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# Dietary Intake Of Exercising Adults

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# DIETARY INTAKE OF EXERCISING ADULTS

KEMMIS

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Dietary Intake of Exercising Adults
(TITLE)

BY

Danika H. Kemmis

**THESIS**

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## ABSTRACT

Purpose. The purpose of this study was to assess the dietary intake of Eastern Illinois University Adult Physical Fitness members.

Target Population. Current members (n=186) of the Eastern Illinois University Adult Physical Fitness Program.

Methods. Dietary intake was assessed with the use of a computer-assisted interview administered food frequency questionnaire.

Results. A total of 51 adults partook in the dietary assessment and counseling session. This comprised 27.4% of all Adult Physical Fitness Program participants. The mean reported percentage of calories coming from fats, carbohydrates, and protein were 34.8%,48.3%, and 15.7% respectively. The mean reported mineral intake including sodium and calcium was 2964mg and 906mg respectively. Weekly consumption of fruits and vegetables was below recommended intakes as was total grams of daily dietary fiber. Participants had more than adequate intake of vitamin A and C.

Conclusions. Study participants had diets that were above recommended levels for fats, protein, and sodium, and were inadequate for carbohydrates and fiber. The majority of women were consuming inadequate calcium intake. Study participants were consuming less than the recommended daily servings of fruits and vegetables. Participants were consuming 2 to 3 times the Recommended Dietary Allowances for vitamin A, and vitamin C. Even in an apparently healthy exercise population, a nutrition education program may be warranted.

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# CHAPTER 1

# INTRODUCTION

Dietary factors are associated with approximately 70 percent of all premature deaths, disabilities, and illnesses in the United States (Gabel, 1992). If Americans were to follow the United States Health and Human Services recommendations for better nutrition, the incidence of coronary heart disease, cancers, stroke, noninsulin-dependent diabetes mellitus, atherosclerosis, and alcohol related illnesses and injuries would be drastically reduced (Britt, 1990). Because of the influence of diet on health, the nutritional objectives are of top priority in Healthy People 2000: National Health Promotion and Disease Prevention Objectives for the Nation (Britt, 1990). Is this document, the fundamental objective for improving the eating habits of adults is through a "marked improvement in accessibility of nutrition information and education."

On a year-round, thrice weekly basis, the Eastern Illinois University Adult Fitness Program works with 186 exercising adults, the purpose of which is to decrease the incidence of diseases related to physical inactivity. Providing dietary assessment and counseling in this population was a feasible modality for improving nutrition information and education. Data derived from this assessment can also be used for developing a specific nutrition education program for participants in the Eastern Illinois University Adult Physical Fitness Program.

## Aims

There were three aims for this study: (1) to provide descriptive data on the dietary intake of participants in the Eastern Illinois University Adult Fitness Program; (2) to describe a nutritional assessment, counseling and educational program for other health professionals that could be replicated in similar settings; and; (3) to provide recommendations for further study.

## Significance

Dietary factors are associated with approximately 70 percent of all premature deaths, disabilities, and illnesses in the United States (Gabel, 1992). If Americans were to follow better

dietary practices, the incidence of coronary heart disease, cancers, stroke, noninsulin-dependent diabetes mellitus, atherosclerosis, and alcohol related illnesses and injuries would be drastically reduced (DHHS, 1990). Therefore, it was necessary to determine if individuals were practicing recommended dietary behaviors. Knowing the current dietary intakes of this population could be used for developing a nutrition education program for the target population.

## Limitations

This study was limited to current members (n = 186) of the Eastern Illinois University Adult Physical Fitness Program who volunteered to partake in the dietary analysis, counseling and educational program. Therefore, this study may not be representative of all exercising adults or of all current members of the Eastern Illinois University Adult Fitness Program.

## Definition of Terms

### Calcium

Calcium is an essential nutrient that is necessary for adequate growth and skeletal development. Certain segments of the population, especially women, because of their low caloric intake, and adolescents, because of their higher nutrient requirements, need to make careful food choices to obtain adequate calcium from their dietary intake (NRC, 1989).

### Calorie

A unit to measure heat energy, a calorie is the amount of heat necessary to raise the temperature of one gram of water one degree Centigrade. It is used as a short term for kilo calorie. Calories are used to measure the energy value of food and the energy cost of physical activity (Hoeger, 1992).

### Carcinogenesis

The production of cancer which is a result of some type of mechanism (NRC, 1989).

### Carbohydrates

The major source of calories that the body uses to provide energy for work, cell maintenance,

and heat. Carbohydrates help digest and regulate fat and metabolize protein. Each gram of carbohydrate provides the human body with four calories (Hoeger, 1992).

Fat

Fat is used as a part of cell structure, stored energy, and insulator to preserve body heat. Fat also absorbs shock, supplies essential fatty acids, and carries the fat-soluble vitamins A, D, E, and K. Each gram of fat provides the human body with nine calories. Thus, it is the most concentrated source of energy. (Hoeger, 1992).

Fiber

A form of complex carbohydrate made up of plant material that cannot be digested by the human body (Hoeger, 1992).

Minerals

Inorganic elements found in the body and in food which are essential for maintaining water balance and the acid-base balance. They are essential components of respiratory pigments, enzymes, and enzyme systems, and they regulate muscular and nervous tissue excitability, blood clotting, and normal heart rhythm (Hoeger, 1992). Examples of minerals include calcium, iron, and sodium.

Monounsaturated fat

Fatty acids with only one double bond found along the carbon atom chain (Hoeger, 1992).

Polyunsaturated fat

Fatty acids with two or more double bonds along the carbon atom chain (Hoeger, 1992).

Protein

Proteins are the main substances used to build and repair tissues and maintain normal body fluid balance. Proteins are a part of hormones, antibodies, and enzymes. Proteins can be used as a source of energy, but only when inadequate carbohydrates are available. Each gram of protein yields four calories of energy (Hoeger, 1992).

Recommended Daily Allowances (RDA)

Based on a review of the most current research on nutrient needs for healthy people, the Recommended Dietary Allowances provide daily nutrient intake recommendations for the American public. (Hoeger, 1992).

Saturated fat

Fatty acids with carbon atoms fully saturated with hydrogens, therefore only single bonds link the carbon atoms on the chain. High intake of saturated fats increases the risk for coronary heart disease (Hoeger, 1992).

Sodium

Sodium is the major cation of extracellular fluid. Complex mechanisms regulate electrolyte concentrations in the body fluids and the volume of the extracellular fluid compartment (NRC, 1989).

# CHAPTER TWO

## REVIEW OF LITERATURE

In recent years, the realization that diet plays a major role in the prevention of disease has made many individuals change their dietary behaviors. By changing dietary behaviors it is possible to decrease and even eliminate the risk of certain diseases. This chapter will review the relationship between diet and selected diseases, the role nutrients play in the disease process, current dietary recommendations, and the dietary goals of Healthy People 2000.

### Cardiovascular Disease

In both men and women, cardiovascular disease is the number one cause of premature death and disability in the United States (Farquhar, 1990). Dietary intake can influence many of the risk factors for heart disease including hypertension, elevated plasma cholesterol, diabetes mellitus, and obesity (Goodman, 1988).



#### Hypertension

Hypertension is defined as sustained elevated arterial blood pressure measured indirectly by an inflatable cuff and pressure manometer (NRC, 1989). Hypertension can involve many organ systems, including the heart, endocrine organs, kidneys, and central and autonomic nervous systems. It has been clearly shown to increase the risk of developing stroke, coronary heart disease, congestive heart failure, peripheral vascular disease, and nephrosclerosis (NRC, 1989). Primary hypertension, or high blood pressure, is a major risk factor for cardiovascular disease and death in the United States. The prevalence of hypertension increases with age and is present in approximately 15% of the US. population age 30 and over (NRC, 1989).

No single factor causes hypertension. Different factors play greater or lesser roles in different people and there are variations in the rapidity of onset and degree of severity (NRC,1989). Epidemiological studies of populations with a high prevalence of hypertension have demonstrated a positive correlation between salt intake and blood pressure level (Voors 1983). Although the specific amount of dietary sodium that will begin to show its hypertensive effects is debatable (NRC, 1989), current recommendations are to consume no more than 2,400 mg to

3,000 mg per day (NRC, 1989). Intake of polyunsaturated and saturated fats, calcium, and exposure to psychological stress may also has roles in the expression of hypertension.

In numerous studies, investigators have also shown a strong correlation between obesity and hypertension (NRC, 1989). Weight gain during adult life is associated with increased blood pressure levels (Hubert, 1983). In the Framingham study, the risk of developing hypertension among those normotensive at entry was proportional to subsequent weight gain (NRC, 1989). There was also a strong curvilinear relationship between the incidence of intermittent claudication and coronary risk factors including age, blood cholesterol, abnormal electrocardiograph, systolic blood pressure, relative weight, hemoglobin, and cigarette use (Kannel, 1985). The relative risk of developing intermittent claudication in Framingham patients with coronary heart disease was four times the standard risk, whereas people with angina pectoris had three times greater risk (Kannel, 1985).

In general, risk appears greatest in people who gain weight during the third and fourth decades of life, after which the relationship weakens (NRC, 1989). Loss of weight by obese hypertensives is associated with a reduction in blood pressure, especially during active weight loss (Tuck 1981). The effects of sustained weight loss on blood pressure are not clearly understood. In addition, the mechanisms by which body mass and obesity influence blood pressure are not clearly understood, and there are no established animal models for studying these relationships (NRC, 1989).

With high sodium intake, the body retains more water which increases the blood volume and, in turn, drives up the blood pressure. On the other hand, high intake of potassium seems to regulate water retention and lower the pressure slightly (Hoeger, 1992). In most instances, a combination of aerobic exercise, weight loss, and reduced sodium will bring blood pressure under control (Hoeger, 1992).

Cholesterol

Total cholesterol is a primary, independent risk factor for heart disease (ACSM, 1991). Low density lipoprotein (LDL) cholesterol is also associated with risk for coronary heart disease (Cleeman, 1988). 356,222 men ages 35 to 57 were initially screened in the Multiple Risk Factor Intervention Trial (MRFIT). MRFIT was an age-standardized, 6-year chronic heart disease study of these men. Mortality increased steadily according to decile of total cholesterol from 3 per 1,000 for total cholesterol less than 168 mg/dl to 13 per 1,000 for total cholesterol greater than 263

mg/dl (Stamler, 1986). In MRFIT the 6-year mortality rate doubled between 153 mg/dl and 226 mg/dl and doubled again between 226 mg/dl and 290 mg/dl (Stamler, 1986).

The weight of evidence supports the idea that total cholesterol level, at least from 150 mg/dl upward, is positively associated in a continuous fashion with chronic heart disease risk. Results from the observations of participants in MRFIT also indicated that the association between total cholesterol and 5-year risk of chronic heart disease death for 23,490 black men was similar to that for 325, 384 white men (Neaton, 1984). The results of MRFIT led to the development of the National Cholesterol Education Program (NCEP). The NCEP Adult Treatment Guidelines 1st edition was released by the National Heart, Lung, and Blood Institute in November 1985 (Stephanic,1990). The report recognized that diet is the key to reducing borderline and high-risk blood cholesterol levels. Its purpose was to reduce the prevalence of elevated blood cholesterol in the United States.

Current NCEP recommendations are that all Americans over the age of 20 years should have "desirable" total cholesterol levels below 200 mg/dL. While values between 201 to 239 mg/dL are considered "borderline-high," values over 240 mg/dL and considered "high" (NCEP). Among people ages 50 to 79 years in the Framingham Study, the ratio of total cholesterol to high density lipoprotein was strongly associated with risk of coronary heart disease in men and women. Similar results were obtained with the ratio of low density lipoproteins to high density lipoproteins in women (Cleeman, 1988). According to NCEP, low density lipoprotein has the strongest and most consistent relationship to individual and population risk of coronary heart disease. Therefore, the best target for clinical management and therapy is not the ratio of total cholesterol to high density lipoprotein, but the absolute level of low density lipoprotein-cholesterol (NCEP).

Diet can help to lower both total cholesterol and LDL-cholesterol (DHHS, 1983). Dietary cholesterol and saturated fats in excess amounts appears to contribute to the high LDL-cholesterol levels (DHHS, 1983). Moreover, controlled metabolic studies have shown that dietary cholesterol usually raises the plasma cholesterol level (Goodman, 1988). Thus, by reducing the intake of saturated fatty acids and cholesterol in the diet desirable levels of both total cholesterol and LDL-cholesterol can usually be achieved by the majority of Americans without the use of drug therapy (NRC, 1989).

Diabetes Mellitus

Diabetes mellitus is a disorder of carbohydrate utilization. It is characterized by high blood

glucose levels. It can be diagnosed by the presence of classical signs and symptoms, including elevated blood glucose levels, a fasting plasma glucose greater than 140 mg/dl, or by an abnormal oral glucose tolerance test (Harris, 1985). Two distinct primary forms of diabetes mellitus are Type I, or insulin-dependent (IDDM), and Type II, or non-insulin-dependent (NIDDM). Diabetes mellitus can be controlled by prescription medication or in milder cases by diet and exercise. The median age of people with diabetes (61 years) is higher than that of the general U.S. population (42 years). Approximately 9% of people over the age of 65 years are believed to have NIDDM (NRC, 1989). Approximately 76% of diabetes-related deaths occur among people 65 years of age and older; 45% of those deaths occur after age 74 (NRC, 1989).

There are no clear sex differences in IDDM and NIDDM incidence rates. Rates are slightly high among U.S. females, possibly due to more frequent use of physicians and, presumably, higher rates of NIDDM detection (NRC, 1989). Prevalence rates of NIDDM among adult blacks, Hispanics, and Asian-Americans appear to be higher than those among whites. For blacks, the rates are 50% higher than those for whites (NRC, 1989). The United States data linking NIDDM rates to socioeconomic status are inconsistent with international data. Unlike rates in economically developing countries, which are positively associated with socioeconomic status, NIDDM rates in the United States are highest among the poor (NRC, 1989).

To some degree, genetics do play a role in developing NIDDM. Diabetes is two to four times more common among the parents of children 20 years of age or older with diabetes. Unfortunately, there are no known genetic markers to identify people at high risk of NIDDM. However, adiposity appears to be at least partly determined by genetic predisposition (Burton, 1985). Obesity is also a well known major risk factor for NIDDM. Overfatness is consistently correlated with NIDDM prevalence rates in epidemiological studies (Burton, 1985). Moreover, high waist-to-hip ratio, indicating a more central distribution of body fat, may also increase NIDDM risk in nondiabetics (Burton, 1985).

Although there is genetic predisposition to diabetes, adult-onset diabetes is closely related to overeating, obesity, and lack of physical activity (Hoeger, 1992). In most cases, this condition can be corrected through dietary intake, weight-loss, and exercise. According to research published in 1991 in the New England Journal of Medicine (Helmrich), aerobic exercise helps prevent diabetes in middle-aged men. The protective effect is even greater in those with risk factors such as obesity, high blood pressure, and family history. The preventive effect is attributed to a reduction in body fat and improved sugar and fat metabolism seen with a regular exercise

program. The incidence of diabetes mellitus progressively declined as energy expenditure increased (Helmrich, 1991).

Obesity

In 1985, the National Institutes of Health (NIH) Consensus Development Conference on the Health Implications of Obesity summarized the abundance of evidence on the adverse effects of obesity on health (Burton, 1985) including its independent risk factor for cardiovascular disease (Burton, 1985). Obesity is also related to several heart disease risk factors (discussed previously) including elevated serum LDL-cholesterol levels, lower insulin sensitivity (diabetes) and hypertension (King, 1989).

Obesity, defined as body mass index (weight/height$^2$)(body mass index), is related to both coronary heart disease and to certain types of cancers (NRC, 1989). There are desirable body mass index (BMI) ranges in relation to age (NRC, 1989). Mortality among people with a BMI of 35 kg/m$^2$ or greater is eightfold higher than that of people with a desirable BMI (20 to 25 kg/m$^2$)(NRC, 1989). The minimal death rate in several prospective studies is associated with a BMI of 22 to 25 kg/m$^2$ (NRC, 1989).

Considerable evidence also suggests that regional fat distribution influences the risk of mortality from atherosclerotic cardiovascular diseases and diabetes mellitus. Obesity is of greater risk if it is carried in the abdominal area. Such abdominal obesity is inversely correlated with high density lipoprotein concentration. Both men and women whose fat is distributed mainly about the abdomen have lower high density lipoprotein levels than those in whom the fat is distributed mainly about the hips and thighs (Albrink, 1991). This central, abdominal type of obesity is usually acquired during adult life and is in itself a strong risk factor for atherosclerotic disease (Albrink, 1991). A waist-to-hip ratio of greater than 0.8 in women and greater than 1.0 in men is associated with increased cardiovascular risk (Albrink, 1991). Thus, it appears that the distribution of body fat (i.e., waist-to-hip ratio) as well as the overall level of obesity (i.e., BMI) has a significant positive relationship with heart disease (Stephanic, 1990).

Diet therapy for the individual who is obese can assist in reducing and maintaining ideal body fatness. The goal of the obese individual is to lower caloric intake (diet) and increase energy expenditure (exercise) thus causing a caloric deficit and a decrease in body fatness. Reductions in body fat have been associated with a reduction in LDL-cholesterol, and plasma triglycerides (Goodman, 1988). Moreover, aerobic exercise can raise HDL-cholesterol and may curb the

appetite (Goodman, 1988). In five prospective studies, fat distribution was found to be more strongly related to risk of total deaths, stroke, heart disease, and diabetes mellitus than was BMIor total body fat (NRC, 1989). The risk doubled in people with an increased ratio of waist-to-hip fat (NRC, 1989). Several studies have led to the conclusion that overweight is an independent predictor of risk of atherosclerotic cardiovascular diseases (NRC, 1989). This may be due to the strong association of obesity with risk of hypertension, diabetes mellitus, and lowered levels of high-density lipoprotein cholesterol, which are in themselves important risk factors for atherosclerotic cardiovascular diseases (Manson, 1987).

## Cancer

Cancer is the second leading cause of premature death in the United States (NRC, 1989). In 1993 the American Cancer Society estimates that 526,000 individuals will die of the disease, and it will be diagnosed in another 1,170,000 (American Cancer Society, 1993). Although the specific causes of site specific cancer are unknown, it has become increasingly apparent that life-style and environmental factors play an important role. It is estimated that 40% of cancer incidence among men and 60% of cancer incidence among women are related to diet (Cotugna, 1992).

Many of the associations between diet and cancer are supported by evidence from experiments on animals. Thus, investigations on how these carcinogens react with components of a human diet is limited. Moreover, although many mechanisms have been proposed for the carcinogenic effects of specific dietary factors, the exact mechanisms of carcinogens in humans are not yet established for any diet-related cancers (NRC, 1989). Therefore, the majority of literature discussed below deals primarily with the animal model supplemented when available with studies involving humans.

### Breast Cancer

For many years, investigators have suggested that women with diets high in fat might be more likely to develop breast cancer. However, a recent study of more than 89,000 women found no evidence that a diet low in fat protects against the disease (Brody, 1993). The investigators could not exclude, however, the possibility that dietary fat can reduce breast cancer risk but only at levels far below the current recommendations of 30% of total calories. That is, perhaps dietary fat intake should be closer to 20% of total calories rather than 30% of total calories (Kolata, 1992).

Colorectal Cancer

Miller et al. (1983) compared the intake of food groups and various nutrients, particularly saturated fatty acids, in relation to risk of colorectal cancer. The risk associated with a higher consumption of saturated fatty acids relative to lower consumption for colon and rectal cancer was 2.4 for males and 2.6 for females (Miller,1983). In females, increased intake of saturated fatty acids consistently increased risk for colon cancer and also had an important independent effect over and above an apparent effect of some meats in increasing risk of rectal cancers (Miller, 1983). In males, different meat products appeared to increase risk and intake of saturated fatty acids did not appear to have an independent effect (Miller, 1983).

Ovarian Cancer

Cramer et al (1984) who studied 215 white women with epithelial ovarian cancer and 215 control women matched by age, race, and residence, found that the women with ovarian cancer favored, and consumed greater amounts of foods high in animal fats and significantly less vegetable fat compared with control subjects. There was a significant trend toward an increased risk of ovarian cancer with increasing animal fat consumption (Cramer, 1984).

Dietary Factors and Cancer

Fat. Although each type of cancer has a different relationship to diet, it appears that a common thread among most types of cancer is a diet high in fat. Dietary fats appear to act primarily during the promotion stage of carcinogenesis, but the exact mechanism of action is not known and may depend on the tumor site (NRC, 1989). None the less, recent studies have suggested that tumors of the skin, mammary gland, colon, and pancreas develop more readily in animals fed high-fat diets than in those fed low-fat diets (NRC, 1989). New research suggests that fats derived from animal foods promote rather than initiate the development of prostate cancer and may be the crucial factor determining in which men prostate cancers change from a dormant, symptomless condition to a spreading and possibly lethal malignancy (Brody, 1993).

Carbohydrates. Few studies have been done on the relationship between carbohydrates and carcinogenesis. However, there is some evidence that rats fed sucrose or dextrose develop mammary tumors more readily than those fed lactose, starches, or dextrin (NRC, 1989).

Fiber. Past studies have shown that dietary fiber plays a role in inhibiting colon carcinogens

by absorption or dilution of potential carcinogens or promoters in the colon or by decreasing colon transit time, thereby reducing the length of exposure (NRC, 1989). More recent experimental studies have given variable results that found some types of fiber inhibit carcinogenesis, whereas others actually increase the yield of colon cancers (NRC, 1989). Kune, et al (1987) found high fiber intake to be protective in association with a high vegetable intake. Lyon, et al (1987) used an index of crude dietary fiber and found a weak protective effect, especially in females, after adjustment for caloric intake.

Protein. Diets with a low protein content have usually been found to suppress carcinogenesis, and a tumor-enhancing effect is generally observed at protein levels of 20 to 25% of total caloric intake (Cotugna, 1992). Higher levels of protein consumption produce no further enhancement and may be inhibitory, possibly because of decreased food intake. Dietary protein appears to enhance tumorigenesis only when there is amino acid balance. Thus, the effect is not due to specific amino acids or to amino acid imbalance (Cotugna, 1992).

Caloric Intake. Some studies suggest that higher fat intake contributes toward the promotion of carcinogenesis (Willet, 1992). Other studies suggest that total caloric restriction may inhibit carcinogenesis in animals even when the diet is high in fat (Pariza, 1987). It has not been demonstrated conclusively that excessive energy intake promotes carcinogenesis (Pariza, 1987). Early studies done by Tannenbaum in 1947 and 1959 were concerned mainly with effects of caloric restriction on carcinogenesis (NRC, 1989). His experiments showed that a variety of tumors are inhibited by reducing caloric intake (Carroll, 1975). The inhibitory effect seemed to be exerted at later stages of tumor development rather than at initiation. Since many different types of tumors are inhibited by caloric restriction, the effect may be due simply to lack of energy intake or the metabolites required for tumor development (Carroll, 1975). In most studies, dietary intake was restricted by at least 25% (NRC, 1989). In one study, restricting caloric intake by 10% showed no effect on mammary tumor incidence, but did reduce the tumor mass (Kritchevsky, 1986).

Vitamins. Beta-carotenes are found in dark green leafy vegetables, yellow fruits and yellow vegetables (NRC, 1989). In one study the incidence of tumors decreased and the latent period for development of tumors increased in mice fed supplemental beta-carotene before inoculation with a virus (NRC, 1989). The rate of tumor regression markedly increased when beta-carotene was fed after tumors were already present (NRC, 1989). Similar results were obtained in mice inoculated with another type of carcinoma cells. Injection of beta-carotene decreased the incidence of skin cancer in hairless mice exposed to ultraviolet-B radiation (NRC, 1989). More

information is needed concerning the potential roles of specific carotenoids as chemopreventive agents.

## Osteoporosis

Osteoporosis is predominantly a female disease and is a major cause of fractures and debilitation in older women (Einhorn, 1990). It is characterized by an asymptomatic reduction in the quantity of bone mass per unit volume resulting in an increase fracture risk with minimal trauma (National Osteoporosis Foundation, 1990). Approximately 20 percent of women in the United States suffer one or more osteoporotic fractures by age 65 years (predominantly the hip, lumbar spine or wrist), and as many as 40% of women sustain fractures after age 65 years (National Osteoporosis Foundation, 1990). Up to 20% of those who break their hip will die within one year (Einhorn, 1990). Moreover, about 66% of those who survive their hip fracture will have to be institutionalized (e.g., nursing home)(NRC, 1989).

Although osteoporosis is more common in women than in men and is more common in caucasians than in African Americans (National Osteoporosis Foundation, 1990), fracture rates for men and African-Americans progressively increase after the age of 60 years (NRC, 1989). Estrogen, exercise and diet are three factors that have a major influence on bone mass (National Osteoporosis Foundation, 1990). Because this study is focusing on the relationship between diet and disease the discussion to follow will be limited to the role of diet and osteoporosis.

### Calcium

Bone mass can be influenced by dietary practices, specifically dietary calcium intake. Approximately 1200 g of calcium are present in the body of an adult human; more than 99% of that amount is found in bones (NRC, 1989). All living animals possess powerful mechanisms both to conserve calcium and to maintain constant cellular and extracellular concentrations (Rivlin, 1987). Moreover, because the bone is comprised of predominantly calcium, the bones can always supply the calcium necessary to maintain appropriate serum levels. However, one can see that dietary intake of calcium is crucial in the maintenance of bone health (Einhorn, 1990). That is, as calcium is depleted from the bone, its mass is lowered and subsequent risk for osteoporotic fractures is increased.

Calcium balance depends on several factors such as the amount of calcium in the diet, the

efficiency of calcium absorption by the intestine, the presence of oxalates (Einhorn, 1990), diets high in fat and dietary fiber (Einhorn, 1990), and the losses of calcium in the urine, feces, and sweat (Heaney, 1987). Intestinal absorption decreases with age. This may be due to the age-related decrease in serum levels of the biologically active metabolite of vitamin D produced by kidney that regulates intestinal absorption of calcium (Heaney, 1987). Whether this response to decreased calcium absorption contributes to the decreased skeletal mass and increased incidence of fractures in the elderly is not known (Heaney, 1987).

In a study of two Yogoslavian groups whose diets differed significantly in calcium intake, the differences in bone mass were detected as early as age 30 years (Einhorn, 1990). Evidently, calcium intake in early life can affect peak bone mass at maturity. The level of calcium intake had little effect on the age-related bone loss in either men or women, but it had an impressive effect on hip fractures, with a significantly decreased risk of hip fracture in the high calcium population (Elnhorn, 1990). There is also strong evidence relating calcium supplementation to preventing cortical bone loss. In a nonrandomized prospective study of the effect of various treatments on reducing vertebral fractures in women with generalized osteopenia, it was observed that eight subjects receiving calcium carbonate (1500-2500 mg/day) and 19 receiving calcium supplementation plus vitamin D (50,000 IU once or twice a week) had 50% fewer vertebral fractures than did 27 placebo-treated subjects and 18 untreated controls (NRC, 1989).



Calcium Absorption Factors

There are numerous factors which influence the absorption of calcium including vitamin D, serum calcium concentration, loss of minerals in urine, feces, and sweat and the functional ability of the kidney to produce the major biologically active metabolite of vitamin D. The recommended amount of vitamin D is 400 IU per day during periods of growth (childhood, pregnancy, lactation) and 200 IU per day for nonpregnant, nonlactating adults (RDA 1980).

Fiber has also been proven to decrease intestinal absorption of calcium (Gabel, 1992). The addition of 31 g of wheat fiber to the diets of subjects already consuming a high-protein diet produced a greater negative balance than the high-protein diet alone, suggesting an interaction of protein and fiber that causes greater negative calcium balance than when either is given alone (NRC, 1989). Studies show that fiber chelates calcium in the gastrointestinal tract and is therefore a potential cause of mineral deficiency (NRC, 1989).

The recommended daily allowances for calcium is set at 800 mg per day for nonpregnant,

nonlactating women. However, research has shown that estrogen-depleted postmenopausal women require a full 1500 mg of calcium per day to achieve zero calcium balance (National Institute of Health,1984).

## Current Dietary Practices and Recommendations

In light of the preceding discussion suggesting the importance of dietary behavior and disease, it seems prudent to make general dietary recommendations that would reduce the risk of developing diseases. The recommendations given below have been developed by leading authorities and agencies. Their recommendations are based upon empirical and rational decisions from available research studies. It is difficult to pinpoint exact numbers for some dietary recommendations and some practices contradict each other. For example, fiber can protect against developing coronary heart disease and certain types of cancer, but can decrease the absorption of calcium which can protect against developing osteoporosis. Thus, guidelines are guidelines. They are given for overall health. They are not necessarily for people that may have special health or medical concerns (e.g., diabetic).

### American Heart Association

In the early 1960s, the American Heart Association (AHA) was the first United States organization to recommend dietary modifications for reducing cardiovascular disease risk (Grundy, 1985). In 1982, they recommended that polyunsaturated fatty acids partially replace saturated fatty acids in the diet to make up about 10 percent of total calories (AHA, 1982). These recommendations have recently been lowered to state that polyunsaturated fatty acids should not exceed 10 percent of total calories (AHA, 1988). Other recommendations include reducing cholesterol intake to less than 300 mg/day and limiting the amount of added sugars (simple carbohydrates). The increased consumption of vegetables, fruits, and other sources of complex carbohydrates is strongly encouraged (AHA, 1988).

### National Cancer Institute

The National Cancer Institute has also instituted a set of dietary guidelines for the reduction of cancer (NRC, 1989). In general, this report calls for all Americans to reduce fat intake, eliminate or minimize alcohol use, minimize cured, pickled, and smoked foods, and include more fruits,

vegetables, and whole grains into the diet. More recently, the National Cancer Institute established a set of national cancer control objectives for the year 2000 (Cotugna, 1992). The dietary objectives include a decrease in fat consumption to 30% of total calories and an increase in fiber consumption to 20 to 30 grams per day (Cotugna, 1992).

National Osteoporosis Foundation

The National Osteoporosis Foundation has suggested that a calcium rich diet is essential for building and maintaining healthy bone. Women should ensure that they consume 800 mg of elemental calcium per day (1990).

Surgeon General's Report

In 1988 the Surgeon General's Report on Nutrition and Health acknowledged that certain risks of disease could be reduced with a change in dietary behaviors (NRC, 1989). From this document came the Dietary Guidelines for Americans (1990). It recommends that to stay healthy and to reduce some disease risks one should eat a variety of foods; maintain healthy weight; choose a diet low in fat, saturated fat, and cholesterol; choose a diet with plenty of fruits, vegetables, and grain products; use sugars, salt and sodium in moderation; and limited to moderate use of alcoholic beverages.

Recommended Dietary Allowances

The Recommended Dietary Allowances (RDA) are recommendations for the average daily amounts of nutrients that population groups should consume over a period of time. The RDA's should not be confused with requirements for a specific individual (RDA 1980), and they are not requirements below which deficiency diseases are apt to develop. For many nutrients they are set at sufficiently high levels to cover the needs of most healthy people. Many people who rank below the cutoff point actually have adequate intakes because they require less, whereas some above the recommended quantity point may have inadequate intake to meet their needs (Hoeger, 1992).

The RDA's are intended to be met through a diet that consist of a wide variety of foods rather than by supplementation or by extensive fortification food groups. RDA's have not been set for all recognized nutrients. Therefore diets should be composed of a variety of foods that are attainable by the consumer using the RDA as a guide to assessment of their nutritional adequacy

(RDA 1980).

United States Department of Health and Human Services

A decade-long strategy to improve the nation's health profile through an emphasis on prevention was released in September 1990 by the U.S. Department of Health and Human Services. Called Healthy People 2000, the report places a high priority on improving dietary behaviors to reflect the Dietary Guidelines for Americans. Several national objectives in Healthy People 2000 aim for specific, measurable changes in what Americans eat, as well as increased access to healthier food products, by the year 2000.

Improved nutrition is one of 21 priorities identified in Healthy People 2000. Building on a similar effort that set health objectives for achievement by 1990 (Britt, 1990), Healthy People 2000 seeks to extend the benefits of health promotion and disease prevention to all Americans, especially segments of the U.S. population that experience higher rates of disease and premature death than the overall population (Britt, 1990). Encouraging healthy choices in diet, exercise, weight control, and other risk factors for disease is a major theme throughout Healthy People 2000.

Four cornerstones are recognized as fundamental for the achievement of these objectives: (1) marked improvement in the accessibility of nutrition information and education for the general public, (2) maintenance and improvement of a strong national program of basic and applied nutrition research, (3) further development of the scope and magnitude of the National Nutrition Monitoring System, and (4) development of a sustained program to implement and evaluate these objectives.

The list below are the Healthy People 2000 nutrition objectives:

1. Increase accessibility to and provide sufficient and appropriate nutrition assessment, counseling and education for the general public;
2. Increase the proportion of worksites that offer nutrition education and/or weight management programs for employees;
3. Reduce dietary fat intake to an average of 30 percent of calories or less and average saturated fat intake to less than 10 percent among people aged 2 and older;
4. Increase complex carbohydrate and fiber-containing foods in the diets of adults to 5 or more daily servings for vegetables and fruits, and to 6 or more daily servings for grain products;

5. Increase to at least 50 percent of the proportion of overweight people aged 12 and older who have adopted sound dietary practices combined with regular physical activity to attain appropriate body weight;
6. Increase calcium intake so at least 50 percent of people aged 25 and older consume 2 or more servings daily of foods rich in calcium;
7. Decrease salt and sodium intake so at least 65 percent of home meal preparers prepare foods without adding salt at the table, and at least 80 percent of people avoid using salt at the table, and at least 40 percent of adults regularly purchase foods modified or lower in salt;
8. Increase to at least 85 percent the proportion of people aged 18 and older who use food labels to make nutritious food selections;
9. Reduce coronary heart disease deaths to no more than 100 per 100,000 people and ;
10. Reverse the rise in cancer deaths to achieve a rate of no more than 130 per 100,000 people and;
11. Reduce overweight to a prevalence of no more than 20 percent among people aged 20 and older.



## Specific Recommendations

The recommendations stated previously by several organizations are generalized to include all individuals. The focus is on the major causes of premature death and disability in the United States: heart disease, cancer, and osteoporosis. The following recommendations are more specific and address primary components of nutrition.

### Fat

Since fat has the highest caloric density of the primary nutrients, a decrease in fat consumption can produce the greatest change in dietary energy. There should be greater reduction in fats containing predominantly saturated fatty acids, such as those from animal sources, than in vegetable fats containing predominantly unsaturated fatty acids (RDA 1980). Monounsaturated fatty acids, mainly oleic acid, should comprise 10% to 15% of total calories. Oleic acid was once considered to be "neutral" in its effect on plasma cholesterol. However, recent evidence indicates that oleic acid may cause as much of a decrease in LDL-cholesterol

levels as linoleic acid when either is substituted for saturated fatty acids in the diet (Goodman, 1988).

The intake of fat can be reduced by substituting fish, poultry without skin, lean meats, and low- or nonfat dairy products for fatty meats and whole-milk dairy products; by choosing more oils, fats, egg yolks, and fried and other fatty foods. Total fat intake should be no more than 30 percent of calories and saturated fatty acid intake should be less than 10% of calories.

Cholesterol

Diet can affect the total blood cholesterol level. Saturated fats and cholesterol in the diet raise the blood cholesterol. Body fat also influences total blood cholesterol. Other dietary constituents, including monounsaturated oils and polyunsaturated oils, lower the blood cholesterol when substituted for saturated fats (Grundy, 1985). Only the saturated component raises the cholesterol level. Furthermore, many foods high in saturated fat also are high in cholesterol, and in most Americans, intakes of dietary cholesterol average 400 to 500 milligrams per day (Grundy, 1985). Dietary cholesterol comes entirely from animal sources such as meats, egg yolks, dairy products, organ meats, fish and poultry. The recommended amount of cholesterol per day is less than 300 mg.

Carbohydrate

When dietary fat is reduced, it should be replaced by carbohydrates (Goodman, 1988). Refined sugar offers no nutritional value other than as a source of energy. Complex carbohydrates (whole grains, starches) should comprise at least half of the total carbohydrate intake. Dietary sources of complex carbohydrate often provide necessary vitamins and minerals and are considered desirable for proper intestinal function (U.S. Department of Agriculture and U.S. Department for Health and Human Services, 1990). Soluble dietary fibers (e.g., oat bran, fresh fruits and vegetables, legumes and barley) have been shown to reduce blood cholesterol levels. Insoluble fibers such as wheat bran have essentially no effect on serum cholesterol levels (Council on Scientific Affairs, 1989). Diets high in fiber often contain less fat and cholesterol and often provide fewer calories. Carbohydrates should comprise 60% of total calories.

Fiber

Evidence to date suggests that fiber is necessary to maintain normal functioning of the

gastrointestinal tract. Sources of fiber vary considerably in their physical properties, chemical composition, and composition of the fiber-containing matrix in foods (Council on Scientific Affairs, 1989). Information on levels of dietary fiber intakes in the United States population is very limited, and available only for adults (Council on Scientific Affairs, 1989). There is no single, universally acceptable method for determining total dietary fiber. Currently, United States food composition tables give values for "crude fiber." Estimates for fiber intake for United States adults range from 2.5 to 4.8 grams per day to 11.1 to 23.3 grams per day (Council on Scientific Affairs, 1989).

Protein

Food proteins provide amino acids for the synthesis of body proteins and for the synthesis of many other tissue constituents. More protein is turned over daily within the body than is ordinarily consumed in the diet. The excess amounts consumed are broken down and excreted ( RDA 1980). That is, most American's eat more protein than what the body requires. Certain plant proteins have shown to have a cholesterol-lowering action relative to animal proteins in laboratory animals. This has not yet been established in humans (NRC, 1989). Protein intake is recommended at 10% to15% of total calories.

Total Calories

Total calories should be decreased for the individual who is obese. Obesity is associated not only with elevated serum LDL-cholesterol levels, but is also an independent risk factor for cardiovascular disease. Weight reduction will lower the LDL-cholesterol level in many people, as well as reduce plasma triglycerides and raise HDL-cholesterol levels. Weight reduction can be facilitated by exercise. Studies have shown that regular exercise will curb the appetite as well as burn off excess calories. It also will lower serum triglycerides and raise HDL-cholesterol levels, and, in some individuals, may lower the LDL-cholesterol level (Goodman,1988).

Vitamins

Small amounts of vitamins are required in the diet to promote growth, reproduction, and health. Vitamins A, D, E, and K are called the fat-soluble vitamins, because they are soluble in organic solvents and are absorbed and transported in a manner similar to that of fats. Carotenoids are believed to be helpful in the reduction of certain diseases (NRC, 1989). Human studies are difficult to interpret because the disease itself may affect the variable under study (NRC, 1989).

The effect of dietary beta-carotene supplements on lung cancer are in progress, but results are not yet available (NRC, 1989). Current RDA's for vitamins A, D, E, and K are 4000-5000 IU, 200 IU, 10mg, 45 respectively.

Minerals

Mineral salts are responsible for structural functions involving the skeleton and soft tissues and for regulatory functions including neuromuscular transmission, blood clotting, oxygen transport and enzymatic activity (Hoeger, 1992). Calcium is the most abundant mineral in the human body, making up 1.5 to 2% of the total body weight (NRC, 1989). All living animals possess mechanisms both to conserve calcium and to maintain constant cellular and extracellular concentrations (NRC, 1989). Focus here is on iron, sodium, and calcium.

Iron. Iron intake can be affected by decreasing red-meat consumption in an attempt to lower fat intake. Women in their reproductive years and children are more vulnerable to iron deficiency. It is recommended that fatty meats be replaced with lean meats, poultry (skin removed), fish, and sources of plant protein, such as dried beans. This recommended dietary pattern would continue to furnish adequate sources of heme iron, which is more readily absorbed than inorganic iron in plant foods. Increased consumption of fruits and vegetables will also improve absorption of inorganic iron when consumed at the same time (NRC, 1989). Current RDA for iron is 18 g for women and 10 g for men.

Sodium (salt). Physiological regulating mechanisms normally maintain close control over the concentrations of sodium, potassium, and chloride as well as the total body content of several electrolytes. Failure of regulation profoundly affects body fluid volumes, blood pressure, cardiovascular function, and acid-base balance. Most perturbations in regulation and balance result from disease processes rather than from variations in dietary intake (NRC, 1989). Sodium is present mainly in salt (sodium chloride). The quantity of dietary sodium is often expressed as milligrams of sodium or sodium chloride. Because the typical American diet consist of too many processed foods, too much sodium intake is the problem rather than lack of sodium. The current recommendations are to limit sodium intake to less than 2,400 mg to 3,000 mg per day.

Calcium. Bone is comprised of predominantly calcium. All living animals possess powerful mechanisms both to conserve calcium and to maintain constant cellular and extracellular concentrations. The current recommendations are to consume 800 mg (NRC, 1989) of calcium a day.

Alcohol

The association between moderate alcohol intake and lower coronary heart disease is consistent and moderate. However, the potential benefits of moderate alcohol intake itself have not been differentiated from the effects of other healthy behaviors generally found among people who control their alcohol intake (NRC,1989). Even if very moderate alcohol intake were shown to be causally associated with lower coronary heart disease risk, the potential benefits of recommending alcohol for nondrinkers would be far outweighed by the well-established health risks (e.g., cancer) and accidents (e.g., falls, automobile) associated with alcohol consumption (NRC,1989).

# CHAPTER III
# METHODS

The collection of data, the description of the subjects, and the use of the instrument are explained in this chapter.

## Setting for the Study

### Adult Physical Fitness Program

The Adult Physical Fitness Program is located in the department of physical education on the campus of Eastern Illinois University in Charleston, Illinois. The program is available to apparently healthy adults over the age of 21 years. The cost of the program in $60 per year; $30 for Eastern Illinois University employees. The purpose of the program is to increase and maintain cardiovascular and muscular strength and endurance. The exercise program is administered and supervised by experienced exercise leaders.

### Target Population

The dietary assessment and counseling session was targeted to all current members (n = 186) of the Adult Physical Fitness Program. This population was targeted because providing dietary assessment and counseling in this population was a feasible way for improving nutrition information and education. Moreover, data derived from this assessment could be used for developing a specific and nutrition education program for this population. The Adult Physical Fitness Program is firmly established. Thus, future investigators and educators have access to this population. They can take the recommendations from this study and implement them.

### Recruitment of Subjects

Subjects for the study were recruited in four ways. First, Exercise Leaders encouraged Adult Fitness members to partake in a "nutritional assessment and counseling session." Second, a sign was displayed on the exercise clock for all members to see. The sign stated, "ASK US ABOUT YOUR DIET." Third, an information sheet was distributed to all exercising members following their workout (see Appendix A). Fourth, for those members who did not partake and did not state their interest in the assessment, the investigator called at home during various times of the day and

evening to encourage them to partake. The participant was not called after three non-contact attempts. All participants signed up for a 60 minute time frame. Early morning, evening and day time hours were available as were selected Saturday hours. The assessment took place during October and November, 1993.

Food Frequency Questionnaire

Diet was assessed with the use of a computer-assisted interview administered food frequency questionnaire developed by Block et al. (1986). This 158 line-item food list asks respondents to report how often they usually consume each food, as number of times per day, week, month or year, and whether their usual portion size of that food is small, medium or large with respect to stated medium portion. Age-sex-specific portion sizes are used. The instrument also inquires about consumption of foods from six types of restaurants; whether skin is usually eaten on poultry, or fat on meat; frequency of use of fat or oil in cooking, and types used and; two general questions on the overall frequency of consumption of fruits and vegetables. Vitamin supplement use was also collected.

There are a number of strengths to this questionnaire that led the investigator to choose this method of assessment (Block, 1986). First, the questionnaire is representative of an individual's typical diet. Second, it is relatively brief in administration time, under 30 minutes. Third, it has the capability of assessing nutrients as well as foods or food groups. Four, it has the ability to assess the diet of a variety of demographic groups, through inclusion of foods important to such groups. And five, it has been shown to be representative of the dietary behaviors of the American people. More than 90% of the United States dietary intake for energy and 17 nutrients are covered on the food frequency questionnaire.

The food frequency questionnaire also has a reasonable ability to assess current diet, over a wide range of nutrients and levels of fat intake (Block et al., 1990). In addition to producing correlations in the same range as others have achieved using comparable reference data, it yields average nutrient estimates very similar to those obtained from multiple diet records (Block et al, 1990). Thus, the food frequency questionnaire can be useful both in dietary research settings and in clinical or counseling situations where nutrient estimates for a particular individual's usual diet are needed (Block et al., 1990).

Although other dietary assessment methods are available, their limitations were not exceptable for this investigator. For example, the single 24-hour recall is relatively easy to

administer, but does not provide a valid reflection of an individual's usual diet (Block et al., 1986). Furthermore, although multiple 24-hour recalls, a traditional diet history interview, or a multiday diet record may provide valid assessments of an individual's usual intake, they all require a high level of time on part of the investigator and require considerable time and cooperation on part of the respondent (Block et al., 1986).

The investigator for each individual was Danika Kemmis. With a bachelor of science in dietetics, an undergraduate internship, and several educational workshops, she was qualified to administer the questionnaire and then provide information to the individual pertaining to the responses given during the interview.

Dietary Assessment Session

The dietary assessment took approximately 30 minutes to complete. A computer analysis of the diet was then performed and a dietary and nutritional print-out was given to each participant (see Appendix B). A second copy of the print-out was reserved for the investigator and used later for analysis of data.

Dietary Counseling and Education Session

Each participant was counseled about their specific dietary analysis. This counseling session was supplemented with three pieces of educational literature that was developed by the investigator. The educational literature included information sheets on How to Read a Food Label (see Appendix C), The Food Guide Pyramid (see Appendix D), and Food Facts (see Appendix E). The focus of the counseling and education session was to give information on the relationship between selected dietary behaviors and risks for certain diseases. However, specific individual suggestions were also given to each individual depending upon their data, lifestyle, health status, and the like (e.g., added fats on vegetables).

Participants also had the opportunity to ask questions related to diet, nutrients, vitamins, and so forth. Each participant was given the investigators home and work phone number and encouraged to call if they had any further questions. The counseling session last from 15 to 30 minutes. Thus, the entire assessment, analysis, counseling and education session lasted between 45 and 60 minutes.

## Data Collection and Analysis

For each subject, data were extracted from the computer generated dietary analysis sheet. Data were entered and stored in a database and analyzed with the Statview 512+ program. Where appropriate, frequency distributions and descriptive statistics were used for each variable. The two-tail unpaired t-test was used to test for differences between selected variables. The overall alpha for statistical significance was set at the 0.05 level.

# CHAPTER IV
# RESULTS

The purpose of this chapter is to present the results of the study. The data are presented in Table 1. The information from Table 1 are explained in the text below.

## Population

A total of 51 adults partook in the dietary assessment and counseling session. This comprised 27.4% of all Adult Physical Fitness program participants. Fifty-five percent of the subjects were female (n = 28) and 45% of the subjects were male (n = 23). Ninety-six percent (49 of 51) of the population was Caucasian. The mean age for all subjects was 57 (± 13) years. The youngest participant was 30 years of age and the oldest participant was 80 years of age. Females were slightly older in age than the males (56 years vs. 58 years) but this difference was not statistically significant (t = .53, p = .5999).

## Total Calories

For all subjects, the mean reported total caloric intake was 1765 (± 540.3) calories. The minimal reported total caloric intake was 822 calories and the maximum reported total caloric intake was 3176 calories. Males reported to consume more total calories than did females and this difference was statistically significant (2081 ± 531 calories vs 1506 ± 395 calories; t = 4.4, p = .0001).

## Fat Percentage

For all subjects, the mean reported percentage of total calories coming from fat was 34.8 (± 6.4)%. The minimal reported percentage of total calories coming from fat was 19.7% and the maximum reported percentage of total calories coming from fat was 50%. Males and females reported to consume similar percentages of total calories coming from fat (35.4 ± 5.2% vs 34.4 ± 7.3%; t = .55, p = .5844).

## Fat Grams

For all subjects, the mean reported fat intake was 70 (± 28) g. The minimal reported fat intake was 24 g and the maximum reported fat intake was 165 g. Males reported to consume more grams of

fat than did females and this difference was statistically significant (83 ± 28 g vs 59 ± 24 g; t = 3, p = .0019).

Saturated Fat Percentage

For all subjects, the mean reported percentage of total calories coming from saturated fat was 11.8 (± 2.6)%. The minimal reported percentage of total calories coming from saturated fat was 6% and the maximum reported percentage of total calories coming from saturated fat was 17.4%. Males and females reported to consume a similar percentage of total calories coming from saturated fat (12.4 ± 1.8% vs 11.3 ± 3%; t = 1.6, p = .1102).

Saturated Fat Grams

For all subjects, the mean reported saturated fat intake was 24.0 (± 10.8) g. The minimal reported saturated fat intake was 8.3 g and the maximum reported fat intake was 64 g. Males reported to consume more grams of saturated fat than did females and this difference was statistically significant (29.5± 11.1 g vs 19.5 ± 8.2 g; t = 3.7, p = .0006).

Carbohydrates

For all subjects, the mean reported percentage of total calories coming from carbohydrates was 48.3 (± 6.2)%. The minimal reported percentage of total calories coming from carbohydrates was 37.2% and the maximum reported percentage of total calories coming from carbohydrate was 65.9%. Females reported to consume a greater percentage of total calories coming from carbohydrates than did males and this difference was statistically significant (46.3 ± 4.14% vs 49.9 ± 7.14%; t = 2.14, p = .0373).

Protein

For all subjects, the mean reported percentage of total calories coming from protein was 15.7 (± 2.7)%. The minimal reported percentage of total calories coming from protein was 11.2% and the maximum reported percentage of total calories coming from protein was 21.5%. Males and females reported to consume a similar percentage of total calories coming from protein (15.8 ± 2.3% vs 15.7 ± 3.0 %; t = .08, p = .9367).

Protein Percentage

For all subjects, the mean reported percentage of total calories coming from protein was 15.7(±2.7)%. The minimum reported percentage of total calories coming from protein was 11.2% and the maximum reported percentage of total calories coming from protein was 21.5%. Males and females reported to consume a similar percentage of total calories coming from protein (15.8±2.3% vs 15.7±3.0%; t=.08, p=.9367).

Dietary Calcium

For all subjects, the mean reported calcium intake from dietary intake (no supplements) was 817 (± 338) mg. The minimal reported calcium intake was 298 mg and the maximum reported calcium intake was 1649 mg. Males reported to consume more mg of calcium than did females but this difference was not statistically significant (860 ± 325 mg vs 782 ± 349 mg; t = .82, p = .4175).

Dietary and Supplemental Calcium

For all subjects, the mean reported calcium intake from both dietary intake and supplementation was 906 (± 398) mg. The minimal reported calcium intake from both dietary intake and supplementation was 337 mg and the maximum reported calcium intake from both dietary intake and supplementation was 1804 mg. The mean reported dietary and supplemented calcium intake was greater for females than for males but this difference was not statistically significant (860 ± 325 mg vs 944 ± 452 mg; t = 1, p = .4627). When the women were dicotomized as getting either adequate (≥ 1200 mg) or inadequate (< 1200 mg) calcium intake, 75% (n = 21) of the women were getting inadequate calcium ingestion.

Sodium

For all subjects, the mean reported sodium intake was 2964 (± 1000) mg. The minimal reported sodium intake was 1206 mg and the maximum reported sodium intake was 5689 mg. Males reported to consume more milligrams of sodium than did the females and this difference was statistically significant (3495 ± 1038 mg vs 2529 ± 732 mg; t = 3.89, p = .0003).

Cholesterol

For all subjects, the mean reported cholesterol intake was 199 (± 90) mg. The minimal reported cholesterol intake was 51 mg and the maximum reported cholesterol intake was 572 mg.

Males reported to consume more milligrams of cholesterol than did females and this difference was statistically significant (246 ± 95 mg vs 160 ± 64 mg; t = 3.86, p = .0003).

Dietary Fiber

For all subjects, the mean reported dietary fiber intake was 17 (± 5) g. The minimal reported dietary fiber intake was 9 g and the maximum reported dietary fiber intake was 35 g. Males reported to consume more grams of dietary fiber than did females and this difference was statistically significant (19 ± 6 gms 15 ± 4 g; t = 3, p = .0098).

Iron

For all subjects, the mean reported iron intake from both dietary and supplementation sources was 19 (± 9) mg. The minimal reported iron intake from both diet and supplementation was 7 mg and the maximum reported iron intake from both diet and supplementation was 39 mg. The mean reported diet and supplement iron intake was greater for females than for males but this difference was not statistically significant (19 ± 10 mg vs 18 ± 8 mg; t = 3, p = .719).

Vitamin A

For all subjects, the mean reported vitamin A intake from both diet and supplementation was 10351 (± 5319) IU. The minimal reported vitamin A intake from both diet and supplementation was 3333 IU and the maximum reported vitamin intake from both diet and supplement was 28685 IU. The mean reported diet and supplemented vitamin A intake was greater for males than for females but this difference was not statistically significant (10870 ± 5392 IU vs 9924 ± 5318 IU; t = .6, p = .5325).

Vitamin C

For all subjects, the mean reported vitamin C intake from both diet and supplementation was 355 (± 618) mg. The minimal reported vitamin C intake from both diet and supplementation was 49 mg and the maximum reported vitamin C intake from both diet and supplementation was 4251 mg. The mean reported diet and supplemented vitamin C intake was greater for females than for males but this difference was not statistically significant (236 ± 224 mg vs 452 ± 802 mg; t =1.2, p = .2176).

Beta Carotene

For all subjects, the mean reported beta carotene intake was 3173 (± 2409) IU. The minimal reported beta carotene intake was 740 IU and the maximum reported beta carotene intake was 12686 IU. The mean reported beta carotene intake was greater for males than for females but this difference was not statistically significant (3624 ± 2501 IU vs 2801 ± 2305 IU; $t = 1.2$, $p = .2279$).

Fruits and Vegetables

For all subjects, the mean reported weekly frequency of consuming fruits and vegetables was 41.7 (± 14.6) per week. The minimal reported weekly frequency was 13 and the maximum reported weekly frequency was 81. Females reported to consume more fruits and vegetables on a per week basis than did males but this difference was not statistically significant (41.2 ± 16.1 vs 42.2 ± 13.6; $t = .2$, $p = .8154$).

Table 1. Reported Dietary Intake of Selected Nutrients in 51 Adult Fitness Exercisers.

| | Total (n=51) | | Men (n=23) | | Women(n=28) | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| Total Calories | 1765 | 540 | 2081 | 531 | 1506 | 395 |
| Fat (%) | 34.8 | 6.4 | 35.4 | 5.2 | 34.4 | 7.3 |
| Fat (g) | 70 | 28 | 83 | 28 | 59 | 24 |
| Saturated Fat (%) | 11.8 | 2.6 | 12.4 | 1.8 | 11.3 | 3.0 |
| Saturated Fat (g) | 24.0 | 10.8 | 29.5 | 11.1 | 19.5 | 8.2 |
| Carbohydrates (%) | 48.3 | 6.2 | 46.3 | 4.14 | 49.9* | 7.14 |
| Protein (%) | 15.7 | 2.7 | 15.8 | 2.3 | 15.7 | 3.0 |
| Calcium (mg) | 906 | 398 | 860 | 325 | 944 | 452 |
| Sodium (mg) | 2964 | 999 | 3495 | 1038 | 2529** | 732 |
| Cholesterol (mg) | 199 | 90 | 246 | 95 | 160** | 64 |
| Fiber (g) | 17 | 5 | 19 | 6 | 15* | 4 |
| Iron (mg) | 19 | 9 | 19 | 10 | 18 | 8 |
| Vitamin A (IU) | 10351 | 5319 | 10870 | 5392 | 9924 | 5318 |
| Vitamin C (mg) | 355 | 617 | 236 | 224 | 452 | 802 |
| Beta Carotene (IU) | 3173 | 2409 | 3624 | 2501 | 2801 | 2305 |
| Fruits and Vegetables (servings per week) | 41.7 | 14.6 | 41.2 | 16.1 | 42.2 | 13.6 |

SD=Standard Deviation

*p<.05 for differences between males and females

**p<.001 for differences between males and females

See text for information.

# CHAPTER V

## DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to discuss the results from the study, draw conclusions from the results, and make recommendations for further study.

### Discussion

Dietary factors are associated with approximately 70 percent of all premature deaths, disabilities, and illnesses in the United States. (Gabel, 1992). If Americans were to follow the United States Health and Human Services recommendations for better nutrition, the incidence of coronary heart disease, cancers, stroke, noninsulin-dependent diabetes mellitus, atherosclerosis, and alcohol related illnesses and injuries would be drastically reduced (DHHS, 1990).

Current recommendations are that 60% of total calories should come from carbohydrates, 30% from fats, 10% from saturated fat, and 10% from protein. Subjects in our study reported to consume 48% of total calories from carbohydrates, 35% from fats, 11.8% from saturated fat and 15% from protein. Thus, people in our study were consuming fat and protein that is above current recommendations and carbohydrates that are below current guidelines. However, this is of no surprise, as these percentages are typical of what most Americans eat (NRC, 1989).

Consistent with the percentage of calories coming from fats is that the average fat intake for both genders in this study was 70 grams per day. Men consumed statistically significantly more fat grams per day (83 g) than did the women (59 g). Studies with men have suggested that fat grams under 50 per day may play a protective role against prostate cancer (Brody, 1993). Participants did, however, have a mean dietary cholesterol intake below 200 mg per day. Thus, although dietary cholesterol intake is below the recommended intake, fat intake is higher than suggested. It is possible that these people are unaware that although a food item may have no cholesterol, it can still contribute toward total blood cholesterol (e.g., no cholesterol potato chips). That is, fat is carried as cholesterol when it enters the body.

The typical American diet is low in fruits and vegetables (NRC, 1989). In this study, the average consumption of fruits and vegetables was 42 servings per week. This is approximately

60% of what is recommended by the United States Department of Health and Human Services (70 servings per week). The consumption of fruits and vegetables provides essential vitamins, fiber and complex carbohydrates. Studies have suggested that when consumption of fruits and vegetables are low, fat and protein intake is high (Council on Scientific Affairs, 1989). That is, people will substitute high fat and highly processed foods (e.g., potato chips) over more health and nutritious items (e.g., apples, carrots). Thus, because subjects in this current study have undesirable fat, protein and carbohydrate intake, it seems reasonable to expect a low consumption of fruits and vegetables.

Fiber has shown to play a role in inhibiting certain carcinogens, decreasing blood cholesterol levels, and weight reduction (Council on Scientific Affairs, 1989). Subjects in our study were on average consuming 17 grams of fiber per day. This is less than the 20 to 30 grams of dietary fiber that is currently recommended.

Physiological regulating mechanisms normally maintain close control over the concentration of sodium. Although the specific amount of dietary sodium that will begin to show its hypertensive effects is debatable (NRC, 1989), current recommendations are to consume less than 3,000 mg per day (NRC, 1989). Subjects in our study were on the average consuming 2964 mg of sodium a day. Thus, this value is on the upper end of acceptable intake.

Fruits and vegetables are also a good source of cancer fighting vitamins A, C, E and beta-carotene. In this study, we were able to assess vitamin A, and vitamin C. Subjects were on average consuming more than twice the RDA for vitamin A, and more than three times the RDA for vitamin C. Thus, it appears that these subjects are getting more than adequate vitamins through their diet and supplements. This is expected, for it is possible to consume adequate amounts of vitamins without eating a diet that is low in fat and high in fruits, vegetables and complex carbohydrates. Many of today's processed foods are fortified with such vitamins (e.g., white bread made with refined grain).

Many participants in our study reported that they use vitamin supplements. They believed that since they did not adhere to sound nutritional principles (e.g., fruits and vegetables, whole grains) they could use a supplement to fortify their diet. Unfortunately, supplements should not be used as a substitute for an inadequate diet. First, vitamins provide no energy. Second, not eating the vitamin rich food also leaves you without other benefits of eating the food such as fiber.

Calcium intake is crucial in the maintenance of bone health. This is of special concern with

women because up to 50% of all postmenopausal women will be affected by osteoporosis (NOF, 1990). Women in our study have reported to intake about 944 mg per day. Moreover, when subjects were dicotomized as getting either adequate or inadequate calcium intake (1200 mg per day), 75% of these women were getting inadequate calcium intake.

The relationship between certain parameters (e.g. blood pressure, body fat, lipids) and diet was not studied. Thus we are unable to state if, for example, those who had higher fat diets also had higher percentages of body fat, blood pressure or total blood cholesterol. Other studies, however, have shown these type of relationships (NRC, 1989).

For some individuals, it was difficult to recall food items, as well as quantity and frequency of consumption. Moreover, the program itself may not be representative of exact nutrients for certain items or in the way that individual people prepare their food. For example, it is possible that a person could have used egg substitute versus a whole egg in the preparation of pancakes. Thus, their actual cholesterol intake would be less than what the nutrition program may have indicated.

Although we did not assess the validity or reliability of the questionnaire, it has shown to be of acceptable reliability in a similar group of subjects (Block, 1990). Similarly, the questionnaire has shown to be of acceptable validity as compared against the data derived from the National Health Interview Survey (Block, 1986). The instrument used is known to be useful both in dietary research settings and in clinical or counseling situations where nutrient estimates for a particular individual's usual diet are needed (Block, 1990).

This study may not be representative of all adults, all exercising adults, or of all members of the Eastern Illinois University Adult Physical Fitness Program. The participants in this study were self selected volunteers. Moreover, only 28.5% (53 of 186) of the currently active participants partook in the nutritional analysis. However, as a whole, 25% of the Eastern Illinois University Adult Physical Fitness population have dietary behaviors that are not meeting current recommendations for the majority of nutrients and food stuffs. We believe that this percentage of "poor" diets warrants a nutrition education program. If by chance our sample was biased with predominantly "good" dietary practice individuals, then we can speculate that the diets of the nonstudy participants were probably worse. This case scenario would support our belief that a nutrition education program is needed in the Adult Physical Fitness Program.

Of interest, it was exciting to learn through the individual counseling and education sessions that many participants were aware of ways to improve their eating habits. Many individuals stated

that they have changed the way that they prepare food by broiling or roasting instead of frying. Many subjects stated that they have cut down on the amount of added fats to their foods. Many women were also aware of the dangers of osteoporosis. They appear to be educated on the facts of the disease and the prevention methods. Although some have utilized this information and changed their behaviors to include food choices that are high in calcium but low in fat (e.g., low fat milk). The majority of women in our study need to act on their concerns.

In summary, the study population was found to have diets that are higher in fat and protein and lower in carbohydrates, fiber, calcium and fruits and vegetables than what is currently recommended by public health officials. Although it is encouraging that study participants were involved in aerobic exercise, modifications in their dietary practices could further reduce their risk of the major causes of premature death and disability in the United States (DHHS, 1990).

## Conclusions

Based upon the results of this study the following conclusions seem appropriate.

1. Study participants had diets that were above recommended levels for fats, protein and sodium, and were inadequate in carbohydrates and fiber.
2. The majority of women were getting inadequate calcium intake.
3. Study participants were getting less than the recommended daily servings for fruits and vegetables.
4. Study participants were getting 2 to 3 times the RDA for vitamin A and vitamin C.

## Recommendations

Based upon the results of this study, the following recommendations seem appropriate.

1. A nutrition education program should be developed for the Eastern Illinois University Adult Physical Fitness Program.
2. The relationship between dietary nutrients and minerals and disease risk factors should be explored in this population (e.g., body fat vs fat intake).

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# APPENDIX A

Recruitment of Subjects Letter

FREE DIETARY ASSESSMENT AND COUNSELING

Diet plays a major role in the prevention of several diseases. For example, diet can help to lower blood pressure, reduce cholesterol, and prevent certain types of cancer. Nutrition is also important to reduce and maintain ideal body weight.

This fall, Danika Kemmis has received a special graduate assistantship from EIU. Her funding will provide personalized dietary (nutrition) assessment and counseling for members of the Adult Fitness Program. Danika has a bachelor of science in home economics with a specialization in dietetics. Many of you may know her. She was an Exercise Leader last spring.

Take advantage of this LIMITED opportunity. The assessment and counseling session will take less than 1 hour. Early morning, mid-day and evening hours are available. We even have Saturday appointments.

Sign-up TODAY at the Check-In Station. A LIMITED number of sessions are available. This opportunity will end on Saturday, November 20.

# APPENDIX B

Dietary Printout

00000000C.

Please note that the following nutrient values should be considered as estimates rather than as precisely accurate values. They are based on the frequency of consumption and portion sizes estimated on the diet questionnaire.

| AVERAGE DAILY NUTRIENTS | | | RECOMMENDED RANGES |
|---|---|---|---|
| TOTAL CALORIES | 1391.1 | CALORIES | DEPENDS ON AGE, SEX, ACTIVITY |
| PROTEIN | 53.2 | GRAMS | .36 GRAMS PER LB BODY WT |
| TOTAL FAT | 62.1 | GRAMS | BASED ON CALORIES - SEE BELOW |
| CARBOHYDRATE | 146.6 | GRAMS | BASED ON CALORIES - SEE BELOW |
| CALCIUM | 586.5 | MILLIGRAMS | 800-1200 MILLIGRAMS |
| PHOSPHORUS | 989.1 | MILLIGRAMS | 800-1200 MILLIGRAMS |
| IRON | 13.0 | MILLIGRAMS | 10-18 MILLIGRAMS |
| SODIUM | 2488.9 | MILLIGRAMS | 1100-3300 MILLIGRAMS |
| POTASSIUM | 2490.9 | MILLIGRAMS | 1875-5625 MILLIGRAMS |
| VITAMIN A | 5576.8 | I.U. | 4000-5000 I.U. |
| THIAMIN (B1) | 1.3 | MILLIGRAMS | 1 - 1.5 MILLIGRAMS |
| RIBOFLAVIN (B2) | 1.6 | MILLIGRAMS | 1.2 - 1.7 MILLIGRAMS |
| NIACIN | 21.3 | MILLIGRAMS | 13 - 19 MILLIGRAMS |
| VITAMIN C | 57.8 | MILLIGRAMS | 60-100 MILLIGRAMS |
| SATURATED FAT | 21.6 | GRAMS | APPROX. 1/3 OF FAT |
| OLEIC ACID | 25.4 | GRAMS | APPROX 1/3 OF FAT |
| LINOLEIC ACID | 12.7 | GRAMS | APPROX 1/3 OF FAT |
| CHOLESTEROL | 140.6 | MILLIGRAMS | 150-300 MILLIGRAMS |
| DIETARY FIBER | 14.4 | GRAMS | 20-30 GRAMS |

000000000

| (MORE) AVERAGE DAILY NUTRIENTS | | RECOMMENDED RANGES |
|---|---|---|
| RETINOL EQUIV | 973.0 RE | 1000 RE |
| CAROTENE ESTIM | 1617.3 MICROGRAMS | NOT ESTABLISHED |
| RETINOL ESTIM | 702.0 MICROGRAMS | NOT ESTABLISHED |
| POLYUNSAT/SAT FAT RATIO: | 0.59 | 0.6 - 1.0 |
| SODIUM/POTASSIUM RATIO: | 1.00 | NOT ESTABLISHED |
| PERCENT OF CALORIES | | |
| FROM FAT: | 40.2 PERCENT | LESS THAN 30 PERCENT |
| FROM PROTEIN: | 15.3 PERCENT | 12% OR MORE, IF OVER AGE 60 |
| FROM CARBOHYDRATE: | 42.2 PERCENT | 50-68% |
| FROM SWEETS: | 2.7 PERCENT | |
| FROM ALCOHOLIC BEV: | 0.2 PERCENT | |

REPORTED WEEKLY FREQUENCY OF CONSUMING CERTAIN FOODS:

| | | | |
|---|---|---|---|
| ANY FRUIT OR JUICE: | 1.7 | BEEF: | 1.4 |
| CITRUS FRUITS OR JUICES: | 0.4 | PORK: | 0.1 |
| ANY VEGETABLE: | 24.2 | HOT DOGS OR LUNCH MEATS: | 0.9 |
| VEGETABLES EXCL. POTATOES,RICE: | 20.4 | BUTTER OR MARGARINE: | 4.8 |
| SALAD: | 4.0 | CHEESES EXCLUDING COTTAGE: | 1.4 |
| CARROTS: | 0.7 | WHOLE MILK: | 2.3 |
| TOMATOES: | 0.2 | ICE CREAM: | 0.5 |
| DEEP YELLOW OR DARK GREEN VEGS: | 1.3 | PASTRIES, SWEETS, SODAS,SUGAR: | 1.2 |
| FISH OR CHICKEN: | 1.4 | FRIED FISH OR CHICKEN: | 0.3 |
| WHOLE GRAINS OR BRAN CEREAL: | 2.4 | | |
| EGGS (NO. OF EGGS): | 0.2 | | |
| ALCOHOLIC BEVERAGES: | 0.1 | | |

WEIGHT OR HEIGHT IS UNKNOWN

# APPENDIX C

How to Read a Food Label

# TIPS ON READING A FOOD LABEL

The SERVING SIZE is often less than a "typical" serving size. This is done to make the product look like it has few calories and a low amount of fat. For this product, most people eat the entire muffin (or 2 servings). Thus, you need to double the calories, fat, cholesterol, ect.

If SUGAR in any of its forms (for example, corn syrup, honey, fructose, maltose, dextrose) is among the first few ingredients think twice before buying and eating it.

Don't be fooled by the name of the product. These are OAT BRAN muffins, yet OAT BRAN is listed as the fifth ingredient. Ingredients are listed in descending order from the most to the least amount. There is more flour (enriched and whole), sugar and soybean oil than there is oat bran.

OAT BRAN MUFFIN

NUTRITION INFORMATION

Serving Size: 1/2 muffin
Number of Servings: 2

| | |
|---|---|
| Calories | 110 |
| Carbohydrate | 17 g |
| Fat | 5 g |
| Protein | 2 g |
| Cholesterol | 155 mg |
| Sodium | 155 mg |

EACH SERVING CONTAINS
1 GRAM OF DIETARY FIBER

Ingredients: Enriched bleach flour (wheat flour, iron, niacin, thiamin, riboflavin), sugar, whole wheat flour, partially hydrogenated soybean oil, oat bran, rolled oats, nonfat milk, molasses, malted barley, leavening agents, natural and artificial flavors, spice.

This number can be within 20% of the actual calorie count

To determine calories from CARBOHYDRATES:
4 kcal/g x 17 g = 68 kcal

To determine calories from FAT:
9 kcal/g x 5 g = 45 kcals

To determine calories from PROTEIN:
4 kcal/g x 2 g = 8 kcals

To determine TOTAL CALORIES, add your calories from carbohydrates, fat and protein:
68 + 45 + 8 = 121 Kcals

KEY POINT: Determine percent of total calories coming from fat:
45/121 = 37%
WOW! 37% of total calories are FAT calories!

This information is provided by the Eastern Illinois University Adult Physical Fitness Progam. It was developed by Danika Kemmis, M.S. candidate in physical education, as part of an EIU Directed Research Assistantship. Fall 1993.

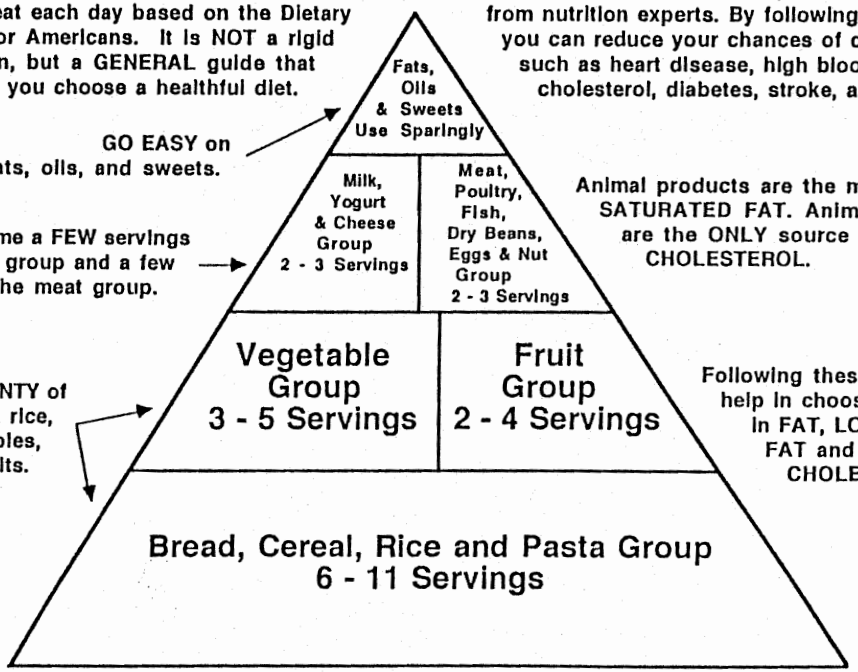
# APPENDIX D

Food Guide Pyramid

# THE FOOD GUIDE PYRAMID

The Food Guide Pyramid is an outline of what to eat each day based on the Dietary Guidelines for Americans. It is NOT a rigid prescription, but a GENERAL guide that lets you choose a healthful diet.

These Guidelines are the best, most current advice from nutrition experts. By following these guidelines, you can reduce your chances of certain diseases such as heart disease, high blood pressure, high cholesterol, diabetes, stroke, and certain cancers.




GO EASY on fats, oils, and sweets.

Consume a FEW servings from the milk group and a few servings from the meat group.

EAT PLENTY of breads, cereals, rice, pasta, vegetables, and fruits.

Animal products are the main source of SATURATED FAT. Animal products are the ONLY source of dietary CHOLESTEROL.

Following these Guidelines will help in choosing a diet LOW in FAT, LOW in SATURATED FAT and LOW in CHOLESTEROL.

Eat a variety of foods to get the nutrients you need.
Do not rely on supplements or highly fortified foods.

This information is adopted from the Dietary Guidelines for Americans. It is provided by the Eastern Illinois University Adult Physical Fitness Program. It was developed by Danika Kemmis, M.S. candidate in physical education, as part of an EIU Directed Research Assistantship. Fall 1993.

# APPENDIX E

Food Facts

# FAT

* Fats have TWICE as many calories as carbohydrates.

* Focus on reducing FAT calories NOT necessarily total calories. You will be more successful in losing and maintaining desirable body weight.

* Daily fat intake should be less than 30% of total calories. For many older adults this would mean consuming less than 50 grams of fat per day.

* Fat is found in almost every food we eat. Animal products contain a high amount of fat (for example, beef, pork, fish, chicken, egg yolks, whole-fat dairy products). Fats are also present in some plant products (for example, nuts and vegetable oils).

* There are different types of fats. All types of fat are undesirable in excessive amounts. You may not cook. Thus, you may not be buying fats for use in cooking or baking. However, fats are found in almost every food we eat. Read the food label! Some "healthy" foods contain saturated fat.

  SATURATED FATS. This type of fat is found primarily in meats and whole-fat dairy products. There are also some vegetable sources of saturated fats. They include palm oil, coconut oil and palm kernal oil. Beware: These types of fats are commonly used in processed foods. For example, refried beans, granola cereal and cookies.

  POLYUNSATURATED FATS. This type of fat is found in primarily vegetable sources like corn oil, safflower oil, soybean oil and cotton seed oil.

  MONOUNSATURATED FATS. This type of fat is found in large amounts in plant oils such as olive oil, canola oil, and peanut oil.

* A low fat diet can protect against heart disease, breast cancer, prostate cancer, and colon cancer.

## CHOLESTEROL

* Fats are transported in the blood as cholesterol. We get cholesterol from 2 places: (1) It is naturally produced by the liver; and (2) we consume dietary cholesterol through the foods we eat.

* Dietary cholesterol comes from animal sources. Examples include beef, pork, chicken, sea food, whole-milk dairy products and egg yolks.

* Plants (for example, fruits and vegetables) do NOT contain cholesterol. However, some plants do contain saturated fat (for example, avocado). Saturated fat increases blood cholesterol.

* Beware of "cholesterol free" products, they may still contain fats (for example, palm oil in granola cereal, vegetables with cream sauce, potato chips, bread). When dietary fats are eaten, they are transported in the blood (body) as cholesterol.

* Intake of dietary cholesterol should be less than 300 mg per day. This is the equivalent of about 1 egg.

* A diet low in cholesterol can help protect against the development of heart disease.

## CARBOHYDRATE

* Carbohydrates are the body's main source of energy. There are two forms of carbohydrates, simple and complex. Consume fewer simple carbohydrates and eat more complex carbohydrates.

* Simple carbohydrates are called sugars. They are found, for example, in candy, soft drinks, jello, puddings, cakes, cookies, and syrups.

* Complex carbohydrates are known as starchy foods. These include grains, vegetables, fruits and beans. Complex carbohydrates also contain fiber.

## FIBER

* Fiber is a type of complex carbohydrate. It is made up of plant material that the body cannot digest. Fiber helps to speed up the passage of food residues through the intestinal tract. This can help to prevent colon cancer. A high-fiber diet can also reduce your risk of heart disease and breast cancer. High-fiber foods include fresh fruits, whole-grain breads and

cereals, vegetables and legumes.

## PROTEIN

* Proteins are used for building new tissues, regulating hormones, maintaining fluid balance, and blood clotting. Most Americans consume more protein than what is needed. Meat is the biggest source of protein.

## VITAMINS

* There are numerous vitamins. Each has a unique role in proper bodily function. Do not depend on vitamin supplements to "make up" for a poor diet. Vitamins lack other benefits of eating food (for example, fiber and energy). Vitamin C, E and beta-carotene (a precursor to vitamin A) may protect against heart disease and certain cancers. They are found in citrus fruit and most vegetables.

## MINERALS

* Minerals are necessary for normal bodily function. Calcium, iron and sodium (salt) are the most common minerals.

* Calcium. A calcium deficiency may lead to osteoporosis ("brittle bones"). Calcium intake should be 1,200 mg per day. Low-fat dairy products are rich in calcium.

* Iron. A low iron intake can lead to anemia. Iron intake should be 10-15 mg per day. Good sources of iron include green leafy vegetables, whole and enriched grains, dried peas, beans and nuts.

* Salt (sodium). A LOW salt diet can protect against high blood pressure, heart disease, stroke and kidney disease. Most Americans consume 2 to 3 times more salt than the body needs. Some baked products (for example, bread) need salt to form the structure of the food. But, in general, reduce salt when cooking meals and do not add salt to your food. Salt intake should be less than 3,000 mg per day.