BACON1=BACON/.017;
IF AGE<20 THEN LIVER1=LIVER/.102;        ELSE LIVER1=LIVER/.102;
IF AGE<20 THEN OTHERMT1=OTHERMTS/.137;   ELSE OTHERMT1=OTHERMTS/.204;
IF AGE<20 THEN FRYPOUL1=FRYPOULT/.055;   ELSE FRYPOUL1=FRYPOULT/.059;
IF AGE<20 THEN BAKPOUL1=BAKPOULT/.124;   ELSE BAKPOUL1=BAKPOULT/.120;
IF AGE<20 THEN CANFISH1=CANFISH/.093;    ELSE CANFISH1=CANFISH/.106;
IF AGE<20 THEN FRYFISH1=FRYFISH/.135;    ELSE FRYFISH1=FRYFISH/.133;
IF AGE<20 THEN COOKFSH1=COOKFISH/.157;   ELSE COOKFSH1=COOKFISH/.130;
IF AGE<20 THEN RAWSHLL1=RAWSHELL/.034;   ELSE RAWSHLL1=RAWSHELL/.034;
IF AGE<20 THEN FRYSHLL1=FRYSHELL/.167;   ELSE FRYSHLL1=FRYSHELL/.157;
IF AGE<20 THEN CKSHLL1=CKSHELL/.[illegible];  ELSE CKSHLL1=CKSHELL/.128;
IF AGE<20 THEN CKCEREA1=CKCEREAL/.223;   ELSE CKCEREA1=CKCEREAL/.210;
IF AGE<20 THEN RTCEREA1=RTCEREAL/.051;   ELSE RTCEREA1=RTCEREAL/.052;
IF AGE<20 THEN WAFFLES1=WAFFLES/.110;    ELSE WAFFLES1=WAFFLES/.087;
IF AGE<20 THEN BREADS1=BREADS/.067;      ELSE BREADS1=BREADS/.065;
IF AGE<20 THEN RICE1=RICE/.150;          ELSE RICE1=RICE/.169;
IF AGE<20 THEN PASTA1=PASTA/.315;        ELSE PASTA1=PASTA/.295;
IF AGE<20 THEN FRYPOTA1=FRYPOTA/.152;    ELSE FRYPOTA1=FRYPOTA/.149;
IF AGE<20 THEN BOILPOT1=BOILPOTA/.154;   ELSE BOILPOT1=BOILPOTA/.150;
IF AGE<20 THEN YAMS1=YAMS/.125;          ELSE YAMS1=YAMS/.125;
IF AGE<20 THEN CORN1=CORN/.172;          ELSE CORN1=CORN/.154;
IF AGE<20 THEN BRUSSEL1=BRUSSEL/.070;    ELSE BRUSSEL1=BRUSSEL/.097;
IF AGE<20 THEN SQUASH1=SQUASH/.143;      ELSE SQUASH1=SQUASH/.142;
IF AGE<20 THEN CAULIF1=CAULIF/.074;      ELSE CAULIF1=CAULIF/.074;
IF AGE<20 THEN BROCCOL1=BROCCOLI/.124;   ELSE BROCCOL1=BROCCOLI/.139;
IF AGE<20 THEN CARROTS1=CARROTS/.055;    ELSE CARROTS1=CARROTS/.058;
IF AGE<20 THEN TOMATOE1=TOMATOES/.117;   ELSE TOMATOE1-TOMATOES/.139;
IF AGE<20 THEN OLIVES1=OLIVES/.023;      ELSE OLIVES1=OLIVES/.035;
IF AGE<20 THEN LETTUCE1=LETTUCE/.054;    ELSE LETTUCE1=LETTUCE/.076;
IF AGE<20 THEN SPINACH1=SPINACH/.105;    ELSE SPINACH1=SPINACH/.119;
IF AGE<20 THEN GRPEAS1=GRPEAS/.080;      ELSE GRPEAS1=GRPEAS/.102;
IF AGE<20 THEN GRBEANS1=GRBEANS/.070;    ELSE GRBEANS1=GRBEANS/.085;
IF AGE<20 THEN DRYBEAN1=DRYBEANS/.17[illegible];  ELSE DRYBEAN1=DRYBEANS/.165;
IF AGE<20 THEN SOYBEAN1=SOYBEANS/.027;   ELSE SOYBEAN1=SOYBEANS/.036;
IF AGE<20 THEN OTHVEG1=OTHERVEG/.053;    ELSE OTHVEG1=OTHERVEG/.053;
IF AGE<20 THEN CITRUS1=CITRUS/.208;      ELSE CITRUS1=CITRUS/.207;
IF AGE<20 THEN APPLES1=APPLES/.186;      ELSE APPLES1=APPLES/.199;
IF AGE<20 THEN PEACHES1=PEACHES/.145;    ELSE PEACHES1=PEACHES/.132;
IF AGE<20 THEN CHERRY1=CHERRIES/.075;    ELSE CHERRY1=CHERRIES/.063;
IF AGE<20 THEN BANANA1=BANANAS/.157;     ELSE BANANA1=BANANAS/.132;
IF AGE<20 THEN MELONS1=MELONS/.557;      ELSE MELONS1=MELONS/.515;
IF AGE<20 THEN RAISINS1=RAISINS/.034;    ELSE RAISINS1=RAISINS/.033;
IF AGE<20 THEN OTHFRT1=OTHERFRT/.157;    ELSE OTHFRT1=OTHERFRT/.143;
IF AGE<20 THEN PB1=PEANUTB/.027;         ELSE PB1=PEANUTB/.022;
IF AGE<20 THEN JAMS1=JAMS/.028;          ELSE JAMS1=JAMS/.024;
IF AGE<20 THEN SYRUP1=SYRUP/.057;        ELSE SYRUP1=SYRUP/.072;
IF AGE<20 THEN SUGAR1=SUGAR/.015;        ELSE SUGAR1=SUGAR/.015;
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IF AGE<20 THEN PIZZA1=PIZZA/.215;          ELSE PIZZA1=PIZZA/.247;
IF AGE<20 THEN BROTH1=BROTH/.135;          ELSE BROTH1=BROTH/.273;
IF AGE<20 THEN OTHSOUP1=OTHERSP/.434;      ELSE OTHSOUP1=OTHERSP/.405;
IF AGE<20 THEN GRAVY1=GRAVY/.034;          ELSE GRAVY1=GRAVY/.064;
IF AGE<20 THEN SAUCE1=SAUCE/.031;          ELSE SAUCE1=SAUCE/.081;
IF AGE<20 THEN KETCHUP1=KETCHUP/.040;      ELSE KETCHUP1=KETCHUP/.054;
IF AGE<20 THEN MAYONN1=MAYONN/.015;        ELSE MAYONN1=MAYONN/.013;
IF AGE<20 THEN LOSALAD1=LOSALAD/.019;      ELSE LOSALAD1=LOSALAD/.043;
IF AGE<20 THEN REGSALD1=REGSALAD/.027;     ELSE REGSALD1=REGSALAD/.037;
IF AGE<20 THEN MUSTARD1=MUSTARD/.020;      ELSE MUSTARD1=MUSTARD/.018;
IF AGE<20 THEN NUTS1=NUTS/.049;            ELSE NUTS1=NUTS/.044;
IF AGE<20 THEN CRACKER1=CRACKERS/.027;     ELSE CRACKER1=CRACKERS/.031;
IF AGE<20 THEN CHIPS1=CHIPS/.041;          ELSE CHIPS1=CHIPS/.033;
IF AGE<20 THEN OTHSNK1=OTHERSNK/.055;      ELSE OTHSNK1=OTHERSNK/.053;
IF AGE<20 THEN CANDY1=CANDY/.047;          ELSE CANDY1=CANDY/.042;
IF AGE<20 THEN CAKE1=CAKE/.034;            ELSE CAKE1=CAKE/.081;
IF AGE<20 THEN ICING1=ICING/.016;          ELSE ICING1=ICING/.011;
IF AGE<20 THEN CHOCSYR1=CHOCSYRP/.044;     ELSE CHOCSYR1=CHOCSYRP/.044;
IF AGE<20 THEN SHERBER1=SHERBERT/.104;     ELSE SHERBER1=SHERBERT/.126;
IF AGE<20 THEN FRJUICE1=FRJUICE/.334;      ELSE FRJUICE1=FRJUICE/.327;
IF AGE<20 THEN FRDRKS1=FRDRINKS/.413;      ELSE FRDRKS1=FRDRINKS/.477;
IF AGE<20 THEN LSOFTDR1=LSOFTDR/.443;      ELSE LSOFTDR1=LSOFTDR/.434;
IF AGE<20 THEN RSOFTDR1=RSOFTDR/.401;      ELSE RSOFTDR1=RSOFTDR/.392;
IF AGE<20 THEN BEVERGE1=BEVERAGE/.027;     ELSE BEVERGE1=BEVERAGE/.036;
IF AGE<20 THEN RCOFFEE1=RCOFFEE/.399;      ELSE RCOFFEE1=RCOFFEE/.353;
IF AGE<20 THEN ICOFFEE1=ICOFFEE/.004;      ELSE ICOFFEE1=ICOFFEE/.005;
IF AGE<20 THEN SCOFFEE1=SCOFFEE/.046;      ELSE SCOFFEE1=SCOFFEE/.039;
IF AGE<20 THEN NONDAIR1=NONDAIRY/.005;     ELSE NONDAIR1=NONDAIRY/.005;
IF AGE<20 THEN CREAM1=CREAM/.032;          ELSE CREAM1=CREAM/.035;
IF AGE<20 THEN BEER1=BEER/1.111;           ELSE BEER1=BEER/.334;
IF AGE<20 THEN WINE1=WINE/.270;            ELSE WINE1=WINE/.235;
IF AGE<20 THEN LIQUOR1=LIQUOR/.038;        ELSE LIQUOR1=LIQUOR/.090;
MILK1=SKIMML1+LOFATML1+WHOLEML1;
CHEESE1=CCHEESE1+RCHEESE1;
OTHDAIR1=YOGURT1+PUDDING1+ICECREA1+SOURCR1+BUTTER1;
MEAT1=HAMBURG1+HOTDOG1+LUNCHMT1+BEEF1+PORK1+BACON1+LIVER1+OTHERMT1;
POULTRY1=FRYPOUL1+BAKPOUL1;
FISH1=CANFISH1+FRYFISH1+COOKFSH1;
SHLLFSH1=RAWSHLL1+FRYSHLL1+CKSHLL1;
MEATALL1=MEAT1+POULTRY1+FISH1+SHLLFSH1;
STARCH1=CKCEREA1+RTCEREA1+WAFFLES1+BREADS1+RICE1+PASTA1+FRYPOTA1+BOILPOT1;
VEGGIES1=YAMS1+CORN1+BRUSSEL1+SQUASH1+CAULIF1+
    BROCCOL1+CARROTS1+TOMATOE1+OLIVES1+LETTUCE1+SPINACH1+GRPEAS1+
    GRBEANS1+DRYBEAN1+SOYBEAN1+OTHVEG1;
FRUITS1=CITRUS1+APPLES1+PEACHES1+CHERRY1+BANANA1+MELONS1+RAISINS1+
    OTHFRT1;
MISCELL1=PB1+JAMS1+SYRUP1+SUGAR1+PIZZA1+BROTH1+OTHSOUP1+GRAVY1+
    SAUCE1+KETCHUP1+MAYONN1+LOSALAD1+REGSALD1+MUSTARD1;
SNACKS1=NUTS1+CRACKER1+CHIPS1+OTHSNK1;
SWEETS1=CANDY1+CAKE1+ICING1+CHOCSYR1+SHERBER1;
DRINKS1=FRJUICE1+FRDRKS1+LSOFTDR1+RSOFTDR1+BEVERGE1+RCOFFEE1+
    ICOFFEE1;
ALCOHOL1=BEER1+WINE1+LIQUOR1;
PROC CORR SPEARMAN; VAR STEPTEST;
    WITH MILK CHEESE OTHDAIRY MEAT POULTRY FISH SHLLFSH MEATALL STARCHES
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VEGGIES FRUITS MISCELL SNACKS SWEETS DRINKS ALCOHOL MILK1 CHEESE1
OTHDAIR1 MEAT1 POULTRY1 FISH1 SHLLFSH1 MEATALL1 STARCH1 VEGGIES1
FRUITS1 MISCELL1 SNACKS1 SWEETS1 DRINKS1 ALCOHOL1 SKIMML1
LOFATML1 WHOLEML1 CCHEESE1 RCHEESE1 YOGURT1 PUDDING1 ICECREA1
SOURCR1 BUTTER1 EGGS1 HAMBURG1 HOTDOG1 LUNCHMT1 BEEF1 PORK1 BACON1
LIVER1 OTHERMT1 FRYPOUL1 BAKPOUL1 CANFISH1 FRYFISH1 COOKFSH1
RAWSHLL1 FRYSHLL1 CKSHLL1 CKCEREA1 RTCEREA1 WAFFLES1 BREADS1 RICE1
PASTA1 FRYPOTA1 BOILPOT1 YAMS1 CORN1 BRUSSELT SQUASH1 CAULIF1
BROCCOL1 CARROTS1 TOMATOE1 OLIVES1 LETTUCE1 SPINACH1 GRPEAS1
GRBEANS1 DRYBEAN1 SOYBEAN1 OTHVEG1 CITRUS1 APPLES1 PEACHES1 CHERRY1
BANANA1 MELONS1 RAISINS1 OTHFRT1 PB1 JAMS1 SYRUP1 SUGAR1 PIZZA1
BRCTH1 OTHSOUP1 GRAVY1 SAUCE1 KETCHUP1 MAYONN1 LOSALAD1 REGSALD1
MUSTARD1 NUTS1 CRACKER1 CHIPS1 OTHUNK1 CANDY1 CAKE1 ICING1 CHOCSYR1
SHERBER1 FRJUICE1 FRDRKS1 LSOFTDR1 RSOFTDR1 BEVERGE1 RCOFFEE1
ICOFFEE1 SCOFFEE1 NONDAIR1 CREAM1 BEER1 WINE1 LIQUOR1 HEIGHT--ARMCIRC
FATPER ARMUDIAM ARMUCIRC AGE HEALTH OCA YEAR VARIETY--VITPILLS
EXERCISE--SMOKE ENERGY--ZINC ENERGYR--ZINCR
PORTION--PROTP SKIPMLK--LIQUOR;
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FITNESS LEVELS AND EATING HABITS IN YOUNG COLLEGE WOMEN

by

VALARIE DIANE MCCANN

B.S., Emporia State University, 1982.

AN ABSTRACT OF A MASTER'S THESIS

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MASTER OF SCIENCE

Department of Foods and Nutrition

KANSAS STATE UNIVERSITY
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ABSTRACT

The objective of this study was to see whether physically fit college women have different eating habits than their less fit counterparts. Ninety young college females (ages 18-25) completed a self-report questionnaire containing a food frequency checklist and questions on their eating patterns, frequency of exercise, and other health habits. Anthropometric measurements were taken, and cardiovascular fitness was assessed using a standardized 3-minute step test. Cardiovascular fitness of the women was positively correlated with their frequency of running, swimming and eating breakfast, and consumption of fruits and vegetables. Physically fit women were also more likely to consume a higher percent of their calories as carbohydrates, and attain a higher percent of their RDAs for vitamin A, ascorbic acid, and thiamine. Cardiovascular fitness was negatively correlated with suprailiac skinfold measurement and percent body fat. Data indicate that physically fit young college women do have different eating habits than less fit college women, and that those differences may be to their advantage in physical performance.