AN ABSTRACT OF THE THESIS OF

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Title: Nutrient Intake and Sources of Fat in the Diets of College Students

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Dietary guidelines recommend that Americans consume no more than 30 percent of energy intake from fat. The most recent national survey reported that U.S. women consume about 36 percent of energy from fat. Very little is presently known about the fat intake, or food sources of fat in the diets of college students, a subgroup of the population, with newly established eating habits. This study examined nutrient intake and sources of fat in the diets of 233 women and 60 men enrolled in six introductory nutrition courses from September 1987 through June 1988. Female students were further subdivided to determine whether the independent variables, living situation (on campus or off campus), or fat content of diet (fat intake less than or equal to 30 percent of energy consumed, or fat intake more than 30 percent of energy consumed) had an effect on nutrient intake or food sources of fat.

Each student in the sample kept a two-day food intake record, and filled out a form reporting their sex, age,

major, and living arrangement. Dietary intakes were analyzed for macronutrients, types of fat, cholesterol, vitamin B6, calcium, iron, and zinc. Mean intakes, nutrient density, proportion of students who did not meet 75 percent of the RDA, and energy distribution as percent intake of protein, fat, and carbohydrate were compared between sample subgroups. Foods were categorized into 27 food groups. Groupings, adapted from Popkin et. al. (15), were based on the Four Food Groups, which were further subdivided by fat content. Per capita consumption of each food group, proportion of users of each food category, and per user consumption of foods in each category were compared between sample subgroups. T-tests were used to compare mean nutrient and food group intakes, and chi-square analysis was used to compare proportion of individuals who met 75 percent of the RDA, and proportion of individuals that consumed foods from each food group.

The college women in this sample exceeded dietary guidelines for fat consumption. They did, however, have a lower intake of fat than a national sample of women 19 to 34 years, living in the western U.S. in 1986, and a correspondingly lower intake of cholesterol. A large proportion of the college women consumed less than 75 percent of the RDA for vitamin B6, calcium, iron, and zinc. Meat is a major source for all of these nutrients except calcium. College women consumed less zinc than the national sample of women, and had a lower intake of meat.

Women with a low fat intake, also, had a lower intake of zinc, and consumed less meat.

The college men did not have a proportionately greater intake of fat than college women, although they did have a greater intake of cholesterol due to the greater consumption of foods of animal origin.

NUTRIENT INTAKE AND SOURCES OF FAT IN THE DIETS OF COLLEGE STUDENTS

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INTRODUCTION

Daily dietary patterns have a substantial impact upon the health of Americans. According to the Surgeon General's Report on Nutrition and Health (1), overconsumption of fat, especially saturated fat and cholesterol, is a major concern for Americans. Consistent evidence from epidemiologic, clinical, and animal studies links a high saturated fat intake with coronary heart disease. In addition, a high intake of total fat is associated with certain types of cancer and obesity.

The magnitude of these diseases is enormous. According to the Surgeon General's Report (1), more than 1.25 million heart attacks occur each year, and more than 500,000 people die as a result. In 1987, heart disease was responsible for more than 35 percent of total deaths in the United States, and cancer for 22 percent. Other diet related diseases included in the top ten leading causes of death in the U.S. are stroke, diabetes mellitus, and atherosclerosis. It is clear that diet can contribute to the development of these diseases, and that modification of diet can contribute to their prevention (1).

Current U.S. Dietary Guidelines (2), issued jointly by the United States Department of Agriculture (USDA) and the Department of Health and Human Services (DHHS), recommend

that Americans reduce their intake of total fat, saturated fat, and cholesterol. The U.S. Dietary Goals (3), and the American Heart Association (4) specifically recommend that Americans limit their total fat intake, and saturated fat intake to 30 percent and 10 percent, respectively, of total caloric intake.

At present, through national nutrition monitoring efforts (5), it is estimated that fat provides 36 percent of the total energy intake of Americans. Consumption of saturated fat and cholesterol is also substantially higher among many Americans than levels recommended by several expert groups. College students are a subgroup of the American population, and very little is currently documented about their fat intake. It is important to know what college students are eating for several reasons. First, college students are just past adolescence and starting to make their own food choices, setting a pattern for life. Valadian et al. (6), reports that food habits are usually established just past adolescence and once habits are established, they are very difficult to change. The food practices of young adults reflect their past training, and may in turn be used to train a new generation (7).

The purpose of this study was to determine total energy, macronutrient, and selected micronutrient intake of a sample of college students, and to determine the food sources that contribute the greatest proportion of fat to

their diets. Nutrient intakes and food sources of fat were compared between males and females, females who live on campus and females who live off campus, and between females who consume 30 percent or less of their calories from fat and females who consume more than 30 percent of their calories from fat. The sample is comprised of 233 females, whose average age is 21 years old, and 60 males, whose average age is 22 years old, who were enrolled in six introductory nutrition classes at Oregon State University during the 1987/88 school year.

REVIEW OF THE LITERATURE

History of Fat Intake of the U.S. Population

In the U.S., during this century, the greatest source of energy in the diet has shifted from carbohydrate to fat. This shift can be attributed to increased consumption of meats and oils, and decreased consumption of grains (8). However, as total fat consumption has been increasing, U.S. consumption of saturated fats has been on the decline, and consumption of polyunsaturated fats has increased (8,9,10). The use of butter and lard have largely been replaced by margarine and salad/cooking oils of plant origin, and since the 1950's, the use of whole milk products has decreased, while the use of low fat milk products has increased.

Over the past ten years, we can look at trends in fat consumption through national nutrition monitoring surveys. The 1976-80 National Health and Nutrition Examination Survey (NHANES II) was conducted on a representative sample of persons aged 6 months to 74 years in the United States. Dietary interviews were used to determine dietary intake through 24 hour recall. Usual patterns of food consumption were also documented (11). NHANES II reported the average fat consumption for the U.S. population to be 36 percent of total kilocalories, and cholesterol consumption averaged 174 milligrams per 1000 kilocalories (11). NHANES II for

adults aged 19-74 years, also revealed the food source contributing the greatest amount of fat was hamburger, with hotdogs and lunchmeats together as the second most important source (12). Results also showed that all beef items together provided over 15 percent of total fat intake (12). Whole milk and pastries closely followed hotdogs and lunchmeats as the third and fourth most important sources of fat, respectively (12).

During the same time period, USDA conducted the 1977-78 National Food Consumption Survey (NFCS). This survey included persons of all ages, and used a 24 hour dietary recall, as well as a 2 day food record to determine dietary intake. Data from the 1977-78 NFCS was slightly different from that of NHANES II. NFCS estimated the mean daily fat intake of the U.S. population to be 41 percent of total kilocalories, and cholesterol consumption averaged 214 milligrams per 1000 kilocalories (8). Woteki et al. (13) attributed differences in estimates of the mean daily fat intake between NHANES II and the 1977-78 NFCS to different methodologies for collecting data, and/or to the use of different data bases for analysis of dietary data. NFCS also reported two food groups that provided the greatest amount of fat; the meat, fish, and poultry group; and the fats and oils group (8).

The most recent national survey on the dietary intake of Americans is the Continuing Survey of Food Intake by Individuals (CSFII), conducted by the USDA in each year of

1985, 1986, and 1987. The 1985 survey found that the fat consumption of adult women aged 19 to 50 years old had changed dramatically since 1977. Over the eight year period, their mean daily fat intake decreased from 41 percent of total kilocalories consumed to 37 percent, of which two-fifths was saturated fat, two-fifths was monounsaturated fat, and one-fifth was polyunsaturated fat (5). Women reported eating less whole milk, less meat as entrees, and fewer eggs; and reported eating more skim and lowfat milk, more meat mixtures, and more grain products (5,14). Popkin (15), however, pointed out that at the same time, women were increasing their consumption of a number of food groups that contain hidden fat, such as higher fat desserts, salty snack foods, high fat potatoes, and high fat grain-based mixed dishes such as macaroni and cheese, and pizza.

Results from the 1986 CSFII (16) survey were similar to those reported from 1985 for women aged 19 to 50 years old. A difference worth noting was that the amount of food energy provided by total fat was 36 percent rather than 37 percent. Women, also reported eating fewer meat mixtures, more lowfat or skim milk, and more fruit in 1986.

Food supply data also documents trends in fat consumption in the U.S. Our fat supply has been increasing for many years, yet survey data show a decrease in individual fat consumption since 1977 (8,9,15). It is speculated that perhaps we are throwing more fat out and

therefore, eating less; and/or we are eating less fat as a component of other food and are consuming more as cooking and salad oil (9,15).

Fat Consumption and Nutrient Intake in the Diets of Adolescents and College Students in the U.S.

Now that we have looked at fat consumption trends at the national level, we can look at the fat consumption trends of adolescents and college students. There are many similarities between the diets of adolescents and the diets of college students. Food habits and nutrient intakes of both college students and teenagers are influenced by the characteristics of their lifestyles, and peer groups (7,17). It has been pointed out that both groups show a clear preference for foods that have appetite appeal, are readily available, and can be eaten quickly and easily (7,18). The following two studies, on the dietary intake of adolescents, are included here because they represent the nutrient intake of a large number of teenagers in the U.S.

The Lipid Research Clinics Prevalence Study (19) compared nutrient intakes of 2,772 U.S. and 2,680 Jerusalem men and women, aged 15-19 years and 35-59 years old from 1972 to 1978. Nutrient intake was assessed by 24 hour dietary recall. The mean fat intake for U.S. men and women aged 15 to 19 years old was 40.0 +/- 0.47 and 38.8 +/- 0.48

percent of total kilocalories, respectively. Cholesterol consumption averaged 156.7 +/- 5.5 and 140.3 +/- 4.9 milligrams per 1000 kilocalories, respectively, for young U.S. men and women; and, the ratio of polyunsaturated to saturated fatty acids was .40 +/- 0.01 and .44 +/- 0.02 for young U.S. men and women, respectively.

Kenney et al. (18) looked at nutrients supplied by food groups in the diets of 1,195 teenaged girls, aged 12, 14, and 16 in 1977 and 1978. Dietary intake data were obtained by two 24-hour dietary recalls. The diets provided an average of 2,017 +/- 679 kilocalories of which 13.2 percent came from protein, 39.1 percent came from fat, and 47.7 percent came from carbohydrate. The food group that provided the greatest amount of energy was the sweets food group, including desserts, candies, and other sweets and sweet beverages provided an average of 450 kilocalories per day. The Starch group, which included potatoes, cereals, and breads was the next most important energy group; followed by meat, fish, and poultry, of which beef contributed the most energy, and was the primary source of vitamin B-12, iron, and zinc. Energy contribution from the fruit and vegetable group reflected both low frequency of use, and low energy concentration.

There is very little data, since 1970, documenting the nutrient intake of college students. Most of the information that is available pertains to college athletes, and a few studies look at the nutrient intake of students

enrolled in home economics courses. It is hard to determine whether these studies reflect the intake of the general college student population, because the students who participated in the studies may have had a greater-than-average interest in nutrition and health. However, it has been documented that college students diets are highly variable (20,21).

Hernon et al. (20) looked at nutrient intakes and foods selected by college students enrolled in an introductory nutrition course throughout the school year in 1980. Mean fat intakes ranged between 34.0 and 36.3 percent of total kilocalories for 56 men and 232 women. The mean nutrient intakes of 19-22 year old men met the 1980 Recommended Dietary Allowances (RDA's) for protein, calcium, vitamin A, iron, thiamin, riboflavin, niacin, and ascorbic acid. The mean nutrient intakes of 19-22 year old women who consumed more than 1200 kilocalories met the 1980 RDA's for the same nutrients except iron. However, more than 28 percent of the women in the study consumed diets with less than 1200 kilocalories, and met the RDA's for only protein, vitamin A, and vitamin C. Men and women, who consumed more than 1200 kilocalories, met USDA's Four/Five Food group recommendations, except for the breads and cereals group.

Vickery et al. (21) looked at dietary practices of 335 college women enrolled in a home economics course between May 1980 and August 1982. The range of fat intake averaged

between 48 and 57 grams per day, or 34 to 37 percent of kilocalories consumed. More than three-fourths of the subjects consumed less than 67 percent of the 1980 RDA for iron, vitamin A, and niacin. The group as a whole consumed limited amounts of meat and milk.

Hoffman (22) recently looked at nutrient intake of 186 Central Michigan University college students enrolled in an upper division nutrition course during the spring of 1987. The mean fat intake was 33 percent of total kilocalories consumed. Sixty percent of the men, and 62 percent of the women consumed more than 30 percent of their total kilocalories from fat, and thus did not meet the U.S. Dietary Goals (3).

According to the above studies, fat intake among college students averages between 32 and 37 percent of kilocalories consumed, well above the recommended fat intake of 30 percent of total caloric consumption. In addition, the above studies also note, and it has been well documented that college women often do not consume adequate energy (20,21,23), or adequate iron (20,21,22,24,25). It has been estimated that up to 50 percent of premenopausal women are iron deficient, and their estimated intake is 10 to 12 milligrams per day (26). The 1989 RDA (27) (Appendix A) for iron is 15 milligrams per day. College women tend to take in less than the RDA for other nutrients as well such as folacin, vitamin B6, and sometimes calcium and zinc (20,22,23,29).

The vitamin B6 intake of college women is often below the RDA. Two studies looked at vitamin B6 intake of college female athletes. Welch et al. (23) showed mean vitamin B6 intake of 29 college female athletes to be 0.5 milligrams per 1000 kilocalories, well below the 1980 RDA (28) (Appendix B) of 2.0 milligrams per day, and 1989 RDA (27) of 1.6 milligrams per day. Nowak et al. (29) also looked at vitamin B6 intake of 10 college women athletes. Their mean intake was 44 percent of the 1980 RDA. The 1986 CSFII (30) showed only 63 percent of women aged 19 to 34 years to meet the RDA for vitamin B6.

Calcium intake is also often below the 1980 and 1989 RDA for college women. Hoffman (22) reported that the average intake of Calcium was 785 milligrams per day, which is close to the 1980 RDA (28) of 800 milligrams per day, but well below the 1989 RDA (27) for college age women of 1200 milligrams per day. Also, if one only looks at the mean intake, a large number of individuals may not by recognized as having a low dietary intake. Thus, Hoffman reported that 35 percent of the women had an intake of less than 75 percent of the 1980 RDA for calcium. The 1986 CSFII (30), documented that 82 percent of 19 to 34 year old women met the 1980 RDA for calcium, and other studies have shown mean calcium intake to be adequate (by 1980 RDA standards) for female college students whose caloric intake was greater than 1200 kilocalories per day (20,23).

Finally, zinc intake is often below the RDA for women

aged 19 to 34 years, living in the west. The 1986 CSFII (30) showed that only 63 percent of women met the 1980 RDA (28) for zinc of 15 milligrams per day. The mean zinc intake for women aged 20 to 39 years was 8.8 milligrams per day, which is well below the 1989 RDA (27) of 12 milligrams per day. Pennington et al. (31) also reported zinc intake to average 65 percent of the 1980 RDA for women aged 25 to 30 years.

It has been noted that many college women's diets appear to be lower in vitamin B6 and zinc than they are in reality because the databases for those nutrients may be incomplete. However, men's diets usually appear to be adequate for these nutrients, probably because they take in substantially more kilocalories. There seems to be substantial variation between studies as to which nutrients or food groups are below recommended standards for college students. Some studies have shown college students to be below the RDA for vitamin B12 (23), but other studies do not show the same results (25). Hernon (20) reported that college students didn't take in enough breads and cereals, and Vickery (21) reported that students were deficient in their intake of meat and milk.

Food Preferences and Practices of College Students

It has been suggested that eating patterns, and food likes and dislikes at college are related to patterns, and

foods served at home during childhood (7,32). Stasch (7), reported that college students' meal choices included more of what a meal "should" include for health reasons, rather than just food preferences. She also found snack food choices were quite different at college than at home. Taste preferences, ease of access to food, finances, and other factors play important roles in determining eating habits among this group (7,33).

The most popular foods among college students include many dessert items, meat items and bread items, and no vegetable items except french fries and salad (32). It has been well documented that college students dislike a large number of vegetable items, and their frequency of consumption is low (7,25,32,33). Frequency of fruit consumption is also often low (22,33). Since fruits and vegetables are not well liked, one might expect that college students have a low intake of vitamins A and C. However, most college students do like orange juice and tomatoes and meet the RDA for vitamin C (7,32), and most meet the RDA for vitamin A, although they do not list sources of vitamin A as preferred foods.

Snacking contributes significantly to the diets of college students. According to Hernon et al. (20), 64 percent of male and 59 percent of female students ate two or more snacks per day. Stasch (7) reported that snack food choices were different at college than at home due to availability of foods and that some foods are not so easily

kept in a dormitory room. According to Stasch (7), coffee, candy and hamburgers were used with greater frequency at college than at home, and milk, iced tea, fruit, cake, and cheese were consumed less frequently as snacks.

Jakobovits (25) reported the average number of eating times for 195 college women was greater than five per day, and almost half (47 percent) of the subjects reported snacking primarily in the evening. The most frequently eaten snack foods included coffee, tea, bread and bread products, fruit, candy, cookies, milk, alcoholic beverages, fruit juice, and sweets.

According to Houghton's study (34) of 65 freshmen women at Oregon State University living in residence halls, the most common snacks were, in descending order: cookies, cake, and doughnuts; candy; fruit; dairy desserts; popcorn; crackers and chips; soft drinks and alcoholic beverages. The distribution of kilocalories from the snacks were 7.3 percent from protein, 33.4 percent from fat, and 59.3 percent from carbohydrate. Snacks were lower in fat and protein than meals, however, the micronutrient densities of meals were higher than for snacks.

Food intakes of college women tend to be different than those of college men. First, college age women do not consistently consume and adequate intake of energy (20,21), and often have an extreme concern with weight control (29,35,36). Women tend to have more knowledge about nutrition (7), and according to Melby et al. (33), report

eating fewer fatty foods than men. Women choose more of the salads and vegetables, and lower calorie menu items (32), and have a decided preference for lower fat milk products than men do (37). Ries et al. (38) reported that men eat out more often than women.

Persons 18 to 24 years of age eat out more frequently than any other age group (38). According to Ries et al. (38), eating out decreases a person's chances of consuming adequate amounts of calcium, vitamins A, B6, and C, and increases their chances of consuming excess kilocalories. In addition, the density of fat is significantly higher for food consumed at commercial establishments than for food consumed at home.

Place of residence, dormitory or apartment, did not appear to influence dietary adequacy in Jakobovits' study (25). Melby et al. (33), however, reported that students living off campus consumed fruits and vegetables less frequently than did students living in residence halls. Walker et al. (39) analyzed many dormitory meals and found them to be low in thiamin, folacin, vitamin B6, and magnesium. Houghton's study (34), in which 86 percent of the meals were eaten in dormitory cafeterias, showed the distribution of kilocalories to be 15.4 percent from protein, 41.3 percent from fat, and 43.3 percent from carbohydrates. Forty-one percent of the kilocalories from fat is much higher than the average reported fat intake of college students, but is close to the NFCS 1977-78 national

average.

Nutrition Knowledge of College Students

Most college students do have some nutrition knowledge. For example, Melby et al. (33) reported that 90 percent of the respondents to his nutrition knowledge questionnaire, knew the four food groups, the link between high salt intake and high blood pressure, and the link between saturated fat intake and coronary heart disease. He reported that 65 percent of the respondents ate "fat food" less than once per day. Fat food was correctly identified as bacon, sausage, french fries, chips, and hamburgers. He also speculated that perhaps an increased awareness of diet and health among college students led to a low intake of fat.

Much more data, however, indicate a lack of nutrition knowledge among college students. Melby's study (33) found that 47 percent of questionnaire respondents incorrectly identified carbohydrates or protein, as opposed to fat, as the richest source of kilocalories. Only 38 percent could correctly identify cereals, grains, and vegetables as high in complex carbohyrdrates; and 17 percent thought decreasing starch in the diet was the best method to lose weight. Other researchers also note that it is a common perception that high carbohydrate foods such as legumes, bread, and cooked starchy vegetables are high in calories,

and they are often limited in the diets of college women who want to lose weight (20,35,40).

In addition to misinformation about the kilocalorie content of food categories, there might also be some misinformation about specific sources of fat among college students, and in the general population. Flowers-Willetts (41) showed that there was no significant difference in fat content between salad bar meals and hot meals selected in a college cafeteria. Salads are commonly thought of as low kilocalorie foods, yet the salad bar meal contained 43 percent fat, and 1008 kilocalories, while the hot meal contained 40 percent fat and 896 kilocalories.

Rathje et al. (42) looked at meat fat consumption. It was observed that residents of a health conscious community in Arizona increasingly discarded separable fat on red meat, and had cut their purchase of saturated fats in half from 1976 to 1985. Yet, these same households increased their purchase of red meat such as lunchmeats, hot dogs, and meats with inseparable meat fat. According to Rathje, increased consumption of red meat with non-separable meat fat may be due to its convenience and ease of preparation, or perhaps the residents were intending to cut down on fat, yet didn't realize the high fat content of these meats. Rathje speculated that perhaps this community was eating more fat than they realized due to misinformation.

Nutrition misinformation has been documented among college athletes. The belief that vitamins are needed in

greater amounts by athletes is widespread, even though the evidence shows that supplements, in addition to a normal diet, are not beneficial to athletic performance (26,43). It is also common for college athletes to think their nutritional needs are met by their dietary supplement, and they often have poor eating habits combined with dietary supplements (26).

For Those Who Do Follow Dietary Guidelines...

There is some concern for people who do follow the dietary guidelines and limit their fat intake to 30 percent of caloric intake, and restrict their cholesterol intake to less than 100 milligrams per 1000 kilocalories. In order to follow these guidelines, it is often recommended that the population decrease their consumption of red meat, and increase their consumption of fish, poultry, and meat alternatives. However, red meat is a significant source of iron, and the impact of red meat restriction on premenopausal women (who are often iron deficient) in the United States is uncertain (24). Worthington-Roberts (24), compared iron status between 52 college women who either ate red meat as the primary protein source, ate fish and poultry as the primary protein source, or were lactoovovegetarians. No significant differences were found between the groups in daily intake of kilocalories, iron, or fat, although the red meat eaters consumed significantly

more cholesterol than the other two groups (24). Iron stores were significantly higher in the red meat eaters than in the fish and poultry eaters, or the lactoovovegetarians. The lowest iron stores were found in the fish and poultry eaters, and data showed that they consumed few legumes or cereals (24). Also, serum lipid profiles, including total cholesterol, were not significantly different among the three diet groups (44). Among this sample, decreased red meat consumption did not reduce total dietary fat intake, or serum cholesterol levels.

In a controlled diet study, Dougherty et al. (45) showed that when a typical U.S. diet was manipulated to reduce the fat content to approximately 25 percent of total caloric intake, without changing the usual intake of meats, dairy products, fish, and eggs, nutrient content of the diet could by significantly improved. Visible fat was carefully trimmed from meat, and skim milk products were substituted for whole milk products. Carbohydrates such as whole grains, fruits, and vegetables replaced fat to maintain caloric intake. Vitamin C, thiamin, riboflavin, niacin, vitamins B6 and B12, folate, potassium, calcium, magnesium, phosphorus, iron, zinc, and copper intakes increased in the low fat diet. While it is good to know that a low fat diet can be more nutritious, it is important to realize that the typical person might not know how to decrease her fat intake and simultaneously increase the

nutrient content of their diet.

Literature Review of the Methodology

Studies have indicated that surveys using dietary intake data tend to be valid, that is they accurately reflect true intakes reasonably well (46). Stunkard et al. (47) showed that self reports of food intake are strongly correlated with measured food intake.

Reliability (whether repeated assessments achieve the same results) of dietary intake data is questionable, however. Usually individuals exhibit quite a large variation in day to day intake of food and nutrients (intraindividual variation). Twenty-four hour dietary recalls can provide information about dietary intakes of a large population, however, give little information about usual food intake patterns of individuals because of intraindividual variation (48). The number of days required to determine usual intakes of nutrients varies, and is specific to each nutrient (48). Multiple day food intake records are a means of reducing the effects of intraindividual variation on estimates of usual intakes, and thus increasing the accuracy of estimates of mean intakes.

Variability of results may also result from data base rounding errors, different sources of nutrient data in different data bases, and judgement on the part of the food

coder (such as substitutions selected for food items not listed in the data base) (49). Missing values for certain nutrients in some foods may vary from data base to data base. It is important not to misinterpret inadequate data for inadequate intake (48).

In summary, current dietary guidelines advise Americans to lower the amount of fat, saturated fat, and cholesterol in their diets to minimize the risk of chronic diseases such as heart disease, cancer, and obesity. The U.S. Dietary Goals and the American Heart Association recommend that total fat be limited to 30 percent of total caloric intake, saturated fat limited to 10 percent, and cholesterol intake limited to 100 milligrams per 1000 kilocalories. According to the most recent national surveys, dietary fat intake by Americans averages between 36 and 41 percent of caloric intake, with the largest fat contributor being beef. While fat consumption has been on the decline over the past ten years, Americans have a long way to go to lower fat intake to the recommended levels. Very little is known about the current fat intakes of college students in light of the dramatic dietary changes that have occurred over the past ten years in the general U.S. population. It is important to monitor the dietary habits of college students because their newly independent food practices may remain with them for many years, and may be used to train the next generation. Also, there are

still many misconceptions about nutrition and sources of fat. Finally, for those who do follow dietary guidelines, it is important to know which foods and food groups are lacking in their diets, so nutritionists can spot potential nutrient deficiencies. If we can spot the sources of fat in the diets of college students, we can point to areas in which nutrition education is needed.

RESEARCH PROCEDURES

Design of the Study

This study was a survey to examine nutrient intake and sources of fat in the diets of college students. The sample population was comprised of 233 women and 60 men enrolled in an introductory nutrition course at Oregon State University between September 1987 and June 1988. The students kept two-day dietary records as part of a class project, and filled out a form providing demographic information about themselves, such as their sex, age, height, weight, major, and living situation.

Two types of information were analyzed. Nutrient intake data, and food sources of dietary fat. The objectives of the study were to deterimine whether the independent variables, sex (male or female), living situation of women (on campus or off campus), or fat content of women's diets (< or = to 30% of energy from fat, or > 30% of energy from fat), had an effect on nutrient intake or food sources of fat. In addition, comparisons were made to determine whether there were significant differences between the intakes of college women and the intakes of women who participated in the most recent national nutrition surveys.

The specific nutrients that were examined included the macronutrients, types of fat, and cholesterol. Vitamin

B6, calcium, iron, and zinc were also examined because they are nutrients that are often not consumed in adequate quantities by college women; and they are commonly found in protein sources that are associated with fat sources of food, such as meat and dairy products. We specifically wanted to determine whether the women who had low fat diets, also had lower intakes of these nutrients. Food sources of fat were examined by categorizing foods, based on fat content, into 27 food groups adapted from Popkin et al. (15); and determining whether a population's intake of food sources of fat were different from one another.

Experimental Approval of Human Subjects Committee

This study is part of a larger research study which was exempted from review by the Oregon State University Human Subjects Committee on September 2, 1987. (Appendix C).

Data Collection Forms

There were two kinds of forms used in this survey. First, were the forms used for recording food intake (Appendix D) which designated the name of the meal (breakfast, lunch, dinner, or snack), food items that were eaten, the quantity of each food eaten in household measurements, whether the day's intake was typical or not

typical, and whether or not supplements were taken. Students were instructed to specify food preparation methods.

The second form, was an informed consent form and questionnaire (Appendix E), that reported the students' height, weight, sex, age, year in school, major, living arrangement, and permission to use their dietary intake data confidentially as part of a research study.

Selection of Sample

Students enrolled in Human Nutrition complete two day dietary records as part of a class project. Three hundred ninety-three students enrolled in the course between September 1987 and June 1988. All were asked on a voluntary basis if their food records could be used confidentially as part of a research study. Of these students, 223 women and 60 men, 72 percent of those enrolled, completed food intake records and signed consent forms.

Human Nutrition is an introductory course designed for nutrition majors and non-nutrition majors, and the sample includes students from eight of the twelve different colleges at Oregon State University which offer undergraduate degree programs. These students may have had a greater interest in nutrition than the general student body. The majority of students enrolled in Human Nutrition

are female, whereas the majority of the university student population is male. For this reason most of the analyses in this study were limited to the females in the sample.

Data Collection Procedures

Each quarter, in the first weeks of the course, the students were instructed to complete a two-day food intake record as part of a class project. Students were instructed in techniques for estimating their food intake using household measuring utensils and food models. Consecutive weekdays were used to record food consumption rather than weekends because intake on the weekends is often irregular. At the time of recording, students did not know their food records would be part of a research study, and the instructor emphasized that they would not be graded on what they ate. Students calculated the nutrient content of their two days' intake using the West Computer Program (50) for analysis. After dietary records were turned in to the course professor, the students were asked on a voluntary basis if their food records could be used confidentially as part of a research study. Informed consent forms were signed and questionnaires reporting their height, weight, and demographic information were filled out.

Analysis of Data

The subjects' two day dietary records were reanalyzed for nutrient content using the Food Processor II Nutrient Analysis Computer Program (51). This program is based on USDA Handbooks 8-1 through 8-11 and 8-14, and the 1986 release of USDA Home and Garden Bulletin Number 72, "Nutritive Value of Foods". Missing values for individual nutrients were supplemented from food labels or from the research literature. The percent of missing entries for each nutrient analyzed are listed in appendix F. A default list (Appendix G) was developed for food items whose specific quantities or types were not specified. Foods and portion sizes chosen as default items, were those most commonly used by the students in the sample.

The food intake data, the nutrient content of the daily intakes, and corresponding demographic data were transferred to the Statistical Package for the Social Sciences (SPSS) (52) program for statistical analysis.

The subjects' two-day food records were analyzed for the following nutrients: energy, protein, carbohydrate, fat, saturated fat, monounsaturated fat, polyunsaturated fat, cholesterol, vitamin B-6, calcium, iron, and zinc. Sources of dietary fat were identified by sorting foods into 27 food groups (Appendix H) adapted by Popkin et al. (15). Groupings were based on the Four Food Groups, most of which were further subdivided based on the fat content

of foods.

Sample subgroups were identified by the independent variables sex, living arrangement, and fat consumption. Nutrient intakes were compared between males and females, women who lived on campus and women who lived off campus, women who consumed less than or equal to 30 percent of their energy as fat, and women who consumed more than 30 percent of energy as fat. Mean nutrient intake; mean nutrient density; percent of subjects who met at least 75 percent of the 1989 RDA (27) (Appendix A); mean energy distribution from protein, carbohydrate and fat; and mean energy distribution of saturated fat, monounsaturated fat, and polyunsaturated fat were determined and compared between sample subgroups.

Food group intakes were also compared by the independent variables, sex, living arrangement of women, and energy intake from fat for women. Mean food group intake was analyzed for the sample subgroups as per capita consumption of grams of food in each category per day, percent of users of each food group, and as per user consumption of grams of food in each category per day.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) (52) was used in the statistical analysis of data. When

the population variances were not significantly different the standard t-test was used to compare nutrient intake, and nutrient density between males and females, women who live on campus and women who live off campus, and women who consume less than or equal to 30 percent of their kilocalories from fat and women who consume more than 30 percent of their kilocalories from fat. When the sample population variances were significantly different, the pseudo t-test was used. Chi-square analysis was used to determine significant differences between subgroup samples who consumed equal to or greater than 75 percent of the RDA for vitamin B-6, calcium, iron, and zinc.

The standard or pseudo t-test was also used to compare food group intake per capita per day, and food group intake per user per day between the sample subgroups. Chi-square analysis was used to determine significant differences between the sample subgroups for percent of food group users.

The maximum level of significance used for all analyses was $P<.05$.

RESULTS AND DISCUSSION

Description of Sample

The subjects in this study included 223 female students and 60 male students. The 223 female students ranged in age between 18 and 39 years, with the average age being 20.9 years. One hundred ninety-four (87%) were 19 to 24 years old. Their mean height was 166 centimeters, and their mean weight was 59.2 kilograms. The women were enrolled in nine different colleges including, fifty-five (24.7%) in the college of Home Economics, 50 (22.4%) in Health and Physical Education, 34 (15.2%) in Education, 29 (13.0%) in Business, 25 (11.2%) in Science, 9 (4.0%) in Pharmacy, 9 (4.0%) in Liberal Arts, 8 (3.6%) in Agriculture, 1 (0.4%) in Engineering, and 3 (1.3%) were undecided.

The 223 female students were divided into subgroups based on living arrangement (on campus or off campus), and fat content of diet (low fat or high fat content). One hundred fifteen (51.6%) of the female subjects reported living on campus (ONC Women) in dormitories, coops, or sororities where they would routinely obtain their meals from the resident cafeteria. One hundred seven of the female students reported living off campus (OFC Women) in apartments, or with their parents where they or their

family prepared their own meals. Fifty-eight (26%) of the female subjects had a low fat intake (LF Women), and consumed 30 percent or less of their kilocalories from fat, and 165 (74%) of female subjects had a high fat intake (HF Women), and consumed more than 30 percent of their kilocalories from fat. Hoffman (22) reported a similar proportion (28%) of 138 college women who consumed less than 30 percent of their total kilocalories from fat.

The 60 male students ranged in age between 18 and 38 years old, with the average age being 22.4 years. Forty-seven (78%) were 19 to 24 years. The mean height of the men was 179.8 centimeters, and the mean weight was 78.5 kilograms. The men were enrolled in eight different colleges, including 25 (41.7%) in the college of Health and Physical Education, 14 (23.3%) in Business, 5 (8.3%) in Liberal Arts, 4 (6.7%) in Pharmacy, 4 (6.7%) in Engineering, 3 (5%) in Science, 2 (3.3%) in Home Economics, 2 (3.3%) in Agriculture, and 1 (1.7%) undeclared. Nineteen (31.7%) lived on campus, and 41 (68.3%) lived off campus. As the sample size of male students was small, and heavily weighted in one major, Health and Physical Education, only descriptive statistics, and a few comparisons between males and females are given in this study.

Mean Nutrient Intakes

Mean daily energy and nutrient intakes for women, based on an average of two consecutive day's intakes, are shown in Table 1. Mean energy intake was below the 1989 recommended allowance (27) of 2200 kilocalories for women aged 19 to 24 years old, of average body size, engaged in light to moderate activity. This is consistent with other studies that show energy intake is often below the recommended amount for college aged women (20,21,23).

When compared with the 1980 Recommended Dietary Allowances (RDA) (28)(Appendix B), the mean intake of female students did not meet the RDA for folacin, vitamin B6, iron, or zinc. These results are similar to those of previous studies that show college aged women often do not meet the 1980 RDA for these nutrients (16,20,22,23). However, when compared with the 1989 RDA (27) (Appendix A), women exceeded the RDA for folacin, and vitamin B6, but did not meet the RDA for calcium, iron, or zinc. Between 1980 and 1989, the RDA's for women aged 19 to 24 years old decreased for folacin, vitamin B6, iron, and zinc, and increased for calcium. The RDA for folacin decreased from 400 ug to 180 ug per day. The women's mean intake of folacin was 270 ug per day, which was only 67.5 percent of the 1980 RDA, but 150 percent of the 1989 RDA. The RDA for vitamin B6 also decreased from 2.0 mg per day to 1.6 mg per day. The women's mean intake of vitamin B6 was 1.7 mg per

Table 1. Average daily nutrient and energy intake for female students.

Nutrient	Mean Intake ± S.D.	Percent of 1989 RDA*	Ranges of Intakes
Energy (kcals)	1824 ± 574	---	654 - 4787
Protein (g)	73 ± 24	159	14 - 140
Carbohydrate (g)	233 ± 75	---	89 - 486
Fat (g)	71 ± 32	---	10 - 269
Cholesterol (mg)	220 ± 162	---	7 - 1465
Vitamin A (RE)	1361 ± 1125	170	112 - 8625
Thiamin (mg)	1.5 ± 0.5	136	0.4 - 3.0
Riboflavin (mg)	2.0 ± 0.8	154	0.5 - 4.7
Niacin (mg)	18.8 ± 7.0	125	5.0 - 44.2
Vitamin B6 (mg)	1.7 ± 0.7	106	0.2 - 3.8
Vitamin B12 (ug)	4.3 ± 2.7	215	0.3 - 28.3
Folate (ug)	270 ± 143	150	61 - 1122
Ascorbic Acid (mg)	116 ± 83	193	8 - 538
Calcium (mg)	1049 ± 477	87	226 - 3176
Iron (mg)	13.6 ± 5.9	91	3.7 - 40.2
Zinc (mg)	10.2 ± 3.5	85	1.8 - 23.3

*1989 RDA for females 19-24 years old (Appendix A)

day, which was 85 percent of the 1980 RDA, but 106 percent of the 1989 RDA. The RDA for iron decreased from 18 mg per day to 15 mg per day. The women's mean iron intake was 13.6 mg per day, which was 76 percent of the 1980 RDA, but 91 percent of the 1989 RDA. The RDA for zinc decreased from 15 mg per day to 12 mg per day. The women's mean intake of zinc was 10.1 mg per day, which was 67 percent of the 1980 RDA, and 84 percent of the 1989 RDA. Finally, the RDA for calcium increased from 800 mg per day to 1200 mg per day. The women's mean intake for calcium was 1049 mg per day, which was 131 percent of the 1980 RDA, but only 87 percent of the 1989 RDA.

In this study, micronutrient comparisons were made for vitamin B6, iron, zinc, and calcium because mean intakes of college women are often less than the RDA's for these nutrients. Also, this is a study of fat sources in the diets of college students. Fat intake is often associated with protein sources such as meat and dairy products. Vitamin B6, iron, zinc, and calcium are all nutrients found primarily in protein sources of foods, and one objective of the study was to determine whether individuals who have a lower fat intake, also have an even lower intake of these nutrients.

Mean energy and nutrient intakes for the male students, based on an average of two consecutive days' intakes, are shown in Table 2. Their mean energy intake was slightly above the 1989 recommended allowance of 2900

Table 2. Average daily nutrient and energy intake for male students.

Nutrient	Mean Intake ± S.D.	Percent of 1989 RDA*	Ranges of Intakes
Energy (kcals)	3118 + 1151	---	1113 - 5925
Protein (g)	132 + 59	228	48 - 313
Carbohydrate (g)	392 ± 151	---	121 - 801
Fat (g)	119 ± 55	---	38 - 270
Cholesterol (mg)	440 ± 265	---	32 - 1312
Vitamin A (RE)	1582 ± 842	158	354 - 4451
Thiamin (mg)	2.5 ± 0.9	167	0.8 - 5.1
Riboflavin (mg)	3.4 ± 1.3	200	1.5 - 7.0
Niacin (mg)	34.5 ± 15.5	182	12.9 - 81.2
Vitamin B6 (mg)	3.0 ± 1.4	150	0.9 - 6.8
Vitamin B12 (ug)	10.7 ± 16.7	535	1.6 - 133.9
Folate (ug)	425 ± 239	213	115 - 1206
Ascorbic Acid (mg)	149 ± 110	248	14 - 541
Calcium (mg)	1775 ± 818	148	568 - 3545
Iron (mg)	24.9 ± 14.0	249	6.2 - 69.7
Zinc (mg)	17.9 ± 7.4	119	6.6 - 38.2

*1989 RDA for males 19-24 years old (Appendix A)

kilocalories for men aged 19 to 24 years old, of average body size, with a light to moderate activity level (27). Many of these men were Health and Physical Education majors, and may have had a higher than average activity level, thus greater energy requirements. Men exceeded the 1980 and the 1989 RDA's for protein, vitamin A, thiamin, riboflavin, niacin, vitamin B6, vitamin B12, folacin, ascorbic acid, calcium, iron, and zinc.

Since the men had a substantially greater mean intake of energy than women did, they also took in substantially larger amounts of nutrients, as would be expected. If one compares the nutrient density of their diets (Table 3), however, men did not consume significantly greater amounts of any nutrient per 1000 kilocalories than women did.

Table 4 shows the mean energy and nutrient intakes of female students, compared to women 19 to 34 years old, living in the western U.S., from the 1986 CSFII study (CSFII women) (30). The 1986 CSFII is the most recent national survey that reports the energy and nutrient intakes of women in the U.S. The mean energy intake of college women was greater than CSFII women (1824 kcals vs 1634 kcals, respectively); therefore, college women had a greater intake of most nutrients as well. Table 5 shows the mean nutrient density of college women and CSFII women's diets. College women had a greater intake per 1000 kilocalories of carbohydrate (129.3 g vs 117.2 g), vitamin B6 (1.0 mg vs 0.82 mg), calcium (579.8 mg vs 422.0 mg), and

Table 3. Mean intake of nutrients per 1000 kilocalories for female and male students.

Nutrient	Females Mean Intake	Males Mean Intake
Protein (g)	40.3	42.4
Carbohydrate (g)	129.3	127.0
Fat (g)	38.2	37.6
Vitamin B6 (mg)	1.0	1.0
Calcium (mg)	579.8	571.3
Iron (mg)	7.7	8.4
Zinc (mg)	5.6	5.8

Table 4. Mean daily nutrient intake of female students and females from the 1986 CSFII (30)[a] study.

Nutrient	Female students Mean Intake	1986 CSFII females Mean Intake
Energy (kcals)	1824	1634
Protein (g)	73	65
Carbohydrate (g)	233	188
Fat (g)	71	69
Cholesterol (mg)	220	301
Vitamin A (RE)	1361	1103
Thiamin (mg)	1.5	1.2
Riboflavin (mg)	2.0	1.7
Niacin (mg)	18.8	17.5
Vitamin B6 (mg)	1.7	1.4
Vitamin B12 (ug)	4.3	5.3
Folate (ug)	270	244
Ascorbic Acid (mg)	116	101
Calcium (mg)	1049	739
Iron (mg)	13.6	11.8
Zinc (mg)	10.2	10.0

[a]1986 CSFII results for women 19-34 years old, living in the west.

Table 5. Mean intake of nutrients per 1000 kilocalories for female students and females from the 1986 CSFII (43)[a] study.

Nutrient	Female students Mean Intake	1986 CSFII females Mean Intake
Protein (g)	40	41
Carbohydrate (g)	129	117
Fat (g)	38	40
Cholesterol (mg)	116	185
Vitamin B6 (mg)	1.0	0.8
Calcium (mg)	580	422
Iron (mg)	7.7	7.0
Zinc (mg)	5.6	6.0

[a]1986 CSFII results for women 19-34 years old, living in the U.S.

iron (7.7 mg vs 7.0 mg); and, CSFII women had a greater mean intake per 1000 kilocalories of fat (40.1 g vs 38.2 g), cholesterol (185 mg vs 116 mg), and zinc (6.0 g vs 5.6 g). College students also had a proportionately lower intake of fat (34.4% of kilocalories vs 36.1% of kilocalories), and cholesterol than CSFII women. Popkin et al. (15) reported that level of eduation was one population characteristic that was associated with decreased fat consumption of women since 1977, and may be one reason the college women had a lower mean fat intake than U.S. women. It should be noted, however, that the college women did not, as a group, meet the Dietary Goal (3) of not more than 30 percent of energy intake from fat.

Table 6 shows the average daily nutrient and energy intake for ONC Women and OFC Women. There were no significant differences in nutrient intake for energy, protein, carbohydrate, fat, vitamin B6, calcium, or zinc between the two subgroups. OFC Women, however, had a significantly greater mean intake of iron than ONC Women did (14.6 mg vs 12.8 mg, respectively), ($p<.05$). Nutrient density (Table 7) also shows OFC Women to have a greater mean intake of iron per 1000 kilocalories than ONC Women (8.1 mg vs 7.3 mg) ($p<.05$). Jakobovits et al. (25) reported that college women's place of residence (on campus or off campus) did not seem to affect dietary adequacy. These results are consistent with Jakobovits except for iron intake.

Table 6. Comparison of mean daily nutrient and energy intake between ONC Women and OFC Women.

Nutrient	ONC Women Mean Intake	OFC Women Mean Intake
Energy (kcals)	1783	1872
Protein (g)	70	76
Carbohydrate (g)	231	236
Fat (g)	68	74
Vitamin B6 (mg)	1.7	1.7
Calcium (mg)	1069	1035
Iron (mg)	12.8[a]	14.6[b]
Zinc (mg)	9.9	10.5

[a,b]Different superscripts in a row are significantly different $p<.05$.

Table 7. Mean intake of nutrients per 1000 kilocalories for ONC Women and OFC Women.

Nutrient	ONC Women Mean Intake	OFC Women Mean Intake
Protein (g)	40	41
Carbohydrate (g)	131	128
Fat (g)	38	39
Vitamin B6 (mg)	1.0	1.0
Calcium (mg)	598	563
Iron (mg)	7.3[a]	8.1[b]
Zinc (mg)	5.6	5.7

[a,b]Different superscripts in a row are significantly different at $p<.05$.

Table 8 compares the average daily nutrient and energy intake for LF Women and HF Women. The LF Women consumed significantly fewer kilocalories (1563.1 vs 1915.9), less protein (66.6 g vs 74.8 g), fat (42.3 g vs 81.3 g), and zinc (8.7 g vs 10.7 g); and significantly more vitamin B6 (1.9 mg vs 1.6 mg) than HF Women. The LF Women still consumed adequate protein as measured by the 1989 RDA (27); however, their mean zinc intake was only 73 percent of the RDA, while the HF Women consumed 89 percent of the RDA for zinc. HF Women consumed significantly less vitamin B6 than the LF Women, yet their mean intake still met the 1989 RDA. There were no significant differences between the two subgroups for intake of iron or calcium; both groups consumed less than the 1989 RDA.

Table 9 compares nutrient density of LF Women and HF Women. LF Women consumed significantly ($P<.05$) more protein (42.6 g vs 39.5 g), carbohydrate (153.3 g vs 120.8 g), vitamin B6 (1.2 mg vs 0.9 mg), calcium (636.9 mg vs 559.7 mg), and iron (8.6 mg vs 7.3 mg) per 1000 kilocalories than HF Women, even though their total mean intake was lower for protein, and not significantly different for carbohydrate, calcium, and iron. As would be expected, HF Women consumed significantly ($P<.01$) more fat (42.3 g vs 26.5 g) per 1000 kilocalories than LF Women. These results suggest that even though LF Women consume less energy and smaller quantities of nutrients, they consume greater quantities of nutrient dense foods, and

Table 8. Comparison of mean daily nutrient and energy intake between LF Women and HF Women.

Nutrient	LF Women Mean Intake	HF Women Mean Intake
Energy (kcals)	1563 [a]	1916 [b]
Protein (g)	67 [c]	75 [d]
Carbohydrate (g)	237	232
Fat (g)	42 [a]	81 [b]
Vitamin B6 (mg)	1.9[c]	1.6[d]
Calcium (mg)	995	1068
Iron (mg)	13.2	13.8
Zinc (mg)	8.7[a]	10.7[b]

[a,b]Different superscripts in a row are significantly different $p<.01$.
[c,d]Different superscripts in a row are significantly different $p<.05$.

Table 9. Mean intake of nutrients per 1000 kilocalories for LF Women and HF Women.

Nutrient	LF Women Mean Intake	HF Women Mean Intake
Protein (g)	43 [a]	40 [b]
Carbohydrate (g)	153 [c]	121 [d]
Fat (g)	27 [c]	42 [d]
Vitamin B6 (mg)	1.2[c]	0.9[d]
Calcium (mg)	637 [a]	560 [b]
Iron (mg)	8.6[a]	7.3[b]
Zinc (mg)	5.7	5.6

[a,b]Different superscripts in a row are significantly different $p<.05$.
[c,d]Different superscripts in a row are significantly different $p<.01$.

fewer "empty calories".

Individual Nutrient Intakes Compared to the RDA

Mean nutrient intakes of a population have a broad range, with some individuals having low intakes and others having high intakes of most nutrients. Looking only at population intake means, therefore, does not provide adequate information about nutrient intakes of individuals. Thus, we also identified the number of individuals who failed to meet 75 percent of the RDA for vitamin B6, calcium, iron, and zinc. We chose 75 percent as the dividing point, because the RDA's are set with a margin of safety above the mean requirement for most healthy individuals.

Table 10 compares the number and percent of female and male students who failed to meet at least 75 percent of the 1989 RDA. A significantly greater proportion of males met at least 75 percent of the 1989 RDA for vitamin B6 ($p<.001$), calcium ($p<.01$), iron ($p<.001$), and zinc ($p<.001$). Out of 223 female students, 56 (25.1%) failed to meet at least 75 percent of the RDA for vitamin B6, 97 (43.5%) for calcium, 91 (41.0%) for iron, and 87 (39%) for zinc. Out of 60 male students only 5 (8.3%) failed to meet 75 percent of the RDA for vitamin B6, 9 (15.0%) for calcium, 1 (2.0%) for iron, and 10 (16.7%) for zinc.

When ONC Women and OFC Women were compared (Table 11),

Table 10. Number and percent of female and male students consuming less than 75 percent of the 1989 RDA.

Nutrient	Females (n=223) No.	%	Males (n=60) No.	%
Vitamin B6	56	25.1[a]	5	8.3[b]
Calcium	97	43.5[a]	9	15.0[b]
Iron	91	41.0[a]	1	2.0[b]
Zinc	87	39.0[a]	10	16.7[b]

[a,b]Different superscripts in a row are significantly different $p<.01$.

Table 11. Number and percent of ONC Women and OFC Women consuming less than 75 percent of the 1989 RDA.

Nutrient	ONC Women (n=115)		OFC Women (n=107)	
	No.	%	No.	%
Vitamin B6	31	27.0	24	22.4
Calcium	49	42.6	47	43.9
Iron	54	47.0	36	34.0
Zinc	43	37.4	43	40.2

there were no significant differences between the proportion who met at least 75 percent of the RDA for vitamin B6, calcium, iron, and zinc.

Significantly more ($p<.05$) LF Women than HF Women failed to meet at least 75 percent of the RDA for zinc (51.7% vs 34.5%) (Table 12). There were no significant differences in the number of HF women and the number of LF women who met at least 75 percent of the RDA for vitamin B6, calcium or iron; although there was a significant difference between the two subgroups' average intake for vitamin B6.

Distribution of Energy from Protein, Fat, and Carbohydrate

The Dietary Goals (3) recommend that a healthy distribution of energy intake is approximately 12 percent protein, 30 percent fat, and 58 percent carbohydrate. Table 13 compares the distribution of energy intake from protein, fat, and carbohydrate for female and male students.

The women in this study averaged 16.1 percent protein, 34.4 percent fat, and 51.7 percent carbohydrate. These numbers add up to 102 percent, because multiplying grams of protein by 4, carbohydrate by 4, and fat by 9, to determine the caloric value of food, are only estimates and do not always match the actual caloric value of foods. The women in the study, as a group, did not achieve the Dietary Goals (3); however, they had a lower proportion of energy intake

Table 12. Number and percent of LF Women and HF Women consuming less than 75 percent of the 1989 RDA.

Nutrient	LF Women (n=58)		HF Women (n=165)	
	No.	%	No.	%
Vitamin B6	14	24.1	42	25.5
Calcium	24	41.4	73	44.2
Iron	25	43.0	66	40.0
Zinc	30	51.7[a]	57	34.5[b]

[a,b]Different superscripts in a row are significantly different at $p<.05$.

Table 13. Mean energy distribution as percent intake of protein, fat, and carbohydrate for female and male students.

	Protein %	Fat %	Carbohydrate %
Females (n=223)	16.1 ± 3.4*	34.4 ± 8.3	51.7 ± 8.8
Males (n=60)	17.0 ± 4.4	33.8 ± 8.1	50.8 ± 8.5

*Mean ± Standard deviation

from fat than 1986 CSFII (30) women (36.1%); and college women studied by Hernon et al. (20), who reported mean energy from fat to be 36.5 percent. However, the college women from this study had a slightly greater mean energy intake from fat than the 33 percent Hoffman (22) reported for 138 college women in 1987.

The energy intake for the men in this study, averaged 17.0 percent from protein, 33.8 percent from fat, and 50.8 percent from carbohydrate (Table 13). While these men did not attain the Dietary Goals (3), their intake was closer to them than Hernon et al. (20) reported for 58 college men enrolled in an introductory nutrition course in 1980, (17% protein, 38% fat, and 47% carbohydrate). Hoffman's more recent study (22) of 71 college men reported mean fat intake to be 33 percent of energy intake which compares more closely with our results. There were no significant differences between male and female students in distribution of energy between protein, fat, or carbohydrate.

Table 14 compares the distribution of kilocalories for ONC Women and OFC Women. There was no significant difference between the two subgroups for energy intake from protein, fat, or carbohydrate.

Table 15 compares the distribution of kilocalories among LF Women and HF Women. LF Women had a significantly lower intake of fat (23.9% vs 38.1%) ($p<.01$), and significantly greater intakes of protein (17.1% vs 15.8%)

Table 14. Mean energy distribution as percent intake of protein, fat, and carbohydrate for ONC Women and OFC Women.

	Protein %	Fat %	Carbohydrate %
ONC Women (n=107)	15.8 ± 3.5*	34.2 ± 7.9	52.2 ± 9.2
OFC Women (n=115)	16.6 ± 3.2	34.6 ± 8.9	51.1 ± 8.4

*Mean ± Standard deviation

Table 15. Mean energy distribution as percent intake of protein, fat, and carbohydrate for LF Women and HF Women.

	Protein %	Fat %	Carbohydrate %
LF Women (n=58)	17.1 ± 3.8[a*]	23.9 ± 5.1[c]	61.3 ± 7.3[c]
HF Women (n=165)	15.8 ± 3.2[b]	38.1 ± 5.7[d]	48.3 ± 6.5[d]

*Mean ± Standard deviation
[a,b]Different superscripts in a column are significantly different at $p<.05$.
[c,d]Different superscripts in a column are significantly different at $p<.01$.

($p<.05$), and carbohydrate (61.3% vs 48.3%) ($p<.05$) than HF Women. The LF Women consumed less fat, and more protein than is recommended by the U.S. Dietary Goals (3); and the HF Women consumed more fat, more protein, and less carbohydrate than is recommended.

The differences between LF Women and HF Women's micronutrient intakes are consistent with their differences in macronutrient intakes (see Table 8). The LF Women had a lower intake of zinc, which is commonly found in meat, a high protein food, but their intakes of calcium and iron were not lower. This suggests, and a comparison of food group consumption confirms, that LF Women consumed less meat than HF Women, but intake of dairy products was not significantly different, as calcium intake was similar. Also, LF Women who ate less meat, may have compensated by eating more whole grains or fortified cereals, which would contribute to their iron intake, and also help to explain their higher carbohydrate intake. Results from comparisons of food group consumption are discussed in a later section.

Distribution of Fat and Cholesterol Intake

Current U.S. Dietary Goals (3) recommend that no more than 30 percent of our energy intake come from total fat, of which not more than one-third should be saturated fat (sat fat). U.S. Dietary goals (3) also recommend that

cholesterol intake not exceed 100 milligrams per 1000 kilocalories. Table 16 compares fat intake as percent of energy from sat fat, monounsaturated fat (mono fat), and polyunsaturated fat (poly fat); and cholesterol intake in milligrams per 1000 kilocalories for female and male students. Female students had a mean intake of 12.3% sat fat, 11.8% mono fat, and 6.7% poly fat. Males had a mean intake of 12.2% sat fat, 12.0% mono fat, and 6.5% poly fat. Neither, female nor male students met Dietary Goals. There were no significant differences between males and females in percent intake of sat fat, mono fat, and poly fat; however, the male students consumed significantly ($p<.01$) more cholesterol per 1000 kilocalories than the female students (143 mg vs 116 mg).

There were no significant differences between ONC women and OFC women in percent intake of sat fat, mono fat, poly fat; or cholesterol intake per 1000 kilocalories (Table 17).

LF women consumed significantly ($p<.01$) less energy as sat fat (8.7% vs 13.6%), mono fat (7.7% vs 13.3%), and poly fat (4.9% vs 7.4%) than HF women (Table 18), and they met the Dietary Goals (3) for sat fat comprising less than 10 percent of their energy intake. LF women also had a significantly ($p<.01$) lower intake of cholesterol per 1000 kilocalories than HF women (87 mg vs 127 mg). Their cholesterol intake was also less than the recommended 100 milligrams per 1000 kilocalories.

Table 16. Mean fat distribution as percent energy intake from saturated fat, monounsaturated fat, and polyunsaturated fat; and mean cholesterol intake for female and male students.

	Total Fat % kcal	Saturated Fat % kcal	Monounsaturated Fat % kcal	Polyunsaturated Fat % kcal	Cholesterol (mg/1000 kcals)
Females (n=223)	34.4	12.3	11.8	6.7	116[a]
Males (n=60)	33.8	12.2	12.0	6.5	143[b]

[a,b]Different superscripts in a column are significantly different at $p<.01$.

Table 17. Mean fat distribution as percent energy intake from saturated fat, monounsaturated fat, and polyunsaturated fat; and mean cholesterol intake for ONC Women and OFC Women.

	Total Fat % kcal	Saturated Fat % kcal	Monounsaturated Fat % kcal	Polyunsaturated Fat % kcal	Cholesterol (mg/1000 kcals)
ONC Women (n=107)	34.2	12.4	11.6	6.7	113
OFC Women (n=115)	34.6	12.3	12.1	6.8	120

Table 18. Mean fat distribution as percent energy intake from saturated fat, monounsaturated fat, and polyunsaturated fat; and mean cholesterol intake for LF Women and HF Women.

	Total Fat % kcal	Saturated Fat % kcal	Monounsaturated Fat % kcal	Polyunsaturated Fat % kcal	Cholesterol (mg/1000 kcals)
LF Women (n=58)	23.9[a]	8.7[a]	7.7[a]	4.9[a]	87[a]
HF Women (n=165)	38.1[b]	13.6[b]	13.3[b]	7.4[b]	127[b]

[a,b]Different superscripts in a column are significantly different at $p<.01$.

Food Group Consumption

Foods were grouped into 27 categories (Appendix H) according to their fat content per 100 grams of food. Foods in these 27 food categories accounted for 85 percent of the total fat intake for the entire sample. Consumption of foods in each group was measured in three ways: 1) the per capita consumption, in grams, of foods in each group, 2) the portion of the sample using foods from each group, and 3) the mean quantity, in grams, consumed by the users of each food group. Results for college women were compared with those by Popkin et al. (15) for women, aged 19 to 50 years in the 1985 CSFII survey. Intakes were also compared between female and male students, ONC Women and OFC Women, and LF Women and HF Women.

Food Group Consumption by Female Students and Women in the 1985 CSFII

Table 19 reports the daily per capita food group consumption of 223 female students 19 to 24 years old, and the daily per capita food group consumption of a national sample of 1068 women 19 to 50 years old, as reported by Popkin et al. (15). This sample of college women, as a group, consumed substantially more lower fat milk (357.6 g vs 89.4 g); low fat cheese (14.3 g vs 5.5 g), high fat cheese (23.5 g vs 10.3 g), pasta/rice/and cooked cereal

Table 19. Mean food group consumption of female students and females from CSFII 1985 (15).

Food group	Grams per capita per day		Percentage of users		Grams per user per day	
	Students g	CSFII g	Students %	CSFII %	Students g	CSFII g
Milk						
1. Lower fat	357.6	89.4	88.8	47.8	402.8	183.5
2. Higher fat	5.2	71.8	4.0	47.1	128.5	152.4
Cheese						
3. Lower fat	14.3	5.5	22.9	15.9	62.6	34.7
4. Higher fat	23.5	10.3	67.7	57.2	34.7	18.1
Beef,pork, and mixed dishes						
5. Lower fat	9.8	24.7	12.6	39.1	78.2	63.2
6. Medium fat	16.6	34.6	22.4	58.1	74.0	59.5
7. Higher fat	4.4	11.4	10.3	24.9	42.5	46.0
Poultry, and mixed dishes						
8. Lower fat	19.3	18.3	34.1	35.9	56.6	51.1
9. Higher fat	10.2	10.4	15.2	24.2	66.7	43.1
Lunch meats, sausages						
10. Lower fat	10.9	3.6	28.3	19.6	38.5	18.6
11. Higher fat	7.5	9.0	21.1	39.5	35.6	22.7
Fish,seafood, and mixed dishes						
12. Lower fat	1.3	5.6	3.6	14.4	35.7	39.2
13. Higher fat	3.5	14.8	5.8	30.3	59.6	49.0
14. Egg, egg mixtures	11.5	18.3	21.1	51.0	54.5	35.8
15. Legumes	13.2	16.9	36.8	27.5	35.9	61.3
Breads, Waffles, Pancakes						
16. Lower fat	19.2	9.9	50.2	42.9	38.3	23.1
17. Higher fat	16.8	21.8	41.3	61.2	40.7	35.7
Desserts						
18. Higher fat	55.9	40.8	71.7	65.0	77.8	62.8
Salty Snacks						
19. Higher fat	16.0	8.1	61.0	54.0	26.2	14.9
20. Pasta,rice, cooked cereals	68.7	30.9	58.3	38.2	117.8	80.9
Cereals, ready-to-eat						
21. Lower fiber	8.2	2.9	33.6	18.1	24.2	16.0
22. Higher fiber	6.9	4.1	22.0	20.2	31.2	20.1
Grain mixtures						
23. Higher fat	64.5	48.1	37.2	46.5	173.3	103.6
Potatoes						
24. Higher fat	20.1	19.6	26.0	46.1	77.3	42.6
25. Butter and margarine	5.7	5.2	58.7	72.9	9.7	7.1
Salad Dressings						
26. Lower fat	2.2	0.7	9.9	4.6	21.6	14.4
27. Higher fat	8.7	9.1	55.2	62.8	15.8	14.5

(68.7 g vs 30.9 g), lower fat breads (19.2 g vs 9.9 g), cereals (15.1 g vs 7.0 g), higher fat grain mixtures (64.5 g vs 48.1 g), desserts (55.9 g vs 40.8 g), and higher fat salty snacks (16.0 g vs 8.1 g), than women from the 1985 CSFII. Women in the 1985 CSFII consumed substantially more higher fat milk (71.8 g vs 5.2 g); beef/pork, low fat (24.7 g vs 9.8 g), medium fat (34.6 g vs 16.6 g), and high fat (11.4 g vs 4.4 g)); and fish, low fat (5.6 g vs 3.5 g), and high fat (14.8 g vs 3.5 g). Both groups had similar intakes of poultry (low fat and high fat); butter and margarine; and salad dressing. These comparisons indicate this sample of college women consumed less of the plain meats, with or without separable meat fat; and more cheese, and food groups with hidden fats, such as high fat grain mixtures, desserts, and salty snacks than American women nationally. These kinds of foods are readily accessible in the college environment, and are consistent with reported food preferences of college students (32).

Table 19 also reports the percentage of users of each food group among the college women, and 1985 CSFII women. A greater proportion of college women than 1985 CSFII women used lower fat milk (88.8% vs 47.8%), lower fat cheese (22.9% vs 15.9%), higher fat cheese (67.7% vs 57.2%), lower fat lunch meats (28.3% vs 19.6%), legumes (36.8% vs 27.5%), lower fat breads (50.2% vs 42.9%), higher fat desserts (71.7% vs 65.0%), higher fat salty snacks (61.0% vs 54.0%), pasta/rice/cooked cereals (58.3% vs 38.2%), and lower fiber

ready-to-eat cereals (33.6% vs 18.1%). A greater proportion of 1985 CSFII women used higher fat milk (47.8% vs 4.0%), lower fat beef/pork (39.1% vs 12.6%), medium fat beef/pork (58.1% vs 22.4%), higher fat beef/pork (24.9% vs 10.3%), higher fat poultry (39.5% vs 21.1%), lower fat fish (14.4% vs 3.6%), higher fat fish (30.3% vs 5.8%), eggs (51.0% vs 21.1%), higher fat breads (61.2 % vs 41.3%), higher fat grain mixtures (46.5% vs 37.2%), higher fat potatoes (46.1% vs 26.0%), butter/margarine (72.9% vs 58.7%), and higher fat salad dressing (62.8% vs 55.2%). Even though the per capita consumption of legumes for CSFII 1985 women was higher, a greater proportion of college women reported using legumes. Per capita consumption of grain mixtures and potatoes were also higher for college students; however, a greater percentage of CSFII women used these groups.

Table 19 also reports the grams of food consumed by the users of each food group. College women ate larger quantities of food in most of the groups. This may be explained by the fact that they took in more total kilocalories than CSFII 1985 women. The exceptions include the food categories which the CSFII women consumed more of; higher fat milk (152.4 g vs 128.5g), higher fat beef/pork (46.0 g vs 42.5 g), lower fat fish (39.2 g vs 35.7 g), and legumes (61.3 g vs 35.9 g).

The 1985 and 1986 CSFII (5,14) report that women are consuming less whole milk, meat as entrees, and eggs, and

eating more low fat milk, and grain products since 1977. Popkin (15) also pointed out that these same women are also consuming more hidden sources of fat from grain mixtures (i.e. pizza, macaroni and cheese), high fat potatoes, desserts, and high fat salty snacks. The results from this study suggest that these college women exemplify these trends even more than the national survey women do. A greater number of college women seem to use and consume lower fat milk and grain products, and use less meat as entrees, and fewer eggs. However, decreases in fat consumption from these groups may be offset by the consumption of cheeses, desserts, and salty snack foods. Mean fat intake of CSFII 1986 women was 36 percent of energy consumed, and 34.4 percent of energy for the college women. Perhaps these college women could achieve the Dietary Goals (3) by substituting lean meats, or fish for high fat grain mixtures and cheese, and by cutting back on high fat desserts and salty snack foods.

Food Group Consumption by Female and Male Students

Table 20 reports mean food group consumption of female and male students. Male students had significantly greater daily per capita consumption than female students for low fat milk (637.8 g vs 357.6 g), medium fat beef/pork (34.0 g vs 16.6 g), higher fat lunchmeat/sausage (17.5 g vs 7.5 g), higher fat fish (23.3 g vs 3.5 g), eggs (29.1 g vs 11.5 g),

Table 20. Mean food group consumption for female students and male students.

Food Group	Grams per capita per day		Percentage of users		Grams per user per day	
	Females g	Males g	Females %	Males %	Females g	Males g
Milk						
1. Lower fat	357.6[a]	637.8[b]	88.8	95.0	402.8[e]	671.4[f]
2. Higher fat	5.2	40.2	4.0	3.3	128.5	1207.3
Cheese						
3. Lower fat	14.3	12.3	22.9	10.0	62.6	122.9
4. Higher fat	23.5	30.7	67.7	63.3	34.7	48.5
Beef,pork, and mixed dishes						
5. Lower fat	9.8	14.6	12.6	18.3	78.2	79.4
6. Medium fat	16.6[a]	34.0[b]	22.4	35.0	74.0	97.1
7. Higher fat	4.4	10.3	10.3	13.3	42.5	77.0
Poultry, and mixed dishes						
8. Lower fat	19.3	35.2	34.1	31.7	56.6[e]	111.2[f]
9. Higher fat	10.2	14.2	15.2	13.3	66.7	106.5
Lunch meats, sausages						
10. Lower fat	10.9	15.4	28.3	30.0	38.5	51.2
11. Higher fat	7.5[a]	17.5[b]	21.1[c]	36.7[d]	35.6	47.8
Fish,seafood, and mixed dishes						
12. Lower fat	1.3	7.8	3.6[c]	11.7[d]	35.7	66.8
13. Higher fat	3.5[a]	23.3[b]	5.8[c]	18.3[d]	59.6[e]	127.0[f]
14. Egg, egg mixtures	11.5[a]	29.1[b]	21.1	33.3	54.5[e]	87.4[f]
15. Legumes	13.2[a]	30.3[b]	36.8	41.7	35.9[e]	72.7[f]
8reads, Waffles, Pancakes						
16. Lower fat	19.2[a]	38.6[b]	50.2	55.0	38.3[e]	70.1[f]
17. Higher fat	16.8	26.6	41.3	28.3	40.7[e]	93.9[f]
Desserts						
18. Higher fat	55.9	75.1	71.7	63.3	77.8	118.5
Salty Snacks						
19. Higher fat	16.0	22.3	61.0[c]	35.0[d]	26.2[e]	63.8[f]
20. Pasta, rice, cooked cereals	68.7	98.2	58.3	60.0	117.8[e]	163.7[f]
Cereals, ready-to-eat						
21. Lower fiber	8.2	11.8	33.6	40.0	24.2	29.5
22. Higher fiber	6.9	13.4	22.0	26.7	31.2[e]	50.2[f]
Grain mixtures						
23. Higher fat	64.5[a]	161.8[b]	37.2	46.7	173.3[e]	346.7[f]
Potatoes						
24. Higher fat	20.1[a]	37.9[b]	26.0[c]	40.0[d]	77.3	94.6
25. Butter and magarine	5.7	6.7	58.7[c]	43.3[d]	9.7	15.5
Salad Dressings						
26. Lower fat	2.2[a]	0.6[b]	9.9	5.0	21.6	12.4
27. Higher fat	8.7	10.5	55.2	53.3	15.8	19.7

[a,b]Different superscripts in a row are significantly different at $p<.05$.
[c,d]Different superscripts in a row are significantly different at $p<.05$.
[e,f]Different superscripts in a row are significantly different at $p<.05$.

legumes (30.3 g vs 13.2 g), lower fat breads (38.6 g vs 19.2 g), higher fat grain mixtures (161.5 g vs 64.5 g), and higher fat potatoes (37.9 g vs 20.1 g). The largest and most significant differences between males and females were low fat milk consumption ($p < .001$), high fat grain mixtures ($p < .01$), and eggs ($p < .01$.). Per capita intake by female students was not significantly greater for any food group except lower fat salad dressings (2.2 g vs 0.6 g). These results are to be expected as the male students had a significantly greater mean energy intake than the female students.

Table 20 also shows percent of users of each food group among female and male students. A significantly larger proportion of females used lower fat cheese (22.9% vs 10.0%), higher fat salty snacks (61.0% vs 35.0%), and butter/margarine (58.7% vs 43.3%). Although not significant at $p<.05$, a greater percentage of females used higher fat breads (41.3% vs 28.3%), and higher fat desserts (71.7% vs 63.3%) than male students did. A significantly larger proportion of males used higher fat lunch meats and sausages (36.7% vs 21.1%), lower fat fish (11.7% vs 3.6%), higher fat fish (18.3% vs 5.8%), and higher fat potatoes (40.0% vs 26.0%). Although not significant at the $p < .05$ level, a larger proportion of males also used medium fat beef and pork (35.0% vs 22.4%), and eggs (33.3% vs 21.1%).

Again, as male students had a significantly greater energy intake than female students, male users of food

groups consumed significantly greater quantities of many food groups than female users of food groups (Table 20).

These results indicate that a larger number of male students consume eggs, and meat, and greater quantities of both, than female students. These findings are consistent with the nutrient intakes in Table 16 showing mean cholesterol intake per 1000 kilocalories was significantly greater for males than females. However, mean total fat, and saturated fat intake as percents of energy consumption were not significantly different between males and females. While the men consumed more meat, more of the women consumed cheese, desserts, and higher fat salty snacks.

Food Group Consumption by ONC Women and OFC Women

Table 21 reports food group consumption of ONC Women and OFC Women. Daily per capita consumption by ONC Women was significantly greater than that of OFC Women for higher fat potatoes (26.1 g vs 12.3 g). Daily per capita consumption of OFC Women was significantly greater for higher fat milk (10.4 g vs 0.4 g), higher fat fish (6.3 g vs 0.8 g), pasta/rice/cooked cereal (88.0 g vs 51.3 g), and butter/margarine (7.4 g vs 4.0 g) than for ONC Women.

A significantly greater proportion of ONC Women than OFC Women used lower fat beef/pork (18.3% vs 5.6%), lower fat lunch meat (34.8% vs 21.5%), and higher fat potatoes (33.9% vs 16.8%) (Table 21). A significantly greater

Table 21. Mean food group consumption for ONC Women and OFC Women.

Food Group	Grams per capita per day		Percentage of users		Grams per user per day	
	ONC Women g	OFC Women g	ONC Women %	OFC Women %	ONC Women g	OFC Women g
Milk						
1. Lower fat	378.5	338.5	90.4	87.9	418.5	385.3
2. Higher fat	0.4[a]	10.4[b]	0.9[c]	7.5[d]	42.5	139.2
Cheese						
3. Lower fat	14.3	14.4	27.0	18.7	53.2	77.2
4. Higher fat	22.5	24.8	67.0	69.2	33.6	35.9
Beef, Pork, and mixed dishes						
5. Lower fat	12.4	6.8	18.3[c]	5.6[d]	68.1[e]	120.4[f]
6. Medium fat	11.3	21.5	18.3	26.2	62.0	82.2
7. Higher fat	4.3	4.5	11.3	9.3	37.8	48.6
Poultry, and mixed dishes						
8. Lower fat	19.1	19.7	33.9	34.6	56.4	56.8
9. Higher fat	9.5	11.0	17.4	13.1	54.5[e]	84.1[f]
Lunch meats, sausages						
10. Lower fat	13.2	8.4	34.8[c]	21.5[d]	38.0	39.3
11. Higher fat	7.6	7.5	23.5	18.7	32.3	40.0
Fish, seafood, and mixed dishes						
12. Lower fat	1.3	1.2	2.6	4.7	50.8	26.6
13. Higher fat	0.8[a]	6.3[b]	2.6	9.3	32.2	67.8
14. Egg, egg mixtures	10.4	12.8	19.1	23.4	54.2	54.7
15. Legumes	9.6	17.2	33.9	40.2	28.4	42.7
Breads, Waffles, Pancakes						
16. Lower fat	16.6	22.3	49.6	51.4	33.4[e]	43.3[f]
17. Higher fat	17.4	16.0	46.1	35.5	37.8	45.1
Desserts						
18. Higher fat	61.2	50.2	74.8	68.2	81.9	73.6
Salty Snacks						
19. Higher fat	15.1	17.0	60.9	60.7	24.7	27.9
20. Pasta, rice, cooked cereals	51.3[a]	88.0[b]	58.3	58.9	88.0[e]	149.5[f]
Cereals, ready to eat						
21. Lower fiber	8.9	7.4	35.7	31.8	25.1	23.2
22. Higher fiber	5.2	8.7	19.1	25.2	27.4	34.3
Grain mixtures						
23. Higher fat	52.0	78.5	38.3	36.4	136.0[e]	215.4[f]
Potatoes						
24. Higher fat	26.1[a]	12.3[b]	33.9[c]	16.8[d]	76.8	73.0
25. Butter and magarine	4.0[a]	7.4[b]	49.6[c]	68.2[d]	8.1	10.9
Salad Dressings						
26. Lower fat	3.0	1.2	13.9	5.6	21.6	21.5
27. Higher fat	8.0	9.5	56.5	54.2	14.2	17.6

[a,b]Different superscripts in a row are significantly different at $p<.05$.
[c,d]Different superscripts in a row are significantly different at $p<.05$.
[e,f]Different superscripts in a row are significantly different at $p<.05$.

proportion of OFC Women than ONC Women used higher fat milk (7.5% vs 0.9%), and butter/margarine (68.2% vs 49.6%).

Among users of each food group (Table 21), OFC Women consumed significantly more than ONC Women, of lower fat beef/pork (120.4 g vs 68.1 g); higher fat poultry (84.1 g vs 54.5 g); lower fat breads (43.3 g vs 33.4 g); pasta/rice/cooked cereals (149.5 g vs 88.0 g); and higher fat grain mixtures (215.4 g vs 136.0 g) (Table 21). ONC Women food group users did not consume significantly more of any food group. Perhaps the meals served from resident cafeterias have portion control standards, and serve smaller amounts of foods to ONC Women than they would serve to themselves. There were no significant differences in energy or fat intake between ONC and OFC Women. Perhaps the ONC Women had access to, and ate a greater variety of foods in smaller quantities, whereas, OFC Women's meals had less variety and they ate more of the food items they did have.

There were not many significant differences in food intake between ONC women and OFC women. ONC women seem to have a greater intake of higher fat potatoes; and OFC women seem to have a greater intake of pasta/rice/cooked cereals; and butter/margarine. Perhaps the ONC women have easier access to french fries and hash browns in the cafeterias, and OFC women can help themselves to larger portion sizes of foods they buy and prepare themselves. This study does not show much difference in dietary adequacy between ONC

Women and OFC Women, as was also reported in Jakobovit's study (25).

Food Group Consumption by LF Women and HF Women

Table 22 reports food group consumption for LF Women and HF Women. As would be expected, daily per capita consumption of many higher fat food groups were significantly greater for HF women, since both their mean energy intake, and their mean fat intake were higher than for LF women. Daily per capita consumption among HF Women was significantly greater than among LF Women for higher fat cheese (26.8 g vs 14.1 g), medium fat beef/pork (21.4 g vs 2.8 g), higher fat beef/pork (5.4 g vs 1.5 g), higher fat poultry (12.5 g vs 3.6 g), lower fat lunchmeats (12.6 g vs 6.0 g), higher fat lunchmeats (9.3 g vs 2.5 g), eggs (13.3 g vs 2.5 g), higher fat breads (18.9 g vs 10.9 g), desserts (65.4 g vs 28.5 g), higher fat potatoes (23.5 g vs 10.6 g), and butter/margarine (6.6 g vs 3.1 g). The largest differences in daily per capita consumption were for desserts ($p < .001$), which HF Women ate more than twice as much of as LF Women; medium fat beef/pork ($p < .001$), which HF Women ate more than seven times as much of as LF Women; and high fat cheese ($p < .001$), which HF women ate close to twice as much of as LF Women. Daily per capita consumption by LF women was not significantly greater at $p<.05$ for any food group; however, LF women did consume

Table 22. Mean food group consumption for LF Women and HF Women.

Food Group	Grams per capita per day		Percentage of users		Grams per user per day	
	LF Women	HF Women	LF Women	HF Women	LF Women	HF Women
	g	g	%	%	g	g
Milk						
1. Lower fat	362.9	355.7	87.9	89.1	412.7	399.3
2. Higher fat	10.0	3.5	5.2	3.6	194.2	95.6
Cheese						
3. Lower fat	18.9	12.7	29.3	20.6	64.5	61.7
4. Higher fat	14.1[a]	26.8[b]	53.4[c]	72.7[d]	26.4[e]	36.8[f]
Beef, pork, and mixed dishes						
5. Lower fat	8.7	10.2	12.1	12.7	72.1	80.2
6. Medium fat	2.8[a]	21.4[b]	5.2[c]	28.5[d]	54.5	75.3
7. Higher fat	1.5[a]	5.4[b]	1.7[c]	13.3[d]	85.0	40.5
Poultry and mixed dishes						
8. Lower fat	21.9	18.4	43.1	30.9	50.9	59.4
9. Higher fat	3.6[a]	12.5[b]	5.2[c]	18.8[d]	68.7	66.5
Lunch meats, sausages						
10. Lower fat	6.0[a]	12.6[b]	19.0	31.5	31.6	39.9
11. Higher fat	2.5[a]	9.3[b]	8.6[c]	25.5[d]	28.8	36.4
Fish, seafood, and mixed dishes						
12. Lower fat	1.2	1.3	3.4	3.6	35.4	35.7
13. Higher fat	4.6	3.1	5.2	6.1	89.8	50.5
14. Egg, egg mixtures	6.2[a]	13.3[b]	13.8	23.6	45.3	56.3
15. Legumes	18.1	11.5	41.4	35.2	43.8	32.6
Breads, Waffles, Pancakes						
16. Lower fat	25.8	16.9	63.8[c]	45.5[d]	10.4	37.2
17. Higher fat	10.9[a]	18.9[b]	34.5	43.6	31.7	43.2
Desserts						
18. Higher fat	28.5[a]	65.4[b]	48.3[c]	80.0[d]	59.0	81.8
Salty Snacks						
19. Higher fat	10.9	17.7	48.3[c]	65.5[d]	22.6	27.1
20. Pasta,rice, cooked cereal	81.1	64.3	63.8	56.4	127.1	114.1
Cereal, ready to eat						
21. Lower fiber	12.2	6.7	41.4	30.9	29.4	21.7
22. Higher fiber	7.9	6.5	24.1	21.2	32.9	30.5
Grain mixtures						
23. Higher fat	58.4	66.6	29.3	40.0	199.3	166.6
Potatoes						
24. Higher fat	10.6[a]	23.5[b]	12.1[c]	30.9[d]	87.6	75.9
25. Butter and margarine	3.1[a]	6.6[b]	44.8[c]	63.6[d]	6.8[e]	10.3[f]
Salad Dressings						
26. Lower fat	3.4	1.7	15.5	7.9	22.0	21.2
27. Higher fat	6.8	9.4	34.5[c]	62.4[d]	19.7	15.0

[a,b]Different superscripts in a row are significantly different at $p<.05$.
[c,d]Different superscripts in a row are significantly different at $p<.05$.
[e,f]Different superscripts in a row are significantly different at $p<.05$.

more pasta/rice/cooked cereal (81.1 g vs 64.3 g), lower fat breads (25.8 g vs 16.9 g), lower fat milk (362.9 g vs 355.7 g), higher fat milk (10.0 g vs 3.5 g), and legumes (18.1 g vs 11.5 g) than HF women did.

A significantly greater percentage of LF Women than HF Women used lower fat breads (63.8% vs 45.5%). A significantly greater proportion of HF women consumed higher fat cheese (72.7% vs 53.4%), medium fat beef/pork (28.5% vs 5.2%), higher fat beef/pork (13.3% vs 1.7%), higher fat poultry (18.8% vs 5.2%), desserts (80.0% vs 48.3%), salty snacks (65.5% vs 48.3%), higher fat potatoes (30.9% vs 12.1%), butter and margarine (63.6% vs 44.8%), and higher fat salad dressing (62.4% vs 34.5%) (Table 22).

It is clear, that as a group, more of the HF Women used the higher fat food groups, and consumed more in these groups than the LF Women, especially higher fat meats and desserts. Less than 19 percent of the LF women used red meat at all; however, many (43.1%) used lower fat poultry. Interestingly, few women from any subgroup consumed much fish or seafood, which is readily available and low in fat. LF women also used and consumed more grains than HF women.

It is also worthwhile to look at like intakes of foods. LF women and HF women had similar intakes of lower fat milk, lower fat beef/pork, fish (low and high fat), and higher fiber cereal. The last two, however, were consumed at low levels by everyone in the study.

Quantities of foods eaten by users of each food group

was not very different between LF women and HF women (Table 22), because those who ate foods in each group ate about the same portion sizes. There were two exceptions. HF women consumed greater amounts of higher fat cheese (36.8 g vs 26.4 g), and more butter/margarine (10.3 g vs 6.8 g). Thus, the difference in total fat intake may be attributed to the avoidance of some high fat food groups by LF Women.

These results parallel the nutrient intake results of LF and HF Women. LF Women had a significantly lower intake of protein and zinc, but not iron or vitamin B6, all of which are found in meat. LF Women consume less meat than HF Women, but consume more grains and legumes which are also good sources of iron and vitamin B6. Also, many cereals are fortified with iron and vitamin B6, which also may partially explain their adequate intake of these nutrients. Worthington-Roberts et al. (22), also examined fat intake and iron status of college women. They compared groups of women based on whether their primary protein intake was from red meat, poultry and/or fish, or if they were lactoovovegetarians. They found no significant differences in total fat intake between groups, while the women in this study who had a low fat intake consumed significantly less red meat. Worthington-Roberts also found there were no significant differences between groups for iron intake, as we found in this study. She did find, however, that women who ate red meat had more adequate iron stores than women who did not eat red meat. Meat sources

of iron are more bioavailable than vegetable sources. Iron status of LF Women was not examined in this study.

SUMMARY AND CONCLUSIONS

Nutrient intakes and food sources of fat were analyzed for 233 female students, and 60 male students enrolled in six introductory nutrition classes between September 1987 and June 1988. Daily mean intakes of nutrient and food data were calculated from two-day dietary records. Comparisons were made between males and females; women who lived on campus (ONC Women), and women who lived off campus (OFC Women); and women whose fat intake was equal to or less than 30 percent of their caloric intake (LF Women), and women whose fat intake was greater than 30 percent of their caloric intake (HF Women).

Since the sample population was not a random sample of all college students at this university, but only those enrolled in introductory nutrition classes, they may have had a greater interest in nutrition than the general student body. Otherwise, the female subjects were a reasonably representative sample of the undergraduate student population, in the sense that they represented nine of the twelve colleges granting undergraduate degrees. The men were less representative of the total student population, as most of them were Health and P.E. majors, with a decided interest in nutrition.

Comparison of Intakes of Female Students and Women in the 1985 and 1986 CSFII Surveys

Comparisons of nutrient intakes between the female students and national samples of adult women (1985 and 1986 CSFII)(15,5), showed a greater total energy intake among the college women, but a smaller proportion of kilocalories came from fat (34.4% vs 36.1%). Intakes of college students were lower for zinc and cholesterol than for western U.S. women as a whole.

Comparisons of food sources of fat show the college women consumed greater quantities of lower fat milk, cheese, lower fat bread, pasta/rice/cooked cereal, ready-to-eat cereal, grain mixtures, desserts, and salty snacks than U.S. women in general. The college women consumed less whole milk, beef/pork, eggs, higher fat lunch meats, and higher fat breads.

College women's lower intake of zinc and cholesterol, may be attributable to their lower intake of meat and eggs. Although the college women consumed lower fat diets than CSFII women, they still exceeded the maximum fat intake (30 percent of energy intake) recommended by the Dietary Goals (3). College women's lower intake of whole milk, meat, and eggs may explain their lower fat and cholesterol intake, however, their fat consumption could be further decreased by limiting consumption of cheeses, desserts, and salty snacks (hidden sources of fat).

Comparison of Intakes of Female and Male Students

The mean intakes of female students were less than the 1980 and 1989 RDA's for iron, and zinc. Intake of vitamin B6 failed to meet the 1980 RDA, but did meet the lower 1989 RDA. Intake of calcium met the lower 1980 RDA but not the 1989 RDA. Mean intakes of male students were at least 100 percent of the 1980 and 1989 RDA's for all nutrients calculated.

Men had significantly greater mean intakes of energy, protein, carbohydrate, fat, vitamin B6, calcium, iron, and zinc, than women ($p<.01$). This was accounted for by the larger quantity of food the men ate. When nutrient density was compared, there were no significant differences between men and women in nutrient intake per 1000 kilocalories for any nutrient studied.

When looking at the percent of women and men who did not meet at least 75 percent of the RDA, a larger proportion of women than men did not meet 75 percent of the 1989 RDA for vitamin B6 (25% vs 8.3%), calcium (43.5% vs 15%), iron (41% vs 2%), and zinc (39% vs 16.7%) ($p<.01$).

There were no significant differences between female and male students for percent of energy intake as protein, fat, or carbohydrate; or as saturated fat, monounsaturated fat, and polyunsaturated fat. Males, however, consumed significantly more cholesterol per 1000 kilocalories than women ($p<.01$).

Analysis of the food sources of fat showed that per capita consumption of foods in the meat group, specifically the medium fat beef/pork, higher fat lunch meats/sausages, higher fat fish, eggs, and legumes, was significantly greater for men than for women. A greater proportion of men than women ate foods from the meat group, especially the higher fat lunch meats/sausages, and fish. Per capita consumption by women, was not significantly greater for any food group, because men ate more food; however, a larger porportion of women than men used higher fat salty snacks, butter/margarine, lower fat cheese, higher fat breads, desserts, and lower fat salad dressings. Melby et al. (33) reported that women tend to use lower fat food items more than men. These results show that more women than men do use the lower fat cheese and lower fat salad dressing, however, more women also use higher fat salty snacks, higher fat breads, and desserts than men.

These food group consumption results match the nutrient intake data in that there are no significant differences between men and women for proportional intake of carbohydrate, protein, fat, saturated fat, monounsaturated fat, or polyunsaturated fat. A greater proportion of women ate less meat, but also ate more hidden sources of fat; and a greater proportion of men ate meat, but fewer hidden sources of fat. So their fat intakes balanced out. This comparison also explains why the men had a higher cholesterol intake. They ate more animal

sources of foods than women ate.

Comparison of Intakes of Women Living On and Off Campus

Nutrient intake comparisons between ONC Women and OFC Women showed a significant difference for iron intake only. Mean daily nutrient intake of iron was significantly greater for OFC Women than for ONC Women (14.6 mg vs 12.8 mg). Nutrient density analysis also showed the mean iron intake per 1000 kilocalories to be significantly greater for OFC Women than ONC Women (8.1 mg/1000 kcal vs 7.3 mg/1000 kcal).

Food intake comparisons showed that per capita consumption of pasta/rice/cooked cereal, and grain mixtures was greater among OFC Women than ONC Women, even though the percent of ONC and OFC Women using these food groups were nearly the same. More ONC Women than OFC Women ate higher fat potatoes, and they ate more of them. A greater proportion of ONC Women used lower fat beef/pork, and lower fat lunch meat. This implies that these foods were readily available in the resident cafeterias.

Among meat and grain group users, OFC Women generally consumed greater quantities of meat and grains than ONC Women. Perhaps portion control measures at resident cafeterias are responsible for smaller serving sizes of food than OFC Women prepare and serve themselves. Even though OFC Women who used meat and grains, consumed larger

quantities than ONC Women, neither energy nor fat intake were significantly different between the two groups. Perhaps ONC Women had access to, and ate a greater variety of foods in smaller quantities, whereas OFC Women's meals had less variety and they ate more of the food items they did have. Perhaps the OFC Women had a greater mean iron intake because those who did eat meat and grains (good sources of iron), ate enough of them to provide significantly better intakes of iron than the ONC Women.

Comparison of Intakes of Women Eating Low and High Fat Diets

Nutrient intake comparisons between LF Women and HF Women, showed that HF Women had significantly greater mean intakes of energy, protein, fat, and zinc; and LF Women had a significantly greater intake of vitamin B6. When comparing nutrient density, however, the LF Women had significantly greater intakes of protein, carbohydrate, vitamin B6, calcium, and iron per 1000 kilocalories, and the HF Women only had a significantly greater intake of fat per 1000 kilocalories. These results indicate that HF Women eat more food, and therefore consume a greater quantity of nutrients; LF Women, however, consume more nutrient dense foods.

Also, a larger percentage of LF Women than HF Women did not meet 75 percent of the 1989 RDA for zinc (51.7% vs

34.5%, respectively). Thus, even though the mean nutrient intake of zinc for young women is already well below the RDA, these LF Women have an even lower intake.

When comparing energy distribution, LF Women consume a greater percentage of their kilocalories from protein and carbohydrate, and less from fat than HF Women. Also, LF Women consume significantly less of their energy from saturated fat, monounsaturated fat, and polyunsaturated fat than HF Women do; and their fat intakes are within the recommendations set by the U.S. Dietary Goals (3). LF Women also have a significantly lower intake of cholesterol per 1000 kilocalories than HF Women.

Food intake data show that HF Women consume a significantly greater quantity of the higher fat foods than LF Women. Per capita consumption by HF Women, and percent of HF Women who used the food group, was significantly greater for higher fat cheese, medium and higher fat beef/pork, higher fat poultry, higher fat lunch meats, higher fat desserts, higher fat potatoes, and butter/margarine. The greatest differences in daily per capita consumption between HF Women and LF Women were for desserts (65.4 g vs 28.5 g, respectively), then medium fat beef/pork (21.4 g vs 2.8 g, respectively). LF Women consumed greater quantities of lower fat breads, and legumes than HF Women, although these differences were not statistically significant.

Of food group users, there were not many differences

between LF and HF Women in quantity of foods eaten. If LF Women ate a food group at all, they ate about the same amount as the HF Women. This indicates that the greater per capita consumption of higher fat foods by HF Women is due primarily to a greater proportion of HF Women using the higher fat food groups, rather than amounts eaten by individuals.

The LF Women clearly ate less meat than the HF Women, and they had a significantly lower intake of zinc, but not iron. As meat is the best natural food source of both of these nutrients, perhaps the LF Women ate a lot of food items fortified with iron but not zinc. LF Women ate somewhat more foods from the legumes group which are a rich source of iron. Inadequate zinc intake may be a growing concern as more individuals consume smaller quantities of meat. Meat is also a significant source of vitamin B6, but B6 is also found in many vegetables and whole grains, and in fact a 3/4 cup serving of legumes provides three times as much B6 as a 3 oz. serving of meat (53). Therefore, it is not hard to understand how the LF Women had a greater B6 intake.

Conclusion

In summary, the college women in this study did not meet U.S. Dietary Goals (3) for fat consumption. College women, however, did have a proportionately lower intake of

fat than a national sample of women 19 to 34 years, living in the west in 1986, and a correspondingly lower intake of cholesterol.

A large proportion of the college women consumed less than 75 percent of the RDA for vitamin B6, calcium, iron, and zinc. Meat is a major source for all of these nutrients except calcium. College women consumed less zinc than the national sample, and had a lower intake of meat, a good source of zinc. LF Women, also, had a lower intake of zinc than HF Women, and consumed less meat.

The male students did not have a proportionately greater intake of fat, than women students, although they did have a greater intake of cholesterol due to the greater consumption of foods of animal origin.

Further Research

One pervasive question throughout this study, is whether the LF Women are really health conscious, and cut back on fat intake to avoid future chronic diseases; or if they are obsessed with weight control, or have anorexic tendencies, as so many college aged women do. Usually health conscious individuals are also engaged in an exercise program. If this were true for the LF women, then their mean caloric intake, which is already below recommended levels, would probably not be adequate to maintain weight.

Another area for further research would be to look more closely at nutrient content and portion sizes of resident cafeteria meals. Questions such as, "why were the ONC women lower in iron intake?", and "are students really satisfied with the amount and quality of foods in the cafeterias?" need to be investigated. One could try developing lower fat desserts, lower fat breads, and lower fat mixed grain dishes in resident cafeterias, and monitor student acceptance.

Finally, for sample groups that had a lower fat intake, there was a corresponding lower zinc intake. Zinc intake, status, and bioavailability is a growing concern as more individuals decrease their intake of fat and increase their intake of fiber.

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APPENDICES

Appendix A. 1989 RDA

FOOD AND NUTRITION BOARD, NATIONAL ACADEMY OF SCIENCES—NATIONAL RESEARCH COUNCIL
RECOMMENDED DIETARY ALLOWANCES,[a] Revised 1989
Designed for the maintenance of good nutrition of practically all healthy people in the United States

							Fat-Soluble Vitamins				Water-Soluble Vitamins							Minerals						
Category	Age (years) or Condition	Weight[b] (kg)	Weight[b] (lb)	Height[b] (cm)	Height[b] (in)	Protein (g)	Vitamin A (μg RE)[c]	Vitamin D (μg)[d]	Vitamin E (mg α-TE)[e]	Vitamin K (μg)	Vitamin C (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg NE)[f]	Vitamin B_6 (mg)	Folate (μg)	Vitamin B_{12} (μg)	Calcium (mg)	Phosphorus (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)	Iodine (μg)	Selenium (μg)
Infants	0.0–0.5	6	13	60	24	13	375	7.5	3	5	30	0.3	0.4	5	0.3	25	0.3	400	300	40	6	5	40	10
	0.5–1.0	9	20	71	28	14	375	10	4	10	35	0.4	0.5	6	0.6	35	0.5	600	500	60	10	5	50	15
Children	1–3	13	29	90	35	16	400	10	6	15	40	0.7	0.8	9	1.0	50	0.7	800	800	80	10	10	70	20
	4–6	20	44	112	44	24	500	10	7	20	45	0.9	1.1	12	1.1	75	1.0	800	800	120	10	10	90	20
	7–10	28	62	132	52	28	700	10	7	30	45	1.0	1.2	13	1.4	100	1.4	800	800	170	10	10	120	30
Males	11–14	45	99	157	62	45	1,000	10	10	45	50	1.3	1.5	17	1.7	150	2.0	1,200	1,200	270	12	15	150	40
	15–18	66	145	176	69	59	1,000	10	10	65	60	1.5	1.8	20	2.0	200	2.0	1,200	1,200	400	12	15	150	50
	19–24	72	160	177	70	58	1,000	10	10	70	60	1.5	1.7	19	2.0	200	2.0	1,200	1,200	350	10	15	150	70
	25–50	79	174	176	70	63	1,000	5	10	80	60	1.5	1.7	19	2.0	200	2.0	800	800	350	10	15	150	70
	51 +	77	170	173	68	63	1,000	5	10	80	60	1.2	1.4	15	2.0	200	2.0	800	800	350	10	15	150	70
Females	11–14	46	101	157	62	46	800	10	8	45	50	1.1	1.3	15	1.4	150	2.0	1,200	1,200	280	15	12	150	45
	15–18	55	120	163	64	44	800	10	8	55	60	1.1	1.3	15	1.5	180	2.0	1,200	1,200	300	15	12	150	50
	19–24	58	128	164	65	46	800	10	8	60	60	1.1	1.3	15	1.6	180	2.0	1,200	1,200	280	15	12	150	55
	25–50	63	138	163	64	50	800	5	8	65	60	1.1	1.3	15	1.6	180	2.0	800	800	280	15	12	150	55
	51 +	65	143	160	63	50	800	5	8	65	60	1.0	1.2	13	1.6	180	2.0	800	800	280	10	12	150	55
Pregnant						60	800	10	10	65	70	1.5	1.6	17	2.2	400	2.2	1,200	1,200	320	30	15	175	65
Lactating	1st 6 months					65	1,300	10	12	65	95	1.6	1.8	20	2.1	280	2.6	1,200	1,200	355	15	19	200	75
	2nd 6 months					62	1,200	10	11	65	90	1.6	1.7	20	2.1	260	2.6	1,200	1,200	340	15	16	200	75

[a] The allowances, expressed as average daily intakes over time, are intended to provide for individual variations among most normal persons as they live in the United States under usual environmental stresses. Diets should be based on a variety of common foods in order to provide other nutrients for which human requirements have been less well defined. See text for detailed discussion of allowances and of nutrients not tabulated.

[b] Weights and heights of Reference Adults are actual medians for the U.S. population of the designated age, as reported by NHANES II. The median weights and heights of those under 19 years of age were taken from Hamill et al. (1979) (see pages 16–17). The use of these figures does not imply that the height-to-weight ratios are ideal.

[c] Retinol equivalents. 1 retinol equivalent = 1 μg retinol or 6 μg β-carotene. See text for calculation of vitamin A activity of diets as retinol equivalents.

[d] As cholecalciferol. 10 μg cholecalciferol = 400 IU of vitamin D.

[e] α-Tocopherol equivalents. 1 mg d-α tocopherol = 1 α-TE. See text for variation in allowances and calculation of vitamin E activity of the diet as α-tocopherol equivalents.

[f] 1 NE (niacin equivalent) is equal to 1 mg of niacin or 60 mg of dietary tryptophan.

Appendix B: 1980 RDA

FOOD AND NUTRITION BOARD, NATIONAL ACADEMY OF SCIENCES–NATIONAL RESEARCH COUNCIL
RECOMMENDED DAILY DIETARY ALLOWANCES,[a] Revised 1980
Designed for the maintenance of good nutrition of practically all healthy people in the U.S.A.

							Fat-Soluble Vitamins			Water-Soluble Vitamins							Minerals					
	Age (years)	Weight (kg)	Weight (lb)	Height (cm)	Height (in)	Protein (g)	Vitamin A (μg RE)[b]	Vitamin D (μg)[c]	Vitamin E (mg α-TE)[d]	Vitamin C (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg NE)[e]	Vitamin B-6 (mg)	Folacin[f] (μg)	Vitamin B-12 (μg)	Calcium (mg)	Phosphorus (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)	Iodine (μg)
Infants	0.0–0.5	6	13	60	24	kg × 2.2	420	10	3	35	0.3	0.4	6	0.3	30	0.5[g]	360	240	50	10	3	40
	0.5–1.0	9	20	71	28	kg × 2.0	400	10	4	35	0.5	0.6	8	0.6	45	1.5	540	360	70	15	5	50
Children	1–3	13	29	90	35	23	400	10	5	45	0.7	0.8	9	0.9	100	2.0	800	800	150	15	10	70
	4–6	20	44	112	44	30	500	10	6	45	0.9	1.0	11	1.3	200	2.5	800	800	200	10	10	90
	7–10	28	62	132	52	34	700	10	7	45	1.2	1.4	16	1.6	300	3.0	800	800	250	10	10	120
Males	11–14	45	99	157	62	45	1000	10	8	50	1.4	1.6	18	1.8	400	5.0	1200	1200	350	18	15	150
	15–18	66	145	176	69	56	1000	10	10	60	1.4	1.7	18	2.0	400	5.0	1200	1200	400	18	15	150
	19–22	70	154	177	70	56	1000	7.5	10	60	1.5	1.7	19	2.2	400	5.0	800	800	350	10	15	150
	23–50	70	154	178	70	56	1000	5	10	60	1.4	1.6	18	2.2	400	5.0	800	800	350	10	15	150
	51+	70	154	178	70	56	1000	5	10	60	1.2	1.4	16	2.2	400	5.0	800	800	350	10	15	150
Females	11–14	46	101	157	62	46	800	10	8	50	1.1	1.3	15	1.8	400	5.0	1200	1200	300	18	15	150
	15–18	55	120	163	64	46	800	10	8	60	1.1	1.3	14	2.0	400	5.0	1200	1200	300	18	15	150
	19–22	55	120	163	64	44	800	7.5	8	60	1.1	1.3	14	2.0	400	5.0	800	800	300	18	15	150
	23–50	55	120	163	64	44	800	5	8	60	1.0	1.2	13	2.0	400	5.0	800	800	300	18	15	150
	51+	55	120	163	64	44	800	5	8	60	1.0	1.2	13	2.0	400	5.0	800	800	300	10	15	150
Pregnant						+30	+200	+5	+2	+20	+0.4	+0.3	+2	+0.6	+400	+1.0	+400	+400	+150	[h]	+5	+25
Lactating						+20	+400	+5	+3	+40	+0.5	+0.3	+3	+0.5	+100	+1.0	+400	+400	+150	[h]	+10	+50

[a] The allowances are intended to provide for individual variations among most normal persons as they live in the United States under usual environmental stresses. Diets should be based on a variety of common foods in order to provide other nutrients for which human requirements have been less well defined. See text for detailed discussion of allowances and of nutrients not tabulated. See Table 1 (p. 20) for weights and heights by individual year of age. See Table 3 (p. 25) for suggested average energy intakes.

[b] Retinol equivalents. 1 retinol equivalent = 1 μg retinol or 6 μg β carotene. See text for calculation of vitamin A activity of diets as retinol equivalents.

[c] As cholecalciferol. 10 μg cholecalciferol = 400 IU of vitamin D.

[d] α-tocopherol equivalents. 1 mg *d*-α tocopherol = 1 α-TE. See text for variation in allowances and calculation of vitamin E activity of the diet as α-tocopherol equivalents.

[e] 1 NE (niacin equivalent) is equal to 1 mg of niacin or 60 mg of dietary tryptophan.

[f] The folacin allowances refer to dietary sources as determined by *Lactobacillus casei* assay after treatment with enzymes (conjugases) to make polyglutamyl forms of the vitamin available to the test organism.

[g] The recommended dietary allowance for vitamin B-12 in infants is based on average concentration of the vitamin in human milk. The allowances after weaning are based on energy intake (as recommended by the American Academy of Pediatrics) and consideration of other factors, such as intestinal absorption; see text.

[h] The increased requirement during pregnancy cannot be met by the iron content of habitual American diets nor by the existing iron stores of many women; therefore the use of 30–60 mg of supplemental iron is recommended. Iron needs during lactation are not substantially different from those of nonpregnant women, but continued supplementation of the mother for 2–5 months after parturition is advisable in order to replenish stores depleted by pregnancy.

Appendix C: Exemption by the Human Subjects Committee

Research Office Oregon State University Corvallis, Oregon 97331-2135 (503) 754-3437

September 2, 1987

Principal Investigator:

It has been determined that the following project is exempt from review by Oregon State University's Committee for the Protection of Human Subjects under guidelines from the U.S. Department of Health and Human Services:

Principal Investigator: Constance Georgiou

Student's Name (if any): _____

Department: Foods and Nutrition

Source of Funding: _____

Project Title: A Comparative Study of the Dietary Practices of Two College Student Populations

Comments: _____

A copy of this information will be provided to the Chair of the Committee for the Protection of Human Subjects. If questions arise, you may be contacted further.

Mary E. Perkins

Mary E. Perkins
Research Development Officer

cc: CPHS Chair
7-87

Appendix D: Food Intake Record Form

WORKSHEET FOR
RECORD OF FOOD AND BEVERAGES CONSUMED

Meal	Food and Beverage Description	Food Code	Amount Eaten in Household Units	Decimal Quantity
1. Breakfast				
2. Snacks				
3. Lunch				
4. Snacks				
5. Dinner				
6. Snacks				

Was this day typical? _____yes _____no
If not, how so?

List Brand names and amounts of supplements taken on back.

Appendix E: Demographic Information and Consent Form

I give my consent for my FN 225 dietary and activity records to be included as data in a research study. I understand that my records will be kept anonymous.

Please sign to indicate your informed consent

_____
signature

Please provide the following pieces of information to help in comparing your data to that of other students.

I am a female ___ male___

My age ___ height ___ weight___

I am a freshman___ sophomore___ junior___ senior___ or other___

My major is _____

My current living arrangement is:

Residence Hall ___
Co-op ___
Sorority/Frat ___
Apartment ___
With parents ___

Thank you for your participation.

C. Georgiou

11/87

Appendix F. Percent of Missing Entries

Nutrient	% Missing Entries
Kilocalories	0.00
Protein	0.00
Carbohydrate	0.00
Total Fat	0.00
Sat Fat	1.04
Mono Fat	1.31
Poly Fat	1.03
Cholesterol	0.80
Vitamin B6	1.45
Calcium	0.32
Iron	0.48
Zinc	1.23

Appendix G: Default List

RECORDED AS	DEFAULT ITEM
VEGETABLES (1 cup raw, 1/2 cup cooked)	
Vegetables	Mixed, ckd from frzn
Corn	Canned, drained
Green Beans	Canned, drained
Broccoli (in salad)	Raw, chopped
Broccoli	Ckd from frzn
Salad	1 cup Iceberg Lettuce
Lettuce	Iceberg
FRUIT (1/2 cup)	
Apple	2.75" diameter
Canned fruit, any kind	in heavy syrup
JUICE (3/4 cup)	
Orange juice	Prpd. fr frzn
Apple juice	Canned, bottled
Grape juice	Prpd. fr frzn
Grapefruit juice	Canned, unsweetened
BEVERAGES (1 cup)	
Coffee	Brewed
Tea	Brewed
Wine Cooler	4 oz white wine + 8 oz lemon lime soda
SOUP (1 cup)	
Mushroom Soup	Crm. Mushroom Soup w/ water
Vegetable soup	Vegetarian Vegetable
Clam Chowder	New England
Tomato Soup	Canned, w/ water
STARCH (1 oz, or 1/2 cup)	
Bread	White bread, 28 g
Roll	Dinner roll, comm.
Crackers	Saltines
Muffins	from mix
Rice Cake	1/2 cup puffed rice
Wonton Wrapper	.2 oz wheat flour
Kavali flatbread	Armenian Cracker bread
Potato	Baked with Skin (1 ea)
Mashed Potato	With milk & marg.
Scalloped or Au gratin	from mix
Rice	Instant, prpd.
Pasta	Egg noodles, ckd.
Cereal	Cheerios (1 oz)

Appendix G: Default List (cont.)

FAT		
	Oil	Corn oil (1 T.)
	Light margarine	60% fat, soft (1 t.)
	Miracle Whip	Mayo type salad dres
	Salad Dressing	Italian (2 T.)
	Gravy	Canned (1/4 c.)
DAIRY	(1 cup milk beverage or 1 oz hard cheese)	
	Milk	2% Lowfat
	Chocolate Milk	2% Lowfat
	Hot Cocoa	Mix, Prpd. with water
	Ice Cream	Regular, van (1/2 c.)
	Cheese	Cheddar
	String cheese	Mozzarella, part skim
	Cottage cheese	crmd, sm. curd (1/2 c)
MEAT	(3oz at dinner, 2oz at lunch)	
	Large Egg	Fried in butter (1 ea)
	Grnd. beef	21% fat
	Beef jerky	Beef, dried, chipped
	Meat Loaf	Beef only
	Chicken	
	for dinner	Chicken meat, fried
	for lunch	Chicken roll
	Chicken breast	+ skin, flr. fried
	Turkey	Roast turkey breast
	Turkey, lunchmeat	Turkey roll, lt & dk
	Ham	Lunchmeat, reg
	Salami	Pork & beef
	Steak	Beef round steak
	Tuna	canned in water (1/4c)
	Pepperoni	4 slices/slice pizza
DESSERTS	(1 piece)	
	Waffle Cone	1/2 Fozen Waffle
	Cake	Yellow Cake, comm.
	Cookies	Choc. Chip Cookies (2)
	Doughnut	Cake type
	Pie	Apple Pie
	Candy Bar	Milky Way
SNACKS		
	Chips	Tortilla Chips (1oz)
	Popcorn	Cooked in oil/salted
CONDIMENTS		
	Pickle	Dill Pickle (1)
	Sunflower Seeds	Dry, roasted (2 T.)
	Vinegar	Cider Vinegar
	Mustard or Mayo	1 tsp/slice bread

Appendix H. Food groups (adapted from Popkin et al. (15)

Food Groups	Description
1. Lower fat milk (1)*	(2%, 1%, or skim)
2. Higher fat milk (2)	(Whole milk)
3. Lower fat cheese (1-4)	(Cottage, mozzarella, cheese sauce)
4. Higher fat cheese (5)	(Processed and other cheeses)
5. Lower fat beef/pork and mixed dishes (3)	(lean, trimmed, broiled beef and pork, hamburger w/ ketchup on bun)
6. Medium fat beef/pork and mixed dishes (4)	(Cooked grnd. beef or patty, cheeseburgers, lean roast beef, lean, trimmed pork chops, meat loaf)
7. Higher fat beef/pork and mixed dishes (5)	(Untrimmed roasts, steaks, short ribs, pork chops)
8. Lower fat poultry and mixed dishes (2-3)	(Broiled or roasted chicken breast, skinned poultry)
9. Higher fat poultry and mixed dishes (4)	(Chicken w/ skin, fried, breaded and processed chicken)
10. Lower fat lunch meats and sausages (2-4)	(Boiled, chopped ham, chicken and turkey loaf, poultry franks)
11. Higher fat lunch meats and sausages (5)	(Frankfurters, bologna, pork sausage, salami)
12. Lower fat fish, seafood, mixed dishes (1-2)	(Tuna canned in water; steamed, baked shrimp, scallops, flounder, haddock, seafood stews)
13. Higher fat fish, seafood, mixed dishes (3-4)	(Tuna salad and casseroles, fish sandwich or fish cakes, tuna canned in oil, fried seafood)
14. Egg, egg mixtures	(eggs boiled or fried, omelets, egg salad)

Appendix H (cont.)

Food Groups	Description
15. Legumes	(chili w/ beans, pork&beans, refried beans, split pea soup)
16. Lower fat breads (1-2) (Higher fiber)	(Whole wheat and multigrain breads, corn tortillas)
17. Higher fat breads (3-5)	(White soft rolls, biscuits, cornbread, pancakes, waffles sweet rolls, croissants)
18. Higher fat desserts (3-5)	(Ice cream, cakes, cookies, pies, doughnuts, granola bars)
19. Higher fat salty snacks (3-5)	(potato chips, crackers, corn and tortilla chips, popcorn w/ butter)
20. Pasta, rice, cooked cereal	(Pasta, rice, grits, oatmeal)
21. Lower fiber cereals	(corn flakes, rice cereal)
22. Higher fiber cereals	(Oat cereal, wheat or bran flakes)
23. Higher fat grain mixtures (3-5)	(Pizza, macaroni & cheese, spaghetti and meatballs, pasta salad, tacos, egg rolls)
24. Higher fat potatoes (3-5)	(French fries, potato salad, hash browns)
25. Butter and Margarine	(All butter and margarine products)
26. Lower fat salad dressings (1-3)	(Low calorie dressings)
27. Higher fat salad dressings (4-5)	(Mayonnaise, regular dressings)

Appendix H (cont.)

*Numbers in parentheses indicate
amount of fat (in grams)/100 grams of food

(1) < or = 2.5g

(2) > 2.5 g but < or = to 5 g

(3) > 5.0 g but < or = to 10 g

(4) > 10.0 g but < or = to 20 g

(5) > 20 g