# EFFECT OF KNOWLEDGE, ATTITUDES, BEHAVIORS, BELIEFS AND DEMOGRAPHIC VARIABLES ON CALCIUM AND IRON INTAKE AMONG U. S. WOMEN

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To my wonderful mother, Chandra Prabha
for her love, sacrifice,
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&

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and periodic reminders
that I can do it.

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# CHAPTER I

# INTRODUCTION

Increasingly strong evidence indicates that calcium and iron are two leader nutrients for the human body. These two minerals specifically are of great importance for women due to hormonal changes related to menstruation, pregnancy, lactation and menopause. These factors influence the changing needs of these two nutrients throughout women's life cycle. Therefore, encouraging adequate calcium and iron intake by women becomes a crucial task for nutrition educators.

## Significance of Calcium in Women's Health

Calcium plays an important role in bone mineralization. Calcium deficiency in adults leads to osteoporosis, the loss of bone mass (Sowers, 1993). Harward (1993) described two types of osteoporosis. The first one occurs in postmenopausal women between the ages of 51 and 65 years and affects mainly the vertebrae and distal radius. The second one occurs in both men and women after the age of 75 years and mainly affects the vertebrae, hip, humerus, and tibia. In normal aging there is a gradual loss of bone. The rate of bone loss accelerates greatly about the time of menopause in women and remains high for several years. This results in gradually diminishing bone strength and increased risk of fractures (Barger-Lux & Heaney, 1994). When bone mass becomes too low to mechanically support skeletal integrity, fractures can occur with minimal trauma (Sowers, 1993).

In the United States around 1.5 million fractures are associated with osteoporosis each year including 300,000 hip fractures (Riggs & Melton, 1995). Osteoporosis is characterized by increased bone fragility and increased risk of fracture (WHO, 1994). Cummings et al. (1993) and Melton et al. (1992) estimated that in the future the risk of having a hip fracture after age of 50 will be 17 percent for Caucasian women and 3 percent for African American women.

Calcium is receiving increased attention based on the reports associating low calcium intake, poor calcium absorption or excessive calcium loss with osteoporosis. Because 99% of the calcium in the body is stored in the skeleton, a net loss of calcium from the body must be accompanied by a net loss from the skeleton (Sowers, 1993).

Several studies revealed the fact that inadequate calcium intake or poor calcium absorption for a long period of time causes reduced bone mass and osteoporosis (DHHS, 1990; NIH, 1994; NRC, 1989; Osteoporosis Society of Canada, 1993). Inadequate calcium intake during the teen and young adult period of bone mineralization may contribute to the high incidence of osteoporosis among elderly women. In studies conducted in the United States, investigators have reported a significant correlation between current bone density and past milk or calcium intake in adult women (Halious & Anderson, 1989; Hurxthal & Vose, 1969; Sandler et al., 1985; Nieves et al., 1995). Barger-Lux and Heaney (1994) also reported that long-term calcium restriction and/or insufficient vitamin D may promote the development of bone fragility in susceptible individuals.

According to a report from National Health and Nutrition Examination Survey III (NHANES III), mean and median calcium intakes were lower than the Recommended Daily Allowances (RDA) for almost all female race-ethnic groups above 12 years of age (Alaimo et al., 1994). Likewise, results from the Continuing Survey of Food Intakes by Individuals (CSFII) (HNIS, 1995) indicated an inadequate calcium intake by women. Women of all ages were found to have less calcium than the Adequate Intake (AI) for their age group. The AI for calcium is based on observed or experimentally determined approximations of the average nutrient intake that is required to meet the body's maximum ability to retain calcium (FNB, 1997).

Besides the association between low calcium intake and bone fragility, inadequate calcium or vitamin D status is also associated with hypertension, colon cancer, and breast cancer. An inverse relationship between blood pressure status and dietary calcium have been identified by some reports (McCarron 1992, McCarron et al. 1982). Allender et al. (1996) reported that calcium supplementation reduced systolic blood pressure in hypertensive adults. Recently, Appel et al. (1997) also reported the positive effect of a diet with increased low fat dairy products, fruits, and vegetables and decreased saturated fat and total fat on hypertensive adults. These adults were found to have lowered blood pressure when fed this diet. Bucher et al. (1996) found that calcium supplements of 1500 to 2000 mg per day lowered diastolic and systolic blood pressure significantly in pregnant women.

Other reports suggest that adequate calcium intake may protect from the development of cancer in colonic mucosa. A case control study published by Slattery et al. (1988) provided some support for the hypothesis that dietary calcium protects against colon cancer. In a study by Carrol et al. (1991), high intake of three dietary elements: vitamin D, calcium, and phosphate seemed to influence the yield of mammary cancers in rats. Bostick and colleagues (1993) also found that calcium supplementation reduced proliferation in mucosa cells. However, Kleibeuker et al. (1993) reported an increase in mucosal proliferation after calcium supplementation.

In summary, adequate calcium intake has been identified as an important factor in preventing osteoporosis and may also play a vital role in the prevention of several other health conditions, such as colon cancer and hypertension.

## Significance of Iron in Women's Health

The human body contains approximately 2 to 4 grams of iron. Iron is a constituent of hemoglobin, myoglobin, and a number of enzymes that play very vital roles in human body. Iron is vital to cellular respiration and therefore is present in all cells of the body (Bothwell & Finch 1968).

Based on the Third Report on Nutrition Monitoring in the United States (FASEB, 1995) the body's need for iron varies depending on age and physiological state. It is particularly high during periods of rapid growth, such as the prenatal period, infancy, adolescence, and in women during their child bearing years (NRC, 1989).

Women have high iron needs during certain periods of life. In the United States iron deficiency in women may be observed in two stages of life: during the female reproductive period because of menstrual iron losses; and during pregnancy because of the expanding blood volume of the mother, the demands of the fetus and placenta, and blood losses to be incurred in child birth (National Research Council, 1989; Dollman, 1992). Fairbanks (1994) reported that many non-pregnant females during child bearing years fall short of the RDA for iron because their calorie intake is often restricted and only 5 to 7 mg iron per 1,000 kcal can be expected from an average Western diet.

Iron deficiency is the most prevalent nutrient deficiency in American women (Federation of American Societies for Experimental Biology, 1995). Iron deficiency occurs in three stages: (1) depletion of iron stores, (2) decreased circulation of iron that is measured by serum iron or by transferrin, and (3) anemia, the stage at which deficiency is so marked that the body is unable to make adequate amounts of hemoglobin. Based on NHANES III (1988-94), the prevalence of iron deficiency (having an abnormal value for at least 2 of 3 tests for erythrocyte protoporphyrin, transferrin saturation, or serum ferritin) was 9% to 11% and iron deficiency anemia (iron deficiency plus low hemoglobin) was 2% to 5% in adolescent and young adult women respectively (Looker et al., 1997).

Some of the most serious concerns related to iron deficiency are its effects on the health and development of infants and children. These effects appear to begin during the prenatal period. Low hemoglobin or very low hematocrit levels of the mother during pregnancy are associated with limited fetal growth, more common prematurity, and more frequent neonatal death (Federation of American Societies for Experimental Biology, 1995).

In conclusion, it is clear that iron and calcium are vital minerals for the human body. They are especially important for women because of their high needs due to their physiological status (pregnancy, lactation and menstruation).

## Statement of the Problem

Inadequate calcium and iron intake by women has been identified as being associated with many health problems. Therefore, it is important to identify the factors contributing to inadequate consumption of calcium and iron in women. It is also essential to recognize the relationship between what individuals know and the attitudes they hold, and then how attitudes affect their eating behaviors. By doing so, public misconceptions may be identified and some inventive nutrition education programs can be developed to meet those needs.

## Objective of Study

The present study included two descriptive surveys conducted by the U.S. Department of Agriculture (USDA) in 1990-1991. These surveys were the Continuing Survey of Food Intakes by Individuals series II (CSFII) and the Diet and Health Knowledge Survey (DHKS). This study was limited to the 2009 women subjects

(N= 2009) who successfully completed the CSFII for three consecutive days of diet intake and the DHKS questionnaire.

The overall goal of this study was to identify the factors (attitude, knowledge, beliefs, and demographic variables) that contribute to the insufficient intake of calcium and iron by women.

The specific questions were identified as being relevant to the problem. These questions were used to develop the specific hypothesis statements of the study. Some of the specific questions were as follows-

**1.** What is the relationship between women's knowledge about the recommended number of servings of dairy, meat, poultry and fish products and their calcium and iron intake?

**2.** What is the relationship between women's attitude towards importance of nutrition while grocery shopping and their calcium and iron intake?

**3.** What is the relationship between women's behavior regarding avoidance of certain milk, meat, fish and poultry products and their calcium and iron intake?

**4.** What is the relationship between women's beliefs that eating a variety of foods each day will provide them all minerals they need and their calcium and iron intake.

**5.** What is the relationship between women's demographic characteristics (age, income, race, education and health status like pregnancy and lactation) and their calcium and iron intake?

## Research Hypotheses

The following research hypotheses were developed for this study:

**1.** Knowledge about recommended number of servings of dairy products will be positively correlated with calcium intake in women.

**2.** Women who think that their diet is about right in calcium will consume more calcium than women who think that their diet should be higher in calcium

**3.** Women who think that their diet is about right in iron will consume more iron than women who think that their diet should be higher in iron.

**4.** Women who avoid milk and cheese will have a lower calcium intake than women who consume these foods.

**5.** Women who avoid red meat (such as beef or lamb) will have a lower iron intake than women who consume red meat.

**6.** Women who think that amount of calcium intake is associated with health problems will consume more calcium than women who do not think so.

**7.** Women who think that amount of iron intake is associated with the diseases like anemia, or iron poor blood will consume more iron than women who do not think so.

**8.** Women who agree or strongly agree that eating a variety of foods each day will provide them all minerals they need will be more likely to have an adequate calcium and iron intake than women who disagree or strongly disagree.

**9.** Women who think that cholesterol is found in animal products like meat and dairy products will be more likely to consume adequate calcium and iron than women who do not think so.

**10.** Women who report that nutrition is very important while grocery shopping will be more likely to have an adequate calcium and iron intake than women who report that nutrition is not at all important.

**11.** Women's age will be positively correlated with their calcium and iron intake.

**12.** Women's income will be positively correlated with their calcium and iron intake.

**13.** White women will have higher calcium and iron intakes than non-white women.

**14.** Women's education will be positively correlated with their calcium and iron intake.

**15.** Women who are pregnant or lactating will have greater calcium and iron intakes than women who are not pregnant or lactating.

## Assumptions of the Study

1. True information was provided by respondents.

2. All knowledge questions were of equal difficulty for each respondent.

## Limitations of the Study

**1.** Data were limited to the main meal planner.

**2.** Data were self reported.

**3.** We have information of the representative validity and reliability for only knowledge related questions.

## Definition of Terms

| | |
|---|---|
| Anemia | A reduction in erythrocytes, hemoglobin, or hematocrit levels. |
| Osteopenia | Reduced bone mass due to decreased osteoid synthesis to a level insufficient to compensate for normal bone lysis. |
| Osteoporosis | The loss of bone mass (protein matrix and bone minerals). |
| Mortality | The rate of death occurrence. |
| Morbidity | The rate of occurrence of a disease. |
| Omnivorous | Eating both animal and vegetable foods. |
| Vegetarian | Eating only vegetable foods. |
| Transferrin | A protein that transports iron in the blood. |

# CHAPTER II

# REVIEW OF RELATED LITERATURE

## Dietary Sources of Calcium in the United States

Calcium is a key to good bone health. Throughout a woman's lifetime, the amount of calcium stored in her bones is a key to maintaining straight posture and good health.

According to the data from National Health and Nutrition Examination Survey (NHANES II) most of the calcium (> 55%) in the U. S. food supply came from dairy products. Other rich sources of calcium are leafy green vegetables (broccoli, kale, and collards), lime processed tortillas, calcium-precipitated tofu, calcium fortified food, and bones. Calcium content in water varies from region to region. Calcium salts in antacids may constitute an underreported calcium source (Block et al., 1985).

According to the Nationwide Food Consumption Survey (1987-88) conducted by U. S. Department of Agriculture (USDA), approximately 50% of the calcium was supplied by milk and milk products. Milk used as an ingredient in other foods, such as cheese on pizza and cream in beef stroganoff, contributed about 20% of the total dietary calcium intake. Grains products, and fruits and vegetables were responsible for 12% and 6% of the total dietary calcium, respectively (Fleming & Heimbach, 1994).

It seems this trend has changed over time. According to the data from 1909-1990 food availability studies conducted by the USDA, dairy products contributed 74.5% of the calcium in the U. S. food supply (Gerrior & Zizza, 1994). More recent data for 1994 indicated that milk products contributed about 73% of the calcium in the U. S. food supply. Fruits and vegetables contributed 9% and grain products contributed 5% of the calcium. The remaining 13% of the calcium was supplied by other food sources (CNPP, USDA 1996).

## Calcium Intake in U. S. Women According to Demographic Characteristics

### Age

Several studies have revealed the fact that U. S. women consume inadequate calcium. According to the 1977-1978 Nationwide Food Consumption Survey (NFCS) an average daily intake of calcium was 743 mg for all subjects, but women 35 to 50 years old consumed only 530 mg calcium which was only 66% of the Recommended Dietary Allowances (RDA) (FNB, 1989) and 53% of the recent Adequate Intake (AI) (FNB, 1997) for their age group (HNIS, 1984).

In the past the RDAs were defined and published by the Food and Nutrition Board of the National Academy of Sciences as "The levels of intake of essential nutrients that, on the basis of scientific knowledge, are judged by the Food and Nutrition Board to be adequate to meet the known nutrient needs of practically all healthy persons" (FNB, 1989, p. 1). Recently the RDA was revised based on increased scientific knowledge about some nutrients (calcium, vitamin D, phosphorus, magnesium, and fluoride) and the new AI has been set for calcium. The new AI is based on "observed or experimentally determined approximations of the average nutrient intake, by a defined population or subgroup, that appear to sustain a defined nutritional state, such as normal circulating nutrient values or growth" (FNB, 1997, p. 1-3). The new AI values for calcium were determined from several balance studies and based on maximal calcium retention calculated as a percentage of the body's maximum ability to retain calcium that can be affected by dietary calcium intake. The new AI was set when there was not enough information to set a new RDA (FNB, 1997)

Results of the 1982-84 Hispanic Health and Nutrition Examination Survey (HHANES) and the 1976-80 National Health and Nutrition Examination Survey (NHANES II) indicated that mean calcium intakes from food were below the RDA for women of all age, race, and ethnic groups (Looker et al., 1993). The Total Diet Study from 1982 to 1989 included annual assessments of representative diets for 11 nutrients including calcium (Pennington and Young, 1991). Results from the Total Diet Study also indicated low intake of calcium by women that was 72% of the RDA for women 25-30 years old, and 64% of the RDA for women 60-65 years old. This intake would contribute only 58% and 43% of the AI for their age groups, respectively.

Fleming and Heimbach (1994) reported mean calcium daily intake in women by age using data from USDA'S 1987-88 Nationwide Food Consumption Survey (NFCS). Mean daily calcium intake in women aged 12-19 years was found to be only 66% (789 mg) of the RDA or 61% of the AI. Women aged 20-49 consumed an average daily intake of calcium only 72% of the RDA (578 mg) that will contribute to only 56% of the

AI. Women 50 and over consumed only 79% of the RDA (631 mg) that will contribute to only 53% of the AI.

Based on the results from the national studies, adult women do not consume enough calcium. In the 1989-91 Continuing Survey of Food Intakes By Individuals (HNIS, 1988-91) median daily calcium intakes from food were found to be below recommended values for females 20 years of age and older. Similarly, according to the 1995 CSFII, (HNIS, 1995) females of all ages were found to have their daily mean calcium intake less than the RDA. Females aged 6-25 years had on an average intake of only 65% of the RDA (788 mg) for calcium for their age group. Females aged 30-69 years had on an average intake of 80% of the RDA (614 mg) for their age group. Therefore, none of these women met the higher recommendations for the 1997 AI.

Guthrie (1996) reported results from the 1990-1991 CSFII that younger women (<25 years old) were less likely to meet their RDA for calcium than older women (>25 years old). Moreover, according to the 1994 CSFII (USDA) adult females aged 20-49 years old were consuming on an average only 82 to 88 percent of the RDA for their age group (Guthrie and Schwenk, 1996). However, the Baltimore Longitudinal Study of Aging found that calcium intakes in elderly subjects were not affected by age although calcium intake values tended to be lower in older people (Hallfrisch and Muller, 1993).

Cleveland et al. (1997) recently reported on an average daily dairy group consumption by U. S. women as recommended by the Food Guide Pyramid (1992) using data from the 1989-1991 CSFII. On the average, women aged 20-39 years consumed only 1.3 dairy servings and women aged $\geq$ 40 consumed only an average 1.1

dairy servings. A large proportion of women failed to meet energy-based recommendations for the dairy group of the Pyramid. Only 25% of the women aged between 20-39 years met the recommendation for the dairy group. Only 27% of the women aged between 40-59 years met the recommendations for the dairy group and only 24% of the women aged $\geq$ 60 years consumed enough dairy foods according to Food Guide Pyramid.

**Income**

Several studies reported a high risk of nutrition related problems among people with low income. According to the 1989-91 CSFII (USDA) low income female adults (<131% of poverty index) 20 years of age and older had lower mean daily intakes of calcium than higher income female adults.

Crawford et al. (1995) reported average daily calcium intakes in 2149 black and white girls aged 9-10 years old. Black girls with the highest household income had the lowest mean daily calcium intake (643 mg). Black girls with moderate household incomes consumed slightly higher mean calcium (884 mg) than black girls with lower household incomes (749 mg). However, white girls mean daily calcium intake increased slightly with the household income. Ballew and Sugerman (1995) found that 50% of low income Mexican women living in Chicago consumed less than two thirds of the RDA for calcium.

**Education**

Crawford et al. (1995) reported average daily calcium intake by parental education in 2149 black and white girls. Daily mean calcium intake in black girls was not found to be affected by their parental education, but mean daily calcium intake (908 mg) was higher in white girls whose parents had 4 or more years of college than white girls (871 mg) whose parents had less than a college degree. Holcomb (1995) examined the influence of education on nutrient intakes by older women (65-94 years) living alone in six counties of north-central Kansas. Women with higher education (13 years +) consumed significantly higher mean daily calcium (902 mg) intake than women (676 mg) with lower education.

**Pregnancy**

According to the data from the 1988-1991 NHANES III for all pregnant females, daily mean dietary calcium intakes for pregnant females of all ethnic groups (non-Hispanic whites, non-Hispanic blacks, and Mexican-American) were found to be less than the 1989 RDA's. It should be noted that the mean daily calcium intake of non-Hispanic black pregnant females contributed only 71% of the 1989 RDA (DHHS, 1988-1991)

**Race**

According to the NHANES III 1989-91, mean and median calcium intakes were lower than the RDA for almost all female race-ethnic groups above 12 years of age. Age and sex-specific intakes were generally similar for non-Hispanic whites and Mexican Americans and were lower in non-Hispanic blacks (Looker et al., 1993; Alaimo et al., 1994). Crawford et al. (1995) reported a lower mean daily calcium intake among black girls (720 mg) than white girls (889 mg).

Guthrie (1996) measured dietary patterns and personal characteristics of women consuming recommended amounts of calcium using data from the USDA's 1990-1991 CSFII and Diet and Health Knowledge Survey (DHKS). Black women were found to be less likely to meet their RDA for calcium than white women.

## Bioavailability of Calcium

Besides inadequate calcium intake, calcium needs may not be met because of poor bioavailability. Heaney et al. (1991) stated that the bioavailability of calcium may vary depending on the kind of foods that are being consumed. Calcium is poorly absorbed from foods rich in oxalic acids such as spinach, sweet potatoes, rhubarb and beans. Foods containing phytic acid such as unleavened bread, raw beans, seeds and nuts can also interfere with calcium absorption in the human body. Other food components that might interfere with calcium absorption are sodium, protein, and caffeine. High intakes of sodium chloride also result in an increased loss of calcium (Kurtz et al., 1987).

Similarly different studies have shown that protein increases urinary calcium excretion (Linkswiler et al., 1981; Margen et al., 1974) and caffeine intake increases the risk of hip fractures in women (Kiel et al., 1990). Bioavailability of calcium from supplements may depend upon the amount consumed (Heaney et al., 1975, 1988) and whether it was consumed with a meal (Heaney et al., 1990).

## Influences of Calcium on Bone Health

### Bone mass and bone mineral density

Calcium is a major component of bone. Ninety nine percent of the body calcium resides in the bones and teeth (Andon et al., 1994). Bone mass is believed to be achieved between 19 and 30 years of age. The age at which peak bone mass occurs varies with the skeletal size. Teegarden et al. (1995) measured bone mineral content in 247 females aged 11 to 32 years. They reported that 92% of the maximal total bone mass was present by age 17.9 years and 99% was present by age 26.2 years. Weaver et al. (1995) and Abrams and Stuff (1994) reported more efficient absorption of calcium in adolescents girls compared with young adult women.

Chan et al. (1995) studied effects of calcium on bone and body composition in 48 white pubertal girls. These girls were divided into two groups. One group was supplemented with dairy products to the RDA of 1200 mg calcium daily, the other (control group) received their usual diet. After one year in the study the group that was supplemented with dairy products had significantly greater increases in total body bone mineral (14.2%, intervention group vs 7.6%, control group) and bone mineral density at the lumber spine (22.8% intervention group vs 12.9% control group). Similarly, Johnston et al. (1992) reported a significant effect of calcium supplementation on bone mineral density of children. Chevalley et al. (1994) also found that oral calcium supplements of 800 mg per day prevented the decrease of femoral bone mineral density in vitamin-D-replete elderly patients.

The function of dietary calcium has been largely defined in terms of bone mineralization. Sufficient bone mineralization leads to increased bone density and strength. Nieves et al. (1995) evaluated the relationship between diet and bone mineral density in 139 women from Rockland Country, New York. This study reported that calcium intake by women during the teen years was positively related to bone mineral density of the hip and forearm at the age of 30-39 years. An increase in teenage calcium intake from 800 to 1200 mg per day was estimated to increase hip bone density by six percent. Current intake of dietary calcium and total calcium intake were found to be modestly related to femoral neck and trochanter bone density. Subjects' hip bone density was strongly associated with duration and amount of calcium intake.

It should be noted that besides the well known relationship between adequate calcium intake and achievement of good bone mass, an individual's bone mass is affected by genetics (Johnston & Slemenda, 1991). Bone mass in young women is strongly affected by inherited factors from both parents. This has serious implications for some, since those with a family history of osteoporosis may have an increased risk and therefore need to be actively encouraged to decrease other potential risk factors as much as possible (Matkovic et al., 1990). The other 20% is influenced by other variables such as age, physical activity, drug and hormone use, smoking and diet (Smith et al., 1975).

**Racial and ethnic influences on bone mass and bone mineral density**

Women lose a greater proportion of bone mass as they age when compared with men (National Institute of Health 1984). Whites have less inherent bone mass and often experience more symptoms of osteoporosis than black individuals (Amschler, 1985). Differences between blacks and whites in calcium regulating hormones may provide insight into why blacks have greater bone mass and less osteoporosis. Higher levels of 1,25-dihydroxyvitamin D [1,25-$(OH)_2D$] and parathyroid hormone have been found in black adults (Bell et al., 1985), in black mothers and their newborns [1, 25-$(OH)_2$ $D_3$] (Hollis & Pittard, 1984), and in Mexican Americans (Reasner et al., 1990).

Prevalence of femoral osteopenia and osteoporosis in different ethnic groups was estimated by Looker et al. (1995) using data from NHANES III 1988-91. Osteopenia was defined by World Health Organization (WHO) as bone mineral density values between 1 and 2.5 standard deviation below the mean and osteoporosis was defined as bone mineral density values more than 2.5 standard deviations below the mean for young adults (Kanis et al.,1994). Among females 50 years of age and older, femoral osteopenia occurred in 39% of non-Hispanic whites, 29% of non-Hispanic blacks, and 36% of Mexican Americans. Prevalence estimates for osteoporosis in these three groups were 21%, 10%, and 16%, respectively (Looker et al., 1995).

Several studies explained the beneficial effects of calcium intake on bone loss. Significant bone accretion occurs during adolescence and early adulthood. But the low calcium intakes from food by many adolescents and adults, particularly females, suggest that many American women are not getting the calcium they need to maintain optimal bone health and prevent age-related loss of bone mass and osteoporosis.

### Dietary Sources of Iron in the United States

Iron is available in many different foods in the food supply of the United States . Meat, eggs, vegetables, and cereals (especially fortified cereal products) contribute main dietary sources of iron (National Research Council, 1989). According to data from the 1977-1978 NFCS, heme iron, a highly available source of iron, represented from 7 to 10% of the dietary iron intake of girls and women (Raper et al., 1984).

Food sources of iron available in the food supply of the U. S. have changed over time with a slight decrease in the percentage of iron contributed by meats and an increase in the percentage contributed by grains because of iron fortification. Gerrior and Zizza (1994) reported nutrient content in the U. S. food supply from 1909-1994 using food availability data from USDA. Grain products were a major source of iron (48.9%) and meat, poultry and fish contributed only 18.5% of the iron in 1990.

## Iron Intake in the U. S. Women According to Demographic Characteristics

### Age

Murphy and Calloway (1986) examined the daily iron intake by women 18 to 25 years old using data from NHANES II. The average daily iron intake of these young women was 10.7 mg. From 1982 to 1989 the Total Diet Study included annual assessment of representative diets for 11 nutritional elements (Pennington & Young, 1991). This study found low iron in the diets of teenage and adult females. Mean iron intake of females aged 14 to 16 years was 11 milligrams per day as compared with the 1989 RDA that was 15 milligrams per day. Females 25 to 30 years old had average intake of iron that was about 10.7 mg per day as compared with the RDA for this age group that is 15 mg per day, and elderly women who were in the 60 to 65 age group consumed 10.6 mg of iron per day which is slightly above the RDA of 10 mg per day for that age group. Overall mean daily intake of iron was 92.4% of the 1989 RDA for women 20 years of age and over.

From the results of the 1989-91, CSFII (USDA) the average women age 20 and over had an iron intake that was less than 100% of the RDA (FNB, 1989). According to the results of 1995 CSFII (USDA) females aged 6-49 years consumed 89% of the RDA (13.5 mg) for iron of their age group. Females aged 50 and over were found to have more than enough iron for their age. Alaimo et al. (1994) reported daily iron intake in females by age using data from 1988-91 NHANES III. No significant changes in iron intake were found with age.

Recently, Cleveland et al. (1997) reported that U. S. women consumed the number of servings of meat, poultry, fish and equivalents as recommended by the Food Guide pyramid (USDA; HNIS,1985) using data from CSFII, 1989-1991. It was surprising to notice that only 38% of the women aged 20-39 years met the recommendations for the meat group of the Food Group Pyramid. Forty percent of the women aged 40-59 years met the recommendations of the meat group for the Pyramid. Only 29% of the women aged $\geq$ 60 met the recommendations for the meat group of the Pyramid.

**Education**

Crawford et al. (1995) reported average daily iron intake by parental education in 2149 black and white girls. No difference in mean daily iron intake was found for black or white girls whose parents had different education levels. Holcomb (1995) examined the influence of education on nutrient intakes of older women (65-94 years) living alone in six counties of north-central Kansas. Women with higher education (more than 13 years) consumed only 1 mg more iron than women with lower education ($\leq$ 12 years).

**Income**

According to the data from 1989-91 CSFII (USDA) women aged 20 and over with low income levels (< 131% poverty) consumed lower average daily iron than women with higher income ($\geq$ 131% poverty). Crawford et al. (1995) found less iron intake by 9-10 year old girls with increasing household income. Ballew and Sugerman (1995) reported that more than 80% of low income Mexican women living in Chicago consumed less than two thirds of the RDA for iron.

### Pregnancy

According to the data from 1988-1991 NHANES III, mean daily dietary iron intakes of pregnant females of all ethnic groups (non-Hispanic whites, non-Hispanic blacks, and Mexican-American females) were found to be less than the RDA. Non-Hispanic whites were found to have the lowest mean daily iron intake (DHHS, 1988-1991).

### Race

Results from the 1988-91 NHANES III show mean iron intakes in females were similar in non-Hispanic whites, non-Hispanic blacks, and Mexican Americans (Alaimo et al., 1994). Crawford et al. (1995) reported higher mean daily iron intake (12.3 mg) among 9-10 year old black girls than white girls (11.1 mg).

## Influence of Lifestyle on Iron Availability

There is a concern that some people eating a vegetarian diet may not obtain an adequate intake of some nutrients particularly iron and vitamin $B_{12}$. Low serum ferritin levels in vegetarians compared to non-vegetarians have been reported in some studies (Helman & Darnton-Hill, 1987). Houston et al. (1997) studied how some lifestyle and dietary practices influence iron status in university women. Red meat intake by women was assessed in three groups: those who consumed red meat frequently, infrequently and abstained from eating red meat. Iron intake from vitamin/mineral supplements was found to be greatest in women who reported to be abstaining from red meat. Fewer women abstaining from red meat consumed less than 67% of the RDA for iron compared to women who ate red meat. Serum ferritin level tended to be highest in red meat abstainers, but it was not statistically different from the other two groups. Hallfrisch and Mullar (1993) reported, using 242 women subjects from the Baltimore Longitudinal Study of Aging (BLSA), that iron intakes were affected by supplement use. The percent of women who did not use iron supplements and who consumed less than the 2/3 of RDA for iron from the diet was approximately 25% of women under 50 and 10% of women over 50.

## Bioavailability of Iron

Bioavailabilty of iron might be influenced by several factors. Cook and Monsen's (1976) study indicated that iron absorption may depend on the kind of food ingested. For instance, non-heme iron that is present in vegan and lacto-ovo-vegetarian diet is less bioavailable. Absorption of iron may also be reduced by brans and soybean protein that are abundant in vegetarian diets. Martinez and Layritm (1973) found that mean absorption values of iron were 15 to 20 percent from liver, fish, chicken and beef as compared with less than 5% from vegetables and grains such as wheat, maize, black bean, spinach, rice and soy beans. Therefore, it can be concluded that lower bioavailability of iron in vegetarian diets might lead to iron deficiency.

There might be some other dietary factors that also influence the body burden of iron. Johnson et al. (1994), reported that several dietary practices such as low intake of ascorbic acid and high intake of calcium from supplements may decrease iron bioavailability resulting in low iron stores in the body. Dairy products such as milk, cheese, and yogurt have also been shown to decrease iron absorption (Jackson & Lee, 1992). Hallberg et al. (1992) concluded that the negative effects of dairy products for iron absorption are large enough to warrant reduction of the intake of dairy products with meals that provide most of the dietary iron, especially for those at risk for iron deficiency. However, Turnlund et al. (1990) found that milk did not enhance or inhibit the absorption of iron from cereal in healthy young women.

## Influences of Iron on Hematological Status

The function of iron in the body is to transport oxygen and utilize it in the production of cellular energy. Absorbed iron from dietary intake in the body comprises that in hemoglobin (which contains most of the body's iron), in myoglobin and in iron dependent enzymes. Hemoglobin plays an important role in oxygen transport within the cells of the body. Ferritin and hemosiderin comprise the storage forms of iron that serves as a reserve for the production of hemoglobin and other iron compounds. Iron deficiency is likely to result when consumption or absorption of iron from the diet is insufficient to meet the metabolic needs of the body and values for iron containing compounds go below normal.

### Factors influencing hematological status

Besides dietary intake, hematological status might be impaired by depressed immune response (Chandra, 1992) and neurological dysfunction (Beard et al., 1993). Worwood (1997) summarized the influences of several diseases on iron status from different studies. He reported a higher incidence of serum ferritin concentration in patients with liver disease, patient with human immunodeficiency virus infection and patients with malignant disorders. Houston et al. (1997) found that smoking had a negative effect on serum ferritin levels. Requirements for hematological status change with age. These variations result from on-going age-related physiological processes such as growth or changes in organ function. Gastrointestinal blood loss is the most frequent cause of iron deficiency by increasing age; blood loss could result from many factors such as polyps, carcinoma, or peptic ulcer (Johnson et al., 1994).

## Demographic Characteristics and Iron Deficiency in the United States

Data from national studies indicate that iron deficiency and iron deficiency anemia are still relatively common in the United States among women especially during child bearing age. The prevalence of iron deficiency in NHANES I was found to be 15% in women 18-44 years of age and 6% in women 60-74 years of age (Hallfrisch & Muller, 1993). About ten percent of the women aged 20-49 years old were found to be iron-deficient in NHANES II (1976-80). About half of the women of that age group (20-49 years old) had iron deficiency anemia. Data from NHANES III (1989-94) show no decrease in anemia prevalence (Guthrie & Schwenk, 1996).

Looker et al. (1997) determined the prevalence of iron deficiency in the United States. Estimation of iron deficiency and iron deficiency anemia were based on data collected in NHANES III, 1988-94. Iron deficiency was defined as having an abnormal value for at least 2 laboratory values for erythrocyte protoporphyrin, transferrin saturation, or serum ferritin; and iron deficiency anemia was defined as having low hemoglobin status. According to this study 9% to 11% of the adolescent and young adult women were found to be iron deficient. Prevalence of iron deficiency was found to be lower (5%-7%) among women older than 50 years. Two to five percent of the women were diagnosed as having iron deficiency anemia. Iron deficiency was higher in minority women (when poverty level and parity were statistically controlled) as compared with white women. Overall iron deficiency was also found to be more common in poor and less educated women. In 1989 to 1991 low income adults had lower mean intake of iron (USDA, CSFII, 1989-91; HHS, NHANES III, 1988-91).

Besides age related changes there are also racial differences in hemoglobin concentrations. Regardless of age, black women had lower concentrations of hemoglobin than did whites. This difference was not found to be due to the result of differences in iron intake among blacks and whites (Perry et al., 1992).

According to the Pregnancy Nutrition Surveillance System, low income pregnant females, non-Hispanic blacks of all ages and adolescents across racial/ethnic groups had the highest prevalence of anemia in 1992 (HHS, PNSS, 1992). Among low income women who participated in government supported service programs, the prevalence of low birth weight in 1991 was higher for those who were anemic during pregnancy than it was for other women in that sample (HHS, NVS, 1991).

## Nutrition Education Theories

Factors such as demographic characteristics, knowledge and attitudes have been found to be associated with one's food choices. These factors interact to influence the decisions we make about foods. For example, appropriate nutrition knowledge and attitudes regarding diet and health can help people make better food choices.

Many theories/models have been proposed to explain the process of making decisions about food choices. Such theories are important because they are helpful in understanding consumer behavior. These theories can also be helpful in interpreting the present study outcomes and choosing appropriate strategies for nutrition education of women. Therefore, models/theories relevant to this study deserve mention.

### Knowledge-Attitude-Behavior Model (KAB)

According to this model, knowledge must be provided to the public to motivate them to change their diets. This model assumes that a person who is exposed to new information will pay attention to it. This gain in new knowledge will lead to a change in the individual's attitude that will result in improved dietary behavior and practices (McGuire, 1985; Petty & Cacioppo, 1986; Baranowski, 1997).

**The Theory of Reasoned Action and Theory of Planned Behavior**

These theories propose that people hold preconceived beliefs and attitudes about the outcome of a behavior. These attitudes might be influenced by socioeconomic, cultural or peer pressure. These beliefs and attitudes lead to a specific behavioral action such as eating vegetables (Skinner and Woodburn, 1983; Gingiss, 1992). Therefore, these theories present basic models that can be used to understand how attitudes and beliefs influence eating behaviors of the general public regarding certain foods.

The Continuing Survey of Food Intake by Individuals and Diet Health and Knowledge Survey are based on the KAB model. The Diet Health and Knowledge Survey explores people's knowledge, beliefs and attitudes about certain foods. The Continuing Survey of Food Intakes by Individuals gives a very good sense of people's behavioral action as an outcome of their knowledge, beliefs and attitudes about certain foods.

## Dietary Practices Among U. S. Woman According to Knowledge, Attitudes, and Beliefs

### Knowledge

Studies have shown that individuals who have a basic knowledge of nutrition principles apply these principles when selecting foods. Schwartz (1975) found that high school graduates with home economics courses with a unit in food, nutrition and health had higher mean scores in tests of nutritional knowledge, attitudes and practices than did those who had not taken home economics courses. Similarly Mitchell (1990) found that middle class women students had made dietary changes after taking a basic nutrition course. Changes included increased confidence in the adequacy of their diets, decreased supplement use, and reduced fat content of milk.

Guthrie and Fulton (1995) examined the relationship of knowledge of recommended servings of the five major food groups to the number of servings of the food group consumed by female adult meal planners. Data were used from the 1990-1991, CSFII and DHKS conducted by the USDA. For all food groups a positive relationship was found between knowledge of food group servings recommendations and consumption of the corresponding food group. Constant et al. (1994) found a positive effect of nutrition education on calcium intake in the elderly subjects. Mean daily calcium intake was found to be increased from 586 to 705 mg/day after nutrition education.

Houston et al. (1997) compared iron intake and status of university women with different levels of academic coursework in nutrition. Nutrition knowledge did not appear to influence dietary intake or iron status. No difference was found in iron intake or indices of iron status when women who were nutrition majors were compared to non-nutrition majors, and when those who had taken a nutrition course were compared to those who had not.

**Knowledge/Attitudes**

Guthrie (1996) used USDA's 1990-1991 CSFII/DHKS to compare the dietary patterns and personal characteristics of women consuming recommended amounts of calcium to women who did not meet the RDA. A significant difference in calcium intake was found between the two groups of women in terms of knowledge and attitude. Among women who consumed the RDA, 76% were aware of the relationship between calcium intake and health problems, while only 65% of the women who did not meet the RDA for calcium were aware of the relationship. Similarly, women who consumed the RDA for calcium were less likely to avoid all milk and cheese but more likely to avoid whole milk than women who did not consume the RDA for calcium.

Frederick and Hawkins (1992) evaluated the nutrition knowledge and attitudes, dietary practices, and bone densities of four different groups including post-menopausal women, college aged dancers, college track team, and nonathletic college women. The number of servings of high calcium foods eaten was significantly correlated with nutrition knowledge scores and attitude scores. A nutrition knowledge score was positively correlated with age, milk score (average servings of milk taken per month), and food frequency score (average servings of calcium rich foods taken per month).

The attitude score was positively correlated with food frequency score and milk score and was negatively correlated with alcohol use. These correlations indicate that knowledge was being translated into some good dietary practices.

Mitchel and Lerner (1991) studied nutrition knowledge, attitudes and practices of pregnant middle-class women who were seen regularly by an obstetrician. After nutrition education, mean scores secured by mothers were 65% and 79% on the nutrition knowledge and attitude tests, respectively. Overall these women showed changes in dietary habits with an increase in nutrient dense foods. Seventy percent of the mothers met food group recommendations for pregnant women. Fifty-eight percent of the women showed an increase by at least one serving for meat, milk and fruits and vegetable group. No significant relationship was found between nutrition knowledge and attitude tests. However, significant positive correlations between nutrition knowledge and nutrition attitudes were reported in a study of a Canadian nurses (Schwartz, 1976) and in a study of grocers (Stansfield, 1977).

**Beliefs**

Kasper et al. (1994) assessed college women's knowledge of osteoporosis risk factors, their beliefs about the disease, and their practices of preventive behaviors such as adequate calcium intake and physical activity. Respondents believed that it was unlikely that they would develop osteoporosis. They also expressed less responsibility and concern about osteoporosis and believed that it is less serious than other common causes of morbidity and mortality in women, such as heart disease and breast cancer.

No significant relationship was found between risk factor identification and exercise habits, calcium intake, or beliefs about osteoporosis.

Chapman and Chan (1995) evaluated the factors influencing dairy calcium intake in 351 women aged 22 to 85 years. The most commonly mentioned beliefs of the entire sample concerned cholesterol, high calories, and gastrointestinal discomfort. Over 40% of the women reported calcium intakes below 60% of the RDA. Significant differences were found in attitudes and beliefs about dairy calcium when comparing women whose intake was below 60% of the RDA with those whose intake was above 60% of the RDA. Of the women whose intake was below 60% of the RDA, 27.1% believed that they were meeting the RDA for calcium. Women's beliefs that dairy foods were high in calories and cholesterol discouraged them from consuming dairy products. In contrast, women with higher calcium intake were more likely to limit their calorie intake to control weight but they were more concerned about milk consumption and enjoyed milk. Guthrie (1996) reported that women who consumed an adequate amount of calcium believed that one should consume more milk group servings than women who did not consume an adequate calcium.

## Summary

The literature review revealed several studies that had direct or indirect relevance to our proposed work. Researchers have become increasingly aware of the desirability of determining the factors that influence the dietary habits and lifestyle of adults. In spite of the fact that iron and calcium are widely distributed in the food supply, many women do not consume enough of these minerals. It was quite evident from several studies that factors such as knowledge, beliefs, attitude, income level, race, vegetarianism and health status influence dietary habits. For example some studies indicated that nutrition knowledge and a positive attitude toward health were being translated into some good dietary practices.

Some studies suggested several beneficial models or frameworks that can be applied by the nutrition professionals while educating the people. Multiple factors affect food choices, all of which must be assessed if effective educational approaches and nutrition messages are to be developed for all segments of the population. There is still a need to improve our understanding of the process by which consumers make decisions as well as influences on changing eating behaviors.

## The Present Study

The purpose of this study was to identify the characteristics (knowledge, attitudes, beliefs, and demographic variables) that distinguish women who consume low calcium and low iron diets from those who consume adequate intakes of these important elements. This study examined the relationship between knowledge, attitudes, beliefs and demographic characteristics and the amount iron and calcium consumed by woman.

In the present study, data from two descriptive surveys conducted in 1990-91 by the US Department of Agriculture (USDA) were studied. Data were included from the Continuing Survey of Food Intakes by Individuals series II (CSFII) and the Diet and Health Knowledge Survey (DHKS).

Two thousand nine women (2009) were selected in this study who were identified as main meal planners/preparers and successfully completed diet intake for three consecutive days and the DHKS questionnaires.

# CHAPTER III

# METHODOLOGY USED

## Description of the Project

The research design for this project was survey research. Two descriptive surveys conducted by the U. S. Department of Agriculture (USDA) in 1990-1991 were studied:

**1.** The Continuing Survey of Food Intakes by Individuals series II (CSFII) which includes information on food and nutrient intake by 2,960 individuals of all ages surveyed in the 48 conterminous states who provided at least three days of dietary data and completed the DHKS.

**2.** The Diet and Health Knowledge Survey (DHKS) includes information on diet, health and food safety issues from the 2,960 individuals identified as the main meal planner/preparers.

The data set was collected, edited, coded and keyed by the National Analysts (a division of Booz, Allen and Hamilton, Inc.) for the USDA. Therefore prepared final data tapes were available for further analysis by the researchers. The Human Nutrition Information Services (HNIS), a division of the USDA, defined the information to be collected; provided technical information such as food codes, gram weights of common measures of foods, and nutrient composition of foods; and monitored the contract.

The CSFII/DHKS is a recent USDA study on food consumption. These food consumption surveys are major components of the national nutrition monitoring and other related research programs.

### Target population

The target population was individuals of all ages surveyed in the 48 conterminous states. The target population for our study was women identified as main meal planners/preparers.

## Area of Study

This study was designed to identify the factors (knowledge, attitudes, beliefs, and demographic variables) that influence the consumption of calcium and iron.

### Sample design

The 1989-1991 CSFII/DHKS sample design methodology was divided into two independent samples of housing units; (1) the "basic" or all income sample and,(2) the low income sample. Low income was defined as individuals in households with gross income for the previous month at or below 130 percent of the Federal poverty thresholds.

In all income sampling, individuals in all households were eligible to be interviewed. Both samples were derived by National Analysts. The sampling frame and design are discussed in the following sections.

The sampling frame was organized using estimates of the U.S. population in 1980. Adjustments were made at the time of the survey to reflect the current population. The 48 states were grouped into the 9 census geographic divisions. All land areas within the divisions were divided into 3 urbanization classifications which were central city, suburban, and nonmetropolitan. Therefore all cities and counties in the conterminous United States were catalogued into one of 27 superstrata. The 27 superstrata were further divided into smaller geographic pieces. This stratification process resulted into a total of 60 strata, that included 17 central city, 28 suburban, and 15 nonmetropolitan, corresponding to the geographic distribution, urbanization, and density of the population as reported by the Bureau of the Census. Each strata was grouped into smaller homogenous units as counties, cities, and part of cities based upon political, economic, and demographic characteristics, called primary sampling units (PSUs). National Analysts' master sample was selected in four independent replications. Each replication consisted of the selection of one PSU from each of the 60 strata, with probability proportional to the PSUs projected 1985 population. The CSFII/DHKS required 120 PSUs, therefore the first two replicates of the master sample were used for the CSFII/DHKS. Two independent PSUs selections were made from each of the 60 strata.

Each selected PSU was again divided into smaller clusters along census boundaries known as area segments. Each such area segment possessed a minimum of 75 housing units. A total of 260 basic and 500 low income area segments were drawn into the sample. The number of housing units was based upon the prelisted number of housing units in the particular area according to the census information. The selection method was designed so that all households in the assigned segments had the equal probability of being chosen using a systematic selection.

Interviewers visited every sample address to inspect whether that location represented a residential housing unit. If so, interviewers made up to three personal visits followed by up to eight personal calls to households that had a telephone. Households without telephones received a minimum of six personal visits. A screening interview was done to determine the eligibility of the household to participate in the survey. In general all individuals regularly living in the selected household were eligible to participate in the basic survey except roomers, boarders, and employees. Persons who were living away at school, traveling during the survey period or in institutions were excluded. Eligibility to participate in the DHKS survey was confined to the member of the household who was the main meal planner/preparer of that household.

A letter of introduction and a survey fact sheet along with the description of survey was provided to eligible households at the time of interview. The interview was administered in person and began with the household questionnaire containing questions about the composition and characteristics of the household and some food related behaviors. Length of the questionnaire portion of the interview was about 30-40 minutes.

## Data Collection Techniques

The data were collected using self-administered questionnaires and telephone surveys. Dietary information was collected from all members of sample households for three consecutive days. The DHKS respondents were contacted by telephone, if possible, about 6 weeks following collection of the dietary data and asked to answer a series of questions about knowledge of and attitudes toward diet, health and food safety issues. Data collection technique in detail is given below.

At first the interviewer attempted a screening interview to determine if the household was eligible to participate in the survey. If the main meal planner/preparer was not available, any knowledgeable member of the household who was 18 years old or older could serve as the screening respondent.

### CSFII data collection

CSFII data collection included a complete description of food and beverage intake of three consecutive days. The first day's data were collected in a personal in-home interview using a one day dietary recall. The second and third days' data were collected using a self-administered 2-day dietary record. Monetary incentives were given to each member of the household to complete the 3 successive days of food and beverage intake record. These records were made by each household member along with the main meal planner.

The format of the form used to record food intake was the same for all three days. The collected data included the following information;

Detailed description of all foods and beverages consumed;

Quantities of food and beverages taken;

Beginning time of each eating occasion;

Name of each eating occasion;

Person with whom food was eaten;

Whether food was eaten at home or away from home;

Place from which food was obtained;

Use of fat and salt in food preparation (This specific question was asked only from the main meal planner/preparer).

A food instruction booklet was used by the interviewers to help each individual describe adequately the foods and amounts eaten. The instruction booklet was developed by the National Analysts based on information provided by HNIS.

**DHKS data collection**

The Diet and Health Knowledge Survey was conducted on the telephone following the CSFII survey. Households without a telephone were contacted by a personal interview. The mode of telephone interview was the computer assisted telephone interview (CATI) program. Multiple calls were made at different times of the day and on different days of the week in order to reach the respondents. In-person follow ups were also conducted.

The main meal planner or preparer was specified as the DHKS respondent. The DHKS interview took an average of 29-32 minutes to complete.

Although there was no monetary incentive for completing the DHKS telephone interview, the respondents showed very strong interest. It was found that questionnaire content was the motivating factor for the respondents. DHKS questionnaire was based upon respondent knowledge and attitude about the Dietary Guidelines for Americans. The collected data from the DHKS survey included information about self perceptions of the adequacy of intake levels of nutrients and other dietary components, awareness of diet and health relationships, use of food labels, perceived importance of dietary guidance for specific nutrients and other dietary components, and knowledge about food sources of kilocalories, nutrients, and other dietary components.

Additional information was obtained at the request of the Environmental Protection Agency (EPA). This additional information included self reported healthfulness of diet, height and weight, the amount of water intake on day 1 and the usual 24 hour water intake. Other questions were asked such as, whether the person was on special diet, use of vitamin or mineral supplements, use of table salts, use of fish oil and fiber supplements, health status, and physical handicaps, level of physical activity during leisure time, cigarette smoking, TV watching, use and handling of fully cooked meat and poultry dishes purchased from a store or delicatessen, and the frequencies of use of selected foods during the past three months and the average number of times these foods were taken during a day, a week, or a month.

## Data Processing

### Food coding

All completed data were coded by the contractor using food codes and coding guidelines provided by HNIS. Amount of food ingested by the respondent was converted into grams. Different seven-digit codes were designated for different foods. The food descriptions given on the food intake forms were matched to an appropriate seven-digit code by a coder using a computer assisted coding system developed by National Analysts.

### Nutrient data base

Nutrient data base was developed by HNIS to be used in this survey. The amount of each nutrient in each food eaten was calculated using the weight (in grams) of the food and the nutritive value of the food per 100 grams using the nutrient data base. The nutrients in the amount of food eaten by the respondent were added to obtain the nutrient intake for each day, then three days were averaged.

The nutrient data base includes values for food energy and 29 nutrients and other dietary components. These 29 nutrients included fat (saturated, monounsaturated, polyunsaturated), protein, carbohydrate, dietary fiber, cholesterol, and all major vitamins and minerals. The data base also included a calcium equivalent factor.

The values for the food energy, nutrients, and other dietary components, were taken from the USDA Data Base and the USDA Nutrient Data Bank. Most of the values were supported by the laboratory analyses. The nutrient values that were not available from laboratory analysis were attributed from data from other forms of the food or from data for similar foods. The values used for milk when an individual could not specify the fat content were changed to reflect the average fat content of milk consumed by the population.

### Data cleaning

All coded data were cleaned by a computer-assisted cleaning program and also subjected to checking by the contractor. Respondents' intake of food energy, protein, fat, carbohydrate, calcium, iron, and vitamin C were compared with the 2nd and 98th percentiles of individuals of the same age group and gender in order to check the plausibility. The gram weight of each food reported was also estimated against reasonable maximums which have been established by HNIS based upon food groups. All questionable coded data were verified by checking the original questionnaire and carefully corrected in case of error.

## Study Sample Selection

Specific information and data needed to solve the problem of the study were identified, and retrieved from existing CSFII/DHKS data sources. Data from 1989 CSFII / DHKS was eliminated from this study because some questions that were relevant to this study were not asked in that year. Hence, 1990-1991 CSFII/DHKS data were used in this study. The study sample was limited to the women who were identified as meal planners/preparers because of the objective of the study. This study was also limited to the subjects (N = 2009) who successfully completed 3 consecutive days of dietary data and the DHKS questionnaires. Subjects with incomplete DHKS responses were also eliminated from the study.

## Analysis Methodology

To support the objective of the study, specific questions were taken from CSFII/DHKS (1990-1991) questionnaires that were relevant to the study. Question selection was based on the following representative definitions.

All knowledge related questions were affirmed according to the definition of knowledge given by Chamberlain in 1992.

Knowledge: Use of the mind, intellectual ability, rational learning (e.g. recalling, remembering, and recognizing).

Questions addressing women's attitudes were decided using a definition developed by Haber and Runyon (1974) that is given below:

Attitude: A learned predisposition to respond in a specific way, negative or positive, toward people, ideas or situations.

Questions addressing women's behaviors were selected using a definition developed by Crider et al. (1989) that is given below:

Behaviors: Any activity that can be observed, recorded, and measured.

Questions to assess women's beliefs were selected based on a definition developed by Crider et al. (1989) that is given below:

Beliefs: Perception of factual matters, of what is true or false or the cognitive aspects of attitudes.

After deciding relevant questions of the study, specific hypothesis were made so that inference could be drawn about the population of interest. Data analysis techniques appropriate to test the research and null hypothesis were selected at the very beginning phase of the statistical analysis.

During statistical analysis, survey data should be weighted to compensate for the clustered nature of the sample and to more accurately represent the U.S. population. However, the recommended weighting software was unavailable so the data was limited to one person per household and a conservative p value of $p < 0.01$ was used.

All available coded data were analyzed using the statistical software package Statistical Analysis System (SAS). Correlation analysis, t-Test, and analysis of variance (ANOVA) were used to analyze the data. The level of significance for this study was 0.01.

Sapp and Jensen (1997) tested reliability and validity for nutrition knowledge questions that appear on DHKS (1989-1991). Reliability is the extent to which a test yields the same results with repeated trials. Validity is the extent to which a test measures what it is intended to measure. Nutrition knowledge was defined as "The ability to recall information about the nutrient content of foods and the source and form of nutrients present in foods" (Sapp & Jensen, 1997, p. 65).

Reliability of the nutrition knowledge tests was measured using the Kuder-Richardsons's (KR-20) and Spearman-Brown rho (calculated with the split-halves procedure). Reliability estimates for a test should be $\geq$ .70 in order to be reliable to measure knowledge. The KR-20 reliability coefficients for the nutrition knowledge tests were found to be .69, .61, and .58 and the rho-coefficients were found to be .66, .58 and .58 respectively for the DHKS 1989-1991. Hence, these tests do not strongly support the reliability of the 1989-1991 DHKS knowledge questions.

Validity of the nutrition knowledge tests were measured using discriminant, convergent and correspondence tests. Discriminant tests of validity discriminate between people who should theoretically score high and low on knowledge tests. As expected, nutrition knowledge score was found to be significantly higher among more educated people than less educated. Convergent validity was estimated by calculating the product moment correlations between nutrition knowledge and diet health awareness questions. Correlation values were found to be 0.44, 0.50, and 0.44 respectively for the years 1989-1991. Correspondence validity was assessed using product moment correlations of the nutrition knowledge tests. Correlations values were found to be very low for the correspondence validity tests. Hence, discriminant and convergent tests supported the validity of the 1989-1991 DHKS knowledge questions.

## Research Hypotheses

### Hypothesis no. 1

**(a).** Null Hypothesis - Knowledge about number of servings of dairy products is not correlated to calcium intake in women

**(b).** Research Hypothesis - Knowledge about number of servings of dairy products is correlated to calcium intake in women.

**(c).** Sub Hypothesis - Knowledge about number of servings of dairy products is positively correlated to calcium intake in women.

**(d).** Sub Hypothesis - Knowledge about number of servings of dairy products is negatively correlated to calcium intake in women.

**Description** Subjects were asked how many servings of dairy products should a person eat each day if one serving equals one cup of milk or a slice of cheese.

**Statistical analysis** Correlation and analysis of variance were used to determine the relationship between knowledge of number of servings of dairy products and calcium intake in women.

### Hypothesis no. 2

**(a).** Null Hypothesis - Knowledge about number of servings of meat, poultry and fish is not correlated to iron intake in women

**(b).** Research Hypothesis - Knowledge about number of servings of meat, poultry and fish is correlated to iron intake in women.

**(c).** Sub Hypothesis - Knowledge about number of servings of meat, poultry and fish is positively correlated to iron intake in women.

**(d).** Sub Hypothesis - Knowledge about number of servings of meat, poultry and fish is negatively correlated to iron intake in women.

**Description** Subjects were asked that how many servings of meat products should a person eat each day if one serving equals one cup of milk or a slice of cheese.

**Statistical analysis** Correlation and analysis of variance were used to determine the relationship between knowledge of number of servings of meat, poultry and fish and iron intake in women.

**Hypothesis no. 3**

**(a).** Null Hypothesis - Women who think their diet is about right in calcium will not consume more calcium than women who think their diet should be higher in calcium.

**(b).** Research Hypothesis - Women who think their diet is about right in calcium will consume more calcium than women who think their diet should be higher in calcium

**(c).** Null Hypothesis - Women who think their diet is about right in iron will not consume more iron than women who think their diet should be higher in iron.

**(d).** Research Hypothesis - Women who think their diet is about right in iron will consume more iron than women who think their diet should be higher in iron.

**Description** Subjects were asked their opinion about their own diet, whether it should be lower or higher in calcium and iron, or it is just about right compared with what is most healthful.

**Statistical analysis** Analysis of variance was employed to determine the association between subjects' opinion about their diet and their calcium and iron intake.

**Hypothesis no. 4**

**(a).** Null Hypothesis - Women who avoid milk and cheese will not have a lower calcium intake than women who consume these foods.

**(b).** Research Hypothesis - Women who avoid milk and cheese will have a lower calcium intake than women who consume these foods.

**(c).** Null Hypothesis - Women who avoid red meat (such as beef or lamb) will not have a lower iron intake than women who consume red meat.

**(d).** Research Hypothesis - Women who avoid red meat (such as beef or lamb)will have a lower iron intake than women who consume red meat.

**Description** Respondents were asked if they personally avoid milk, cheese and red meat.

**Statistical analysis** T-test was used to assess women's consumption of these foods and their calcium and iron intake.

**Hypothesis no. 5**

**(a).** Null Hypothesis - Women who think that calcium intake is associated with diseases like hypertension, osteoporosis, and some other bone problems will not consume more calcium than women who do not think so.

**(b).** Research Hypothesis - Women who think that calcium intake is associated with diseases like hypertension, osteoporosis, and some other bone problems will consume more calcium than women who do not think so.

**(c).** Null Hypothesis - Women who think that calcium intake is associated with diseases like constipation and kidney disease will not consume more calcium than women who do not think so.

**(d).** Research Hypothesis - Women who think that calcium intake is associated with diseases like constipation and kidney disease will consume more calcium than women who do not think so.

**(e).** Null Hypothesis - Women who think that calcium intake is not associated with health problems will consume less calcium than women who think so.

**(f).** Research Hypothesis - Women who think that calcium intake is not associated with health problems will consume less calcium than women who think so.

**(g).** Null Hypothesis - Women who think that iron intake is associated with diseases like anemia will not consume more iron than women who do not think so.

**(h).** Research Hypothesis - Women who think that iron intake is associated with diseases like anemia will consume more iron than women who do not think so.

(i). Null Hypothesis - Women who think that iron intake is not associated with health problems will not consume less iron than women who think so.

(j). Research Hypothesis - Women who think that amount of iron intake is not associated with health problems will consume less iron than women who think so.

**Description** Subjects were asked if they had heard about any health problem that were related to calcium and iron. If they had heard of health problems they were asked to indicate which health problems.

**Statistical analysis** T-test was used to determine the difference between calcium and iron intakes between the subjects who were aware of calcium and iron related health problems and the subjects who were not.

**Hypothesis no. 6**

(a). Null Hypothesis - Women who strongly agree that eating variety of foods each day will provide them all minerals they need, will not be more likely to have adequate calcium and iron intake than women who strongly disagree.

(b). Research Hypothesis - Women who strongly agree that eating variety of foods each day will provide them all minerals they need will be more likely to have adequate calcium and iron intake than women who strongly disagree.

**Description** Subjects were asked their opinion about eating a variety of food gives all the vitamins and minerals one's need. Their agreement with the statement was measured on the scale of 1 to 6. (1 = Strongly disagree, 6 = Strongly agree, 8 = Do not know)

**Statistical analysis** Analysis of variance was used to assess the difference between calcium and iron intake in subjects' according to their degree of agreement regarding eating variety of foods. Correlation was used to determine if there is any correlation between women who were strongly agree with the statement and their calcium and iron intake.

**Hypothesis no. 7**

**(a).** Null Hypothesis - Women who think that cholesterol is found in animal products like meat and dairy products will be less likely to consume adequate calcium and iron than women who do not think so.

**(b).** Research Hypothesis - Women who think that cholesterol is found in animal products like meat and dairy products will be more likely to consume adequate calcium and iron than women who do not think so.

**Description:** Subjects were asked to identify where cholesterol is found in food products.

**Statistical analysis** Analysis of variance was conducted to determine the association between subjects' knowledge about cholesterol in foods and their calcium and iron intake.

**Hypothesis no. 8**

**(a).** Null hypothesis - Women who report that nutrition is very important while grocery shopping will not be more likely to have an adequate calcium and iron intake than women who report that nutrition is less important.

**(b).** Research Hypothesis - Women who report that nutrition is very important while grocery shopping will be more likely to have an adequate calcium and iron intake than women who report that nutrition is less important.

**Description** Subjects were asked the importance of nutrition for them while grocery shopping on a scale from 1 to 6. (1 = Not at all important, 6 = Very important)

**Statistical analysis** Analysis of variance was tested to assess the differences in calcium and iron intake according to subjects' attitudes regarding nutrition while grocery shopping. Correlation analysis was also employed to identify the relationship between the importance of nutrition while grocery shopping and calcium ad iron intake.

**Hypothesis no. 9**

**(a).** Null Hypothesis - Women's age will not be correlated with their calcium and iron intake.

**(b).** Research Hypothesis - Women's age will be correlated with their calcium and iron intake.

**(c).** Sub Hypothesis - Women's age will be positively correlated with their calcium and iron intake.

**(d).** Sub Hypothesis - Women's age will be negatively correlated with their calcium and iron intake.

**Statistical analysis** Analysis of variance and correlation tests were used to determine the relationship between subjects' age and their calcium and iron intake.

**Hypothesis no. 10**

**(a).** Null Hypothesis - Women's education will not be correlated with their calcium and iron intake.

**(b).** Research. Hypothesis - Women's education will be correlated with their calcium and iron intake.

**(c).** Sub Hypothesis - Women's education will be positively correlated with their calcium and iron intake.

**(d).** Sub Hypothesis - Women's education will be negatively correlated with their calcium and iron intake.

**Statistical analysis** Analysis of variance and correlation tests were used to determine the relationship between subjects' education range and their calcium and iron intake.

**Hypothesis no. 11**

**(a).** Null Hypothesis - Women's income will not be correlated with their calcium and iron intake.

**(b)** Research. Hypothesis - Women's income will be correlated with their calcium and iron intake.

**(c).** Sub Hypothesis - Women's income will be positively correlated with their calcium and iron intake.

**(d).** Sub Hypothesis - Women's income will be negatively correlated with their calcium and iron intake.

**Statistical analysis** Analysis of variance and correlation tests were used to determine the relationship between subjects' income level and their calcium and iron intake.

**Hypothesis no. 12**

**(a).** Null Hypothesis - There will be no relationship between women's race and their calcium and iron intake.

**(b).** Research. Hypothesis - There will be a relationship between women's race and their calcium and iron intake.

**Statistical analysis** T-test was used to determine the association between subjects' race and their calcium and iron intake.

**Hypothesis no. 13**

**(a).** Null Hypothesis - Women who are pregnant or lactating will not have different calcium and iron intakes than women who are not pregnant or lactating.

**(b).** Research. Hypothesis - Women who are pregnant or lactating will have different calcium and iron intakes than women who are not pregnant or lactating.

**(c).** Sub Hypothesis - Women who are pregnant or lactating will have higher calcium and iron intakes than women who are not pregnant or lactating.

**(d).** Sub Hypothesis - Women who are pregnant or lactating will have lower calcium and iron intakes than women who are not pregnant or lactating.

**Description:** As stated in hypotheses no. 8, 9, 10, 11, and 12 the demographic characteristics that were considered for this study were; subject's age, income (household income as a percent of the federal poverty threshold), race, number of years of education and whether the women was pregnant or lactating.

**Statistical analysis** T-test was used to determine the association between subjects' pregnancy or lactation status and their calcium and iron intake.

# CHAPTER IV

# RESULTS

The objective of this study was to identify the characteristics (knowledge, attitudes, beliefs, and demographic variables) that influence calcium and iron intake in women. Data were obtained using CSFII / DHKS (1990 - 1991) conducted by USDA as described in chapter III.

CSFII / DHKS (1990-1991) data were obtained from 2,960 respondents. This study consisted of 2009 women who successfully completed both (CSFII / DHKS) surveys. Women's age, education, income, race, and pregnancy status were considered as demographic variables for the study. Table 1 lists the demographic characteristics of the sample population. Participants ages ranged from 13 to 93 years old. The average age of participants was 48 years. Education was defined as the last year of school the subjects attended. Most of the subjects attended at least 12 years of school. Thirty one percent of the subjects had less than a high school education, 37% of the subjects had a high school diploma and 32% of the subjects had some college. Participant income was assessed as a percentage of the federal poverty level. About 30% of the subjects' household incomes were less than 100% of the poverty level (low income households were over sampled by a factor of 4).

**Table 1:** Demographic characteristics of the study population

| Characteristics | N | Mean | St. Dev. | % |
|---|---|---|---|---|
| Age (Years) | 2009 | 48 | 18 | |
| Education (Years) | 2009 | 12 | 3 | |
| < High school | 614 | | | 31 |
| = High school | 743 | | | 37 |
| Some College | 652 | | | 32 |
| Income (Percent of federal poverty level) | 2009 | 245 | 240 | |
| Race | | | | |
| White | 1655 | | | 82 |
| Others | 354 | | | 18 |
| Pregnancy or lactation | | | | |
| Pregnant/lactating | 82 | | | 4 |
| Not pregnant/lactating | 1927 | | | 96 |

**Table 2:** Correlation of demographic variables with calcium and iron intake

| Variable | | Ca intake | | Fe intake | |
|---|---|---|---|---|---|
| | n | r | p | r | p |
| Age | 2009 | -0.11 | 0.0001 | <0.01 | 0.9574 |
| Education | 2009 | 0.16 | 0.0001 | 0.11 | 0.0001 |
| Income | 2009 | 0.08 | 0.0002 | 0.07 | 0.0022 |

Sample segments in medium poverty level were subsampled at the rate of 40 percent. Therefore, respondent households with low and medium income had their sampling rates increased by the factor of 2.5. Seventy percent subjects had household incomes above the poverty level. Of the 2009 respondents 1655 (82.4%) were white and only 354 (17.6%) of the respondents were others (non-white). Only 82 (4%) subjects of the study population reported being pregnant or breastfeeding. Data were weighted to adjust nonresponse and basic and low income samples to match the population characterristics.

## Influence of the Women's Demographic Characteristics on Calcium and Iron Consumption

As described above, subjects' age, education, income, race, and pregnancy or lactation status were considered as demographic characteristics in the study. The relationships between these variables and calcium and iron consumption were analyzed. Each variable is discussed separately in the following paragraphs.

### Age

Correlation analysis indicated a significant but weak negative correlation between age and mean calcium intake (Table 2). Figure 1 shows the relationship between age and mean calcium intake, using analysis of variance ($F = 4.21$, $p < 0.0001$). As can be seen from figure 1 mean calcium intake was lower in older women than younger women. Women who were less than or equal to 20 years old had an average calcium intake of 670 ± 321 mg. that represents only 56% of the RDA of 1200 mg. for their age group. In contrast, subjects who were at least 80 years old had mean calcium intake of 564 ± 214 mg. that represents 70% of the RDA (FNB, 1989) of 800 mg. for their age group.

In comparing these results to the recently published Adequate Intake (FNB, 1997) young women less than or equal to 20 years old consumed calcium an average of only 52% of the AI for their age group. Women between the ages of 21-50 years consumed only 64% of the AI for their age group. Similarly women who were 50 years old or older consumed only 48% of the AI for their age group.

Unlike calcium, age was not found to be correlated with iron intake (Table 2). Figure 2 shows that the level of iron intake remained constant with age ($F = 0.93$, $p = 0.48$). Women less than 40 years old had a mean iron intake of 11.4 ± 6 mg that represents 76% of the RDA of 15 mg for their age group. Women more than 71 years old had a mean iron intake of 11.5 ± 6 mg that represents 115% of the RDA of 10 mg for their age group.

**Education**

The correlation between the subjects' education level and their mean calcium and iron intake were measured. Significant positive correlations were found between education and mean calcium and iron intake (Table 2). Subjects who had a second grade education had lower calcium (558 ± 331 mg) intake than college educated subjects (728 ± 397 mg) (Figure 3) ($F = 4.25$, $p < 0.0001$).

Subjects with only a second grade education had a mean iron intake of 8.3 ± 3.0 mg. In contrast, college educated subjects had a mean iron intake of 13.5 ± 8.5 mg (Figure 4) ($F = 2.75$, $p = 0.0003$). Women with higher education levels had a higher calcium and iron intake in comparison to women with less education.

**Income**

Significantly positive but weak correlations were found between income and mean calcium and iron intake (Table 2). Figures 5 and 6 show that as women's household income (expressed as a percent of poverty level) increased their mean calcium ($F = 2.57$, $p = 0.006$) and iron ($F = 2.12$, $p = 0.03$) intake increased.

**Race**

The relationship between women's race and their calcium and iron intake was measured using t-tests. Race was found to be significantly related to mean calcium and iron intake ($p < 0.0001$). White women had a significantly higher mean intake of calcium and iron than nonwhite women (Figures 7 and 8).

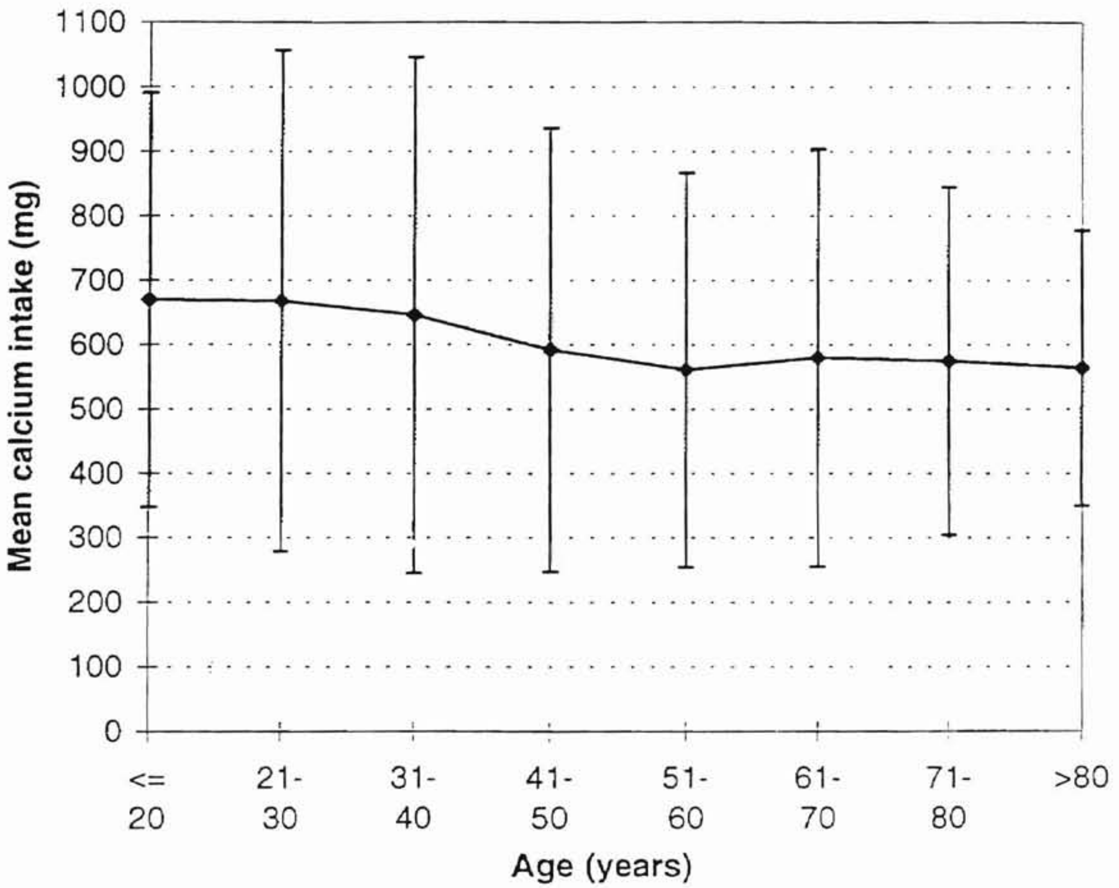


Figure 1: Relationship between age and calcium intake

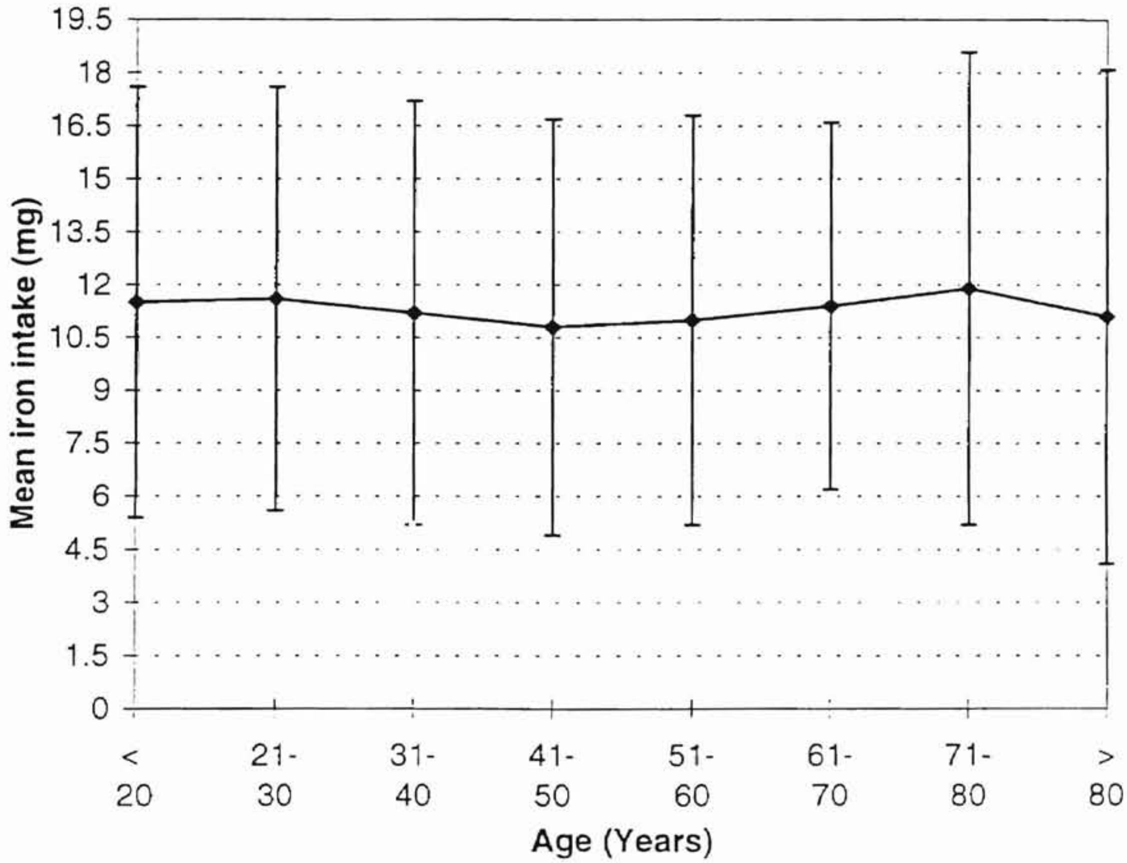


Figure 2: Relationship between age and mean iron intake

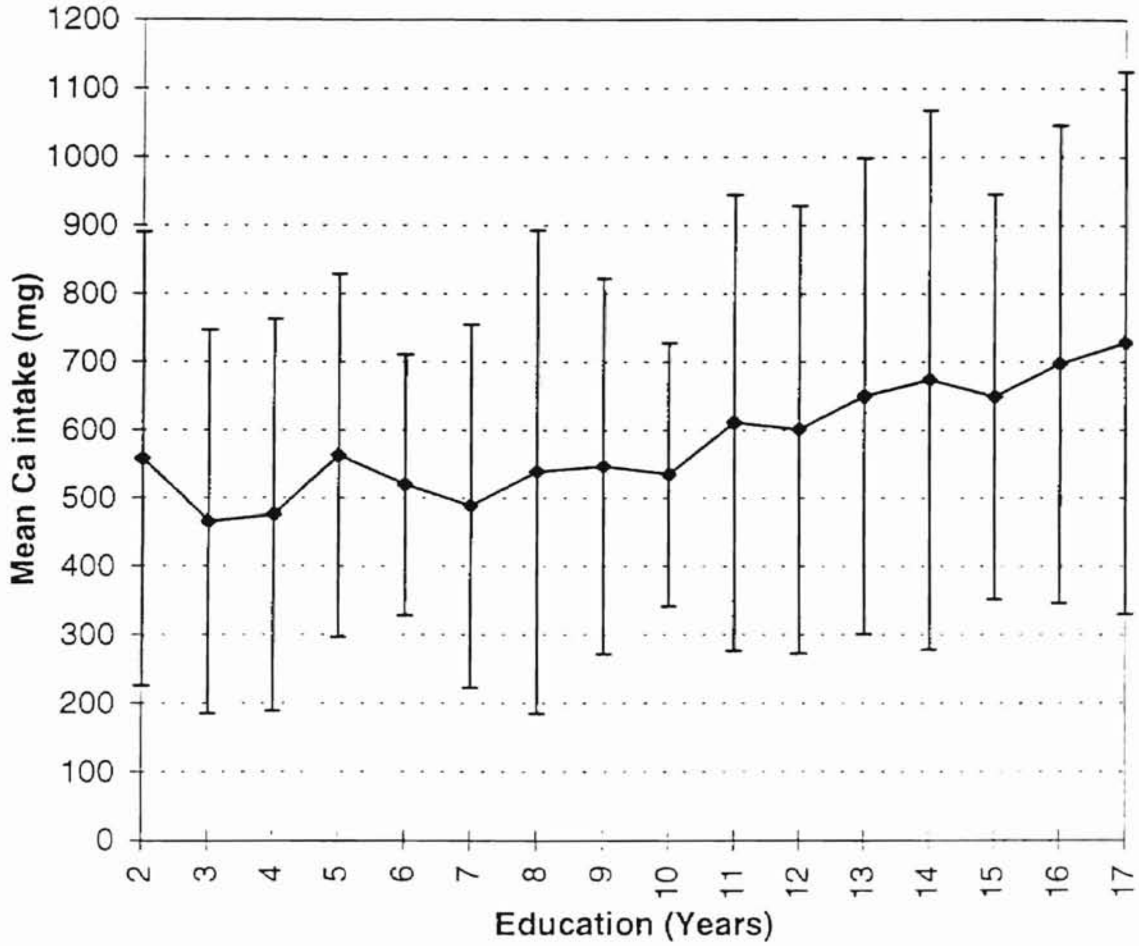


Figure 3: Relationship between education and mean calcium intake

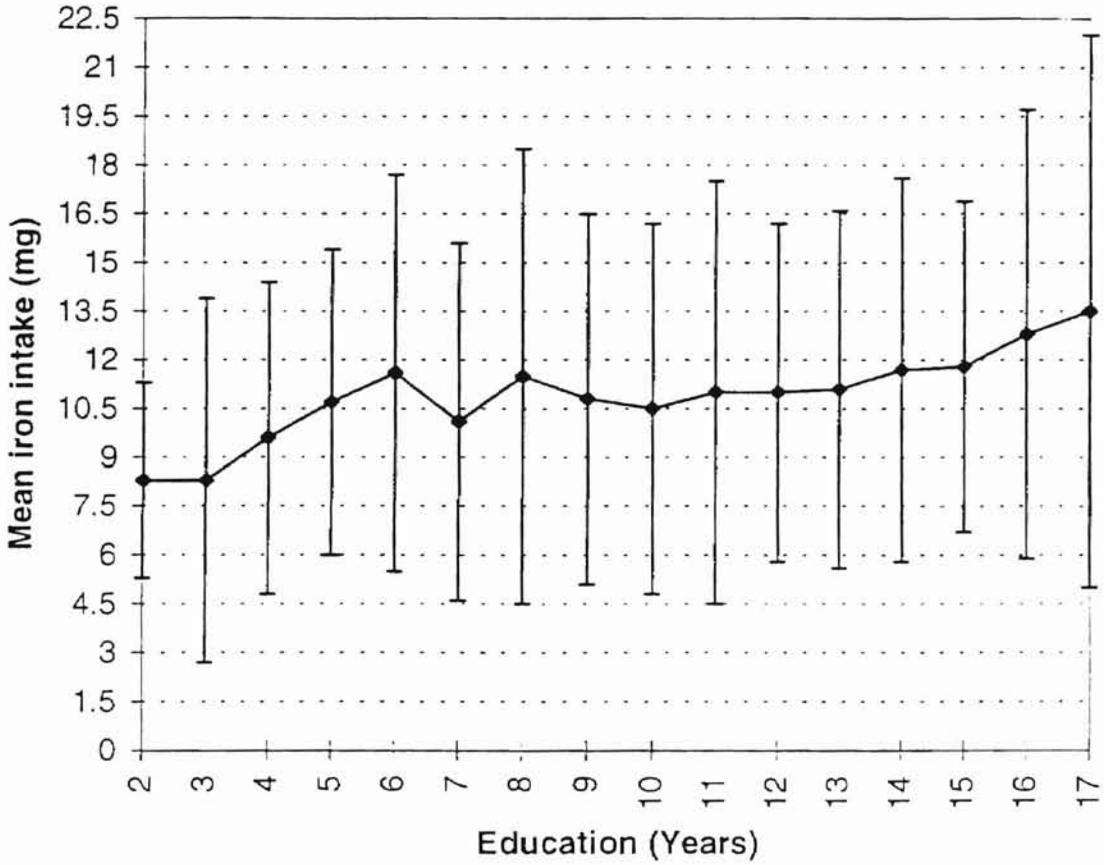


Figure 4: Relationship between education and mean iron intake

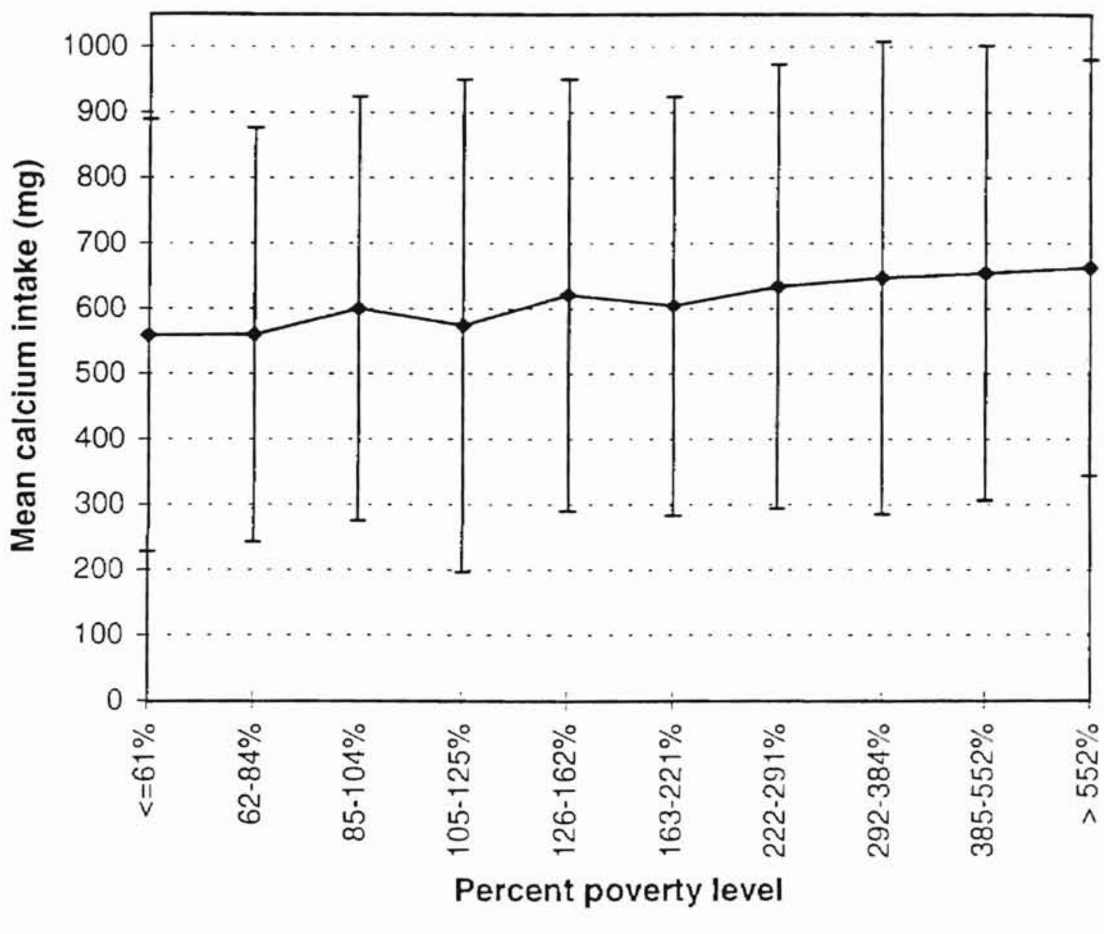


Figure 5: Relationship between income and mean calcium intake

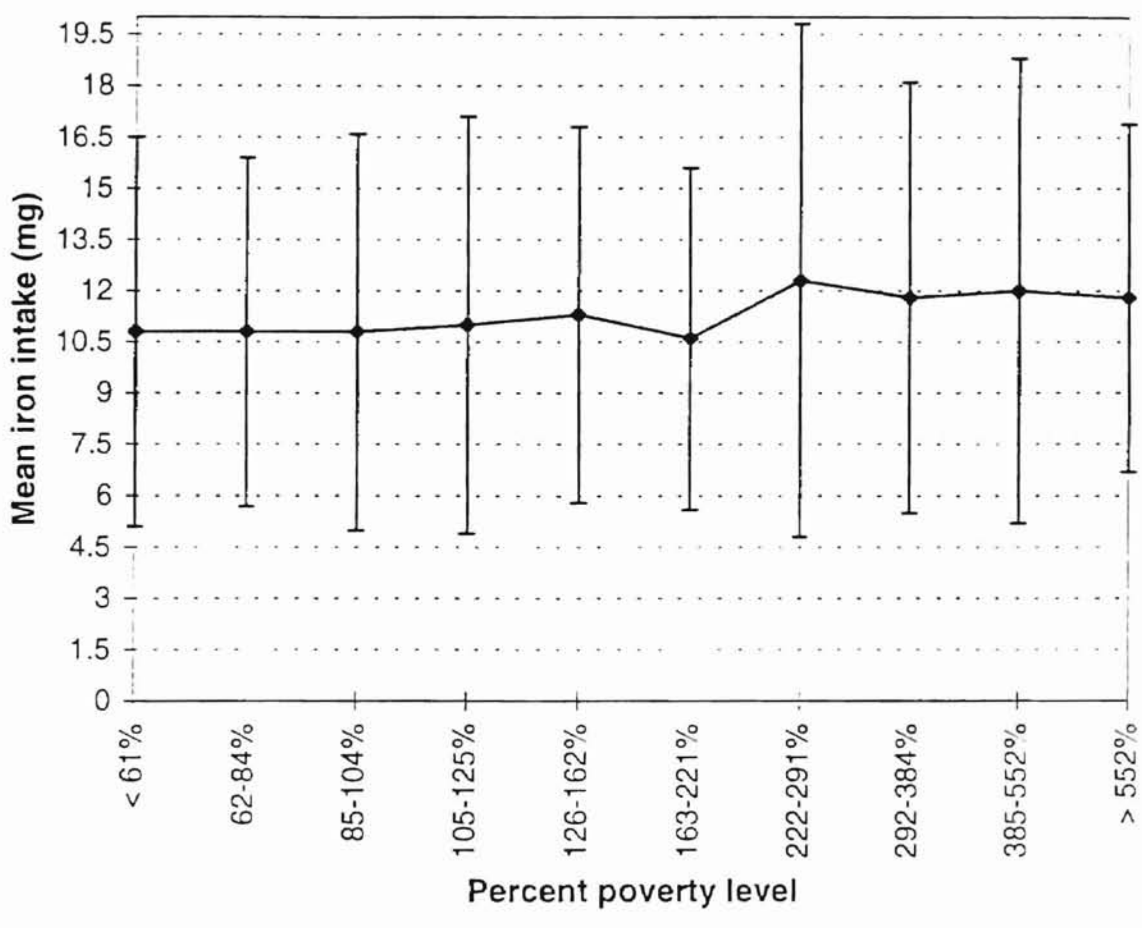


Figure 6: Relationship between percent poverty level and mean iron intake

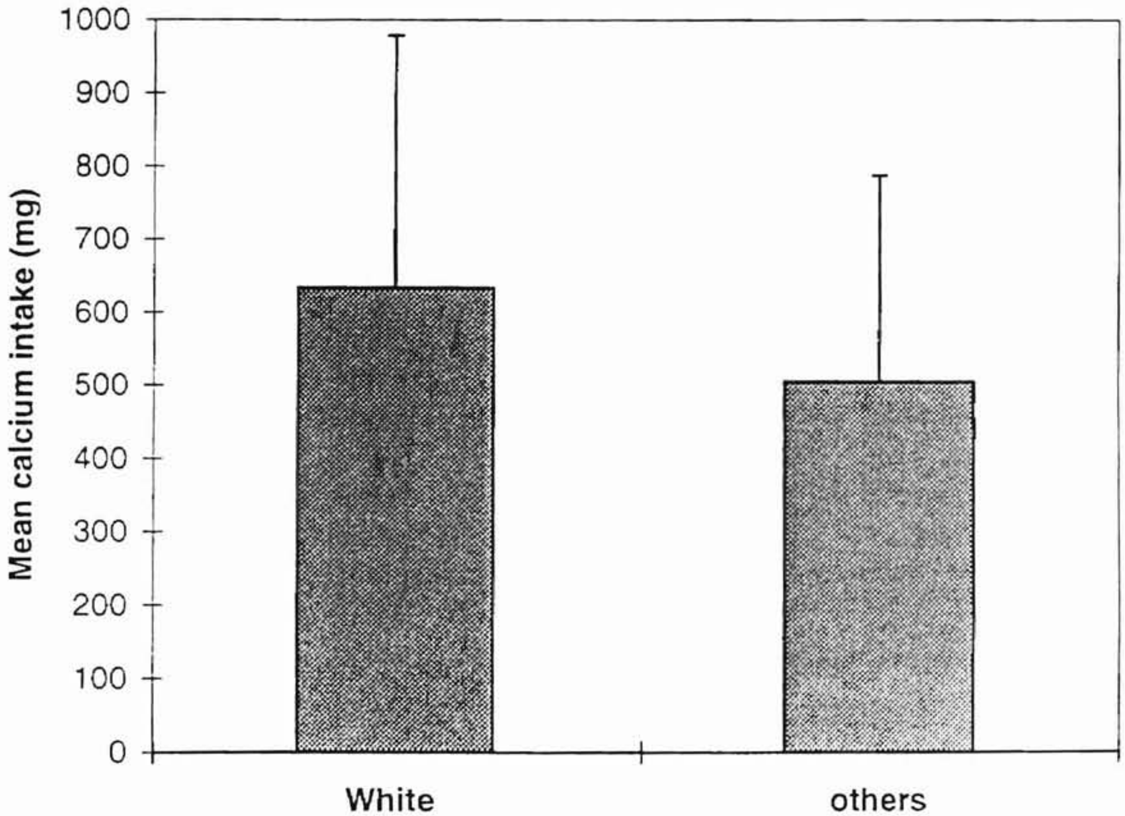


Figure 7: Relationship between race and mean calcium intake

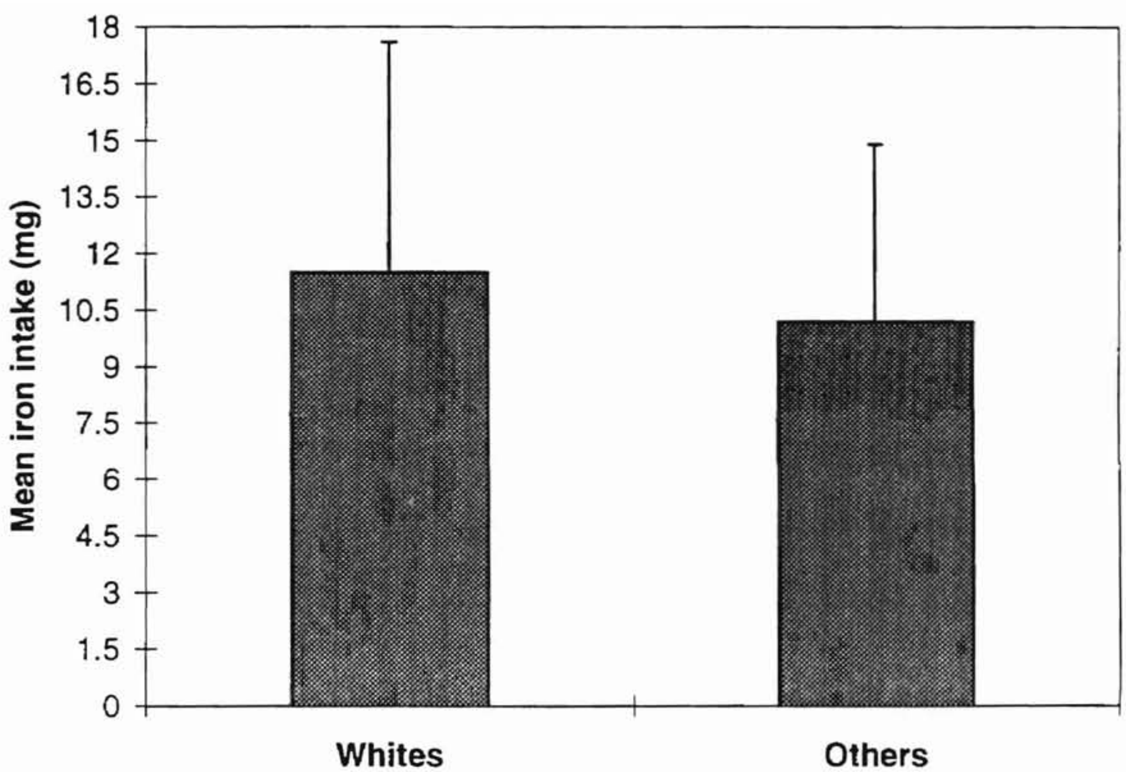


Figure 8: Relationship between race and mean iron intake

### Pregnancy and lactation

The relationship was also measured between women's reproductive status (pregnant or lactating) and their calcium and iron intake. Using t - tests pregnancy and lactation were found to be significantly ($p < 0.0001$) related to calcium and iron intake. As shown in Figures 9 and 10 women who were pregnant or lactating had a significantly higher mean intake of calcium and iron.

## Influence of Dietary Knowledge on Calcium and Iron Consumption in Women

The DHKS respondents were asked a series of questions regarding their knowledge about the number of servings and serving sizes of dairy, meat, poultry, and fish products. They were also asked their opinion about a healthy diet concerning amount of calcium and iron; and association of calcium and iron with diseases. Subjects' responses to questions relating to knowledge about basic nutrition are shown in Table 3.

### Knowledge about number of servings

Respondents were asked to identify the numbers of dairy, and meat poultry or fish servings that people should eat each day for good health. The food guide pyramid developed by USDA (1992) was used to determine the number of serving sizes. About

**Table 3:** Subjects' responses to the nutrition knowledge related questions and their mean calcium and iron intake

| **Questions' Description** | **N** | **%** |
|---|---|---|
| How many servings of dairy products people should take each day for good health (if one cup of milk or a slice of cheese is equal to one serving)? | | |
| 0 Serving | 21 | 1.1 |
| 1 Serving | 510 | 25.4 |
| 2 Servings[1] | 643 | 32.0 |
| 3 Servings[1] | 537 | 26.7 |
| 4 Servings | 233 | 11.6 |
| 5 Servings | 31 | 1.6 |
| ≥ 6 Servings | 34 | 1.7 |
| How many servings of meat, poultry, or fish people should take each day for good health (if a piece the size of a medium hamburger is equal to one serving)? | | |
| 0 Serving | 14 | 0.7 |
| 1 Serving | 868 | 43.0 |
| 2 Servings[1] | 909 | 45.3 |
| 3 Servings[1] | 176 | 8.8 |
| ≥ 4 Servings | 42 | 2.1 |
| In your opinion should your diet be lower or higher in the amount of calcium or is it just about right compared with what is most healthful. | | |
| Lower | 90 | 4.5 |
| Higher | 767 | 38.2 |
| About right | 1081 | 53.8 |
| Don't know | 71 | 3.6 |
| In your opinion should your diet be lower or higher in the amount of iron or is it just about right compared with what is most healthful. | | |
| Lower | 48 | 2.4 |
| Higher | 744 | 37.0 |
| About right | 1105 | 55.0 |
| Don't know | 112 | 5.6 |
| Have you heard about any health problem that might be related to how much calcium a person eats? | | |
| Yes | 1195 | 59.0 |
| No | 814 | 41.0 |

**Table 3:** Continued

| Questions' Description | N | % |
|---|---|---|
| If yes, for the above question then, what health problems are these? | | |
| Osteoporosis and other bone problems | | |
| Yes[2] | | |
| No | 942 | 46.9 |
| Hypertension | 1067 | 53.0 |
| Yes[2] | | |
| No | 18 | 0.9 |
| | 1991 | 99.0 |
| Have you heard about any health problem that might be related to how much iron a person eats? | | |
| Yes[2] | 959 | 48.0 |
| No | 1050 | 52.0 |
| If yes, for the above question then, what health problem are these? | | |
| Anemia / iron poor blood | 80 | 33.8 |
| Yes[2] | 1329 | 66.2 |
| No | | |
| Is cholesterol is found in: | | |
| Vegetables and vegetable oil | 56 | 2.8 |
| Animal products like meat and dairy products[3] | 783 | 39.0 |
| All food containing fat or oil | 1067 | 53.1 |
| Don't know | 103 | 5.1 |

[1] Correct response based on the Food Guide Pyramid, 1992

[2] Correct response according to Third Report on Nutrition Monitoring

[3] Correct response based on Advanced Nutrition and Human Metabolism 2 nd ed., 1995

positive correlation was found between the knowledge about dairy servings and mean calcium intake ($r = 0.19$, $p < 0.0001$). The relationship between knowledge and mean calcium intake using analysis of variance is presented through Figure 11 ($F = 14.03$, $p < 0.0001$). Women who recommended eating more servings of dairy products had higher calcium intake than the women who recommended lower servings.

Surprisingly neither correlation analysis ($r = 0.01$, $p = 0.65$) nor analysis of variance ($F = 0.80$, $p = 0.52$) indicated significant relationships between knowledge of meat, poultry and fish servings and iron intake (Figure 12).

**Opinion about diet**

Respondents were asked to compare their own diet to the amount of calcium and iron they thought was most healthful. About 4.5 percent of subjects thought that their diet should be lower in calcium and 56 percent of subjects responded that their diet is about right. About 3.5 percents subjects responded that they did not know. Subjects responses and their mean calcium and iron intake were compared using analysis of variance. A significant difference ($F = 7.34$, $p < 0.0001$) was found in mean calcium intake among the four groups. Subjects who said "do not know" had a significantly lower mean calcium intake than the other subjects (Figure 13).

Unlike calcium, no significant difference in iron intake was found between subjects with different opinions about their iron consumption ($F = 1.32$, $p = 0.27$). As it can be seen from Figure 14, subjects who indicated that their diet should be lower in iron had iron intakes similar to the subjects who said that their diet is about right in iron.

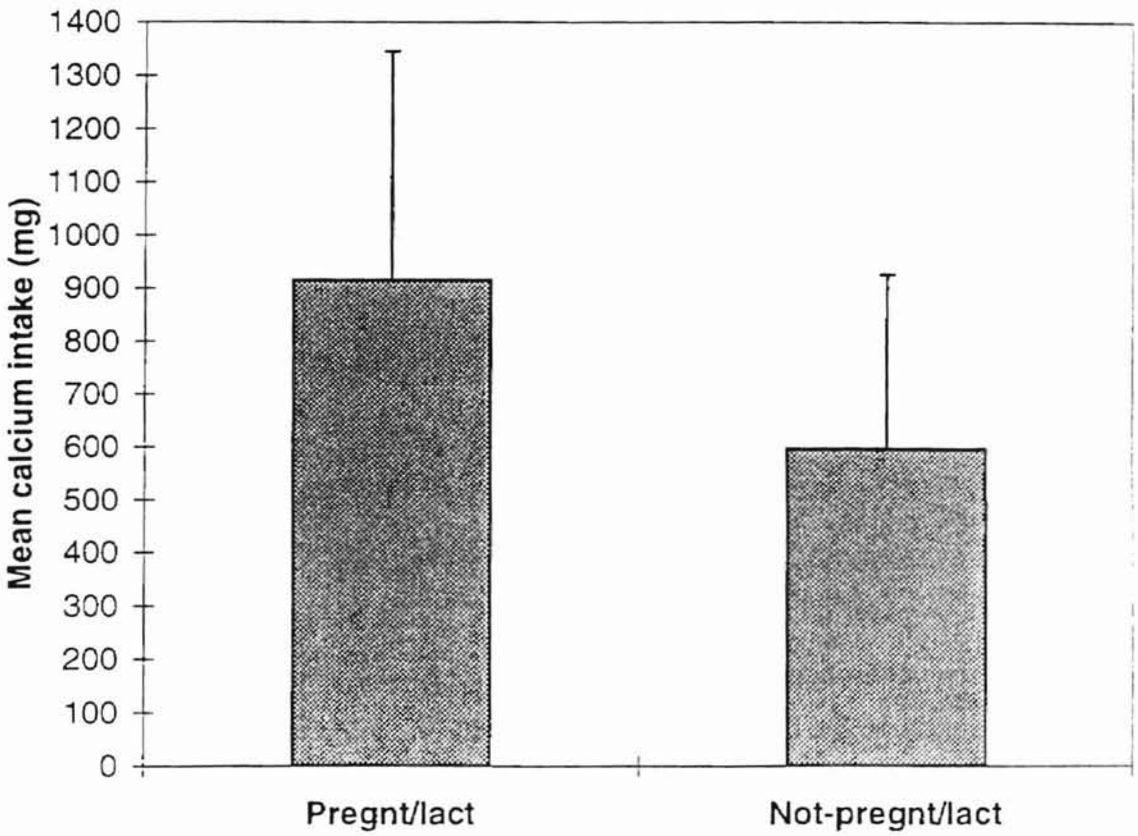


Figure 9: Relationship between pregnancy/lactation and mean calcium intake

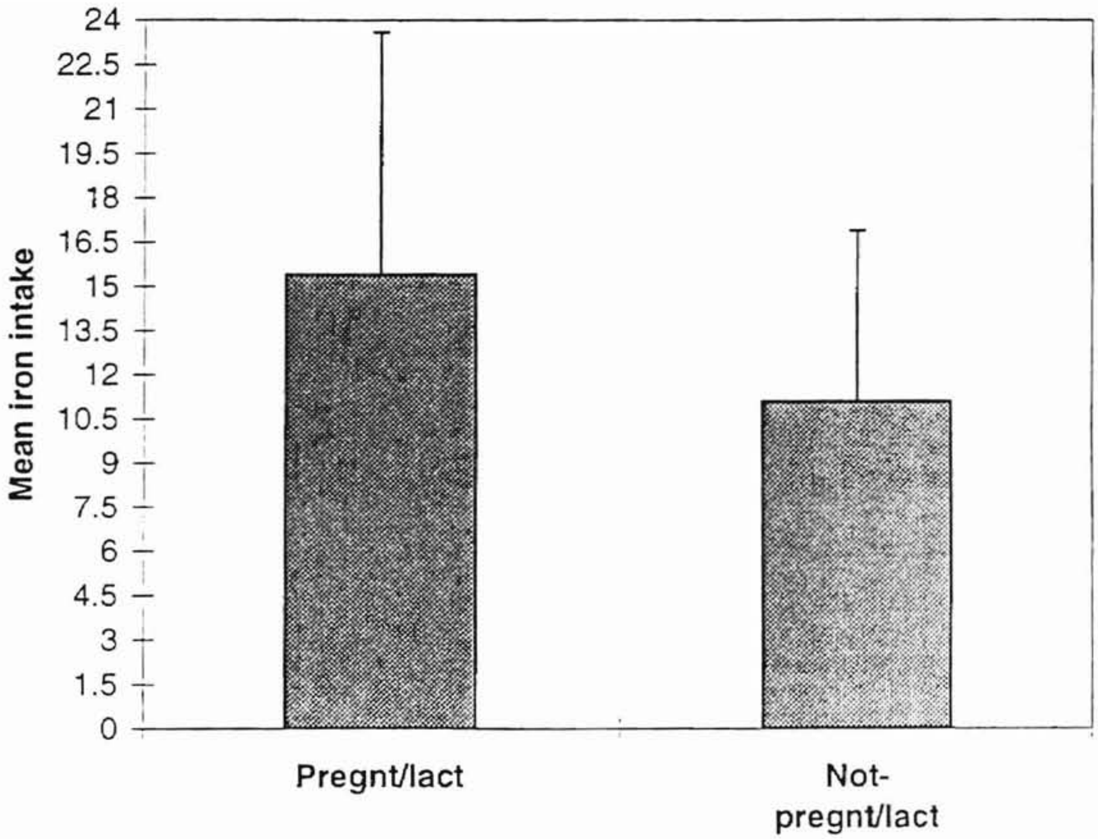


Figure 10: Relationship between pregnancy/lactation and mean iron intake

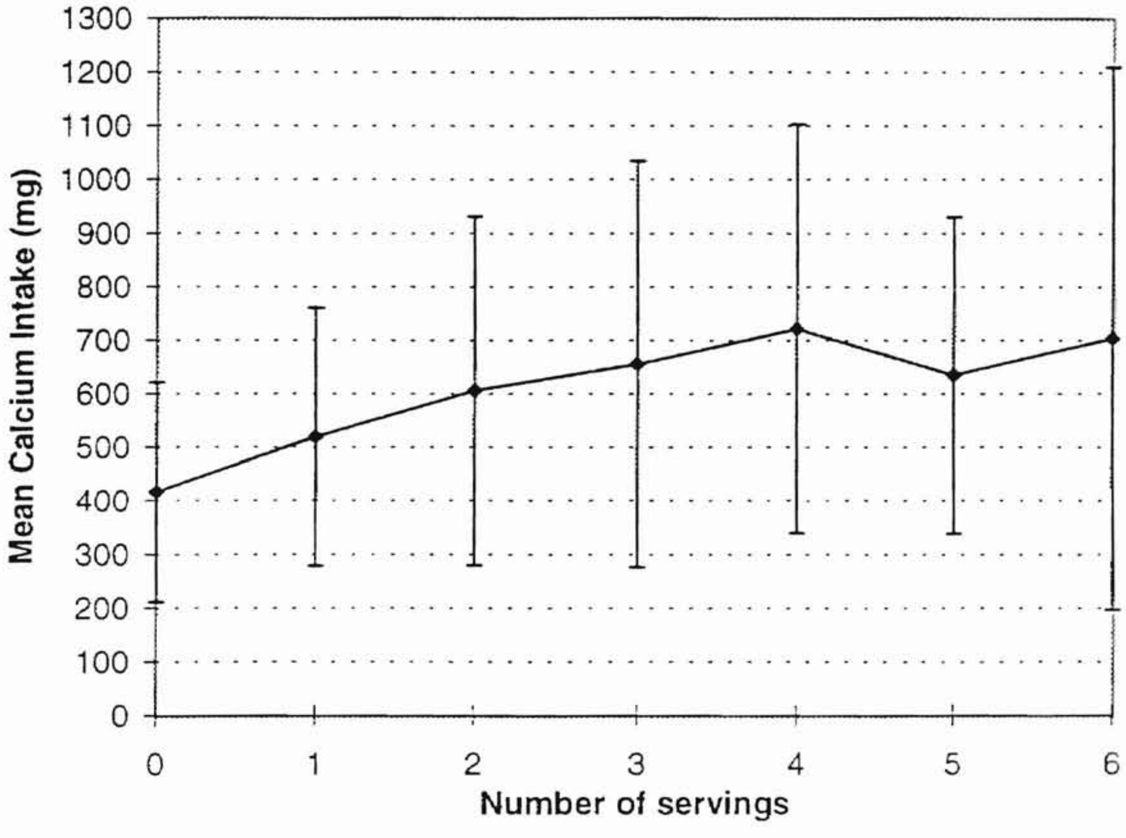


Figure 11: Relationship between mean calcium intake and knowledge of number of servings of dairy products

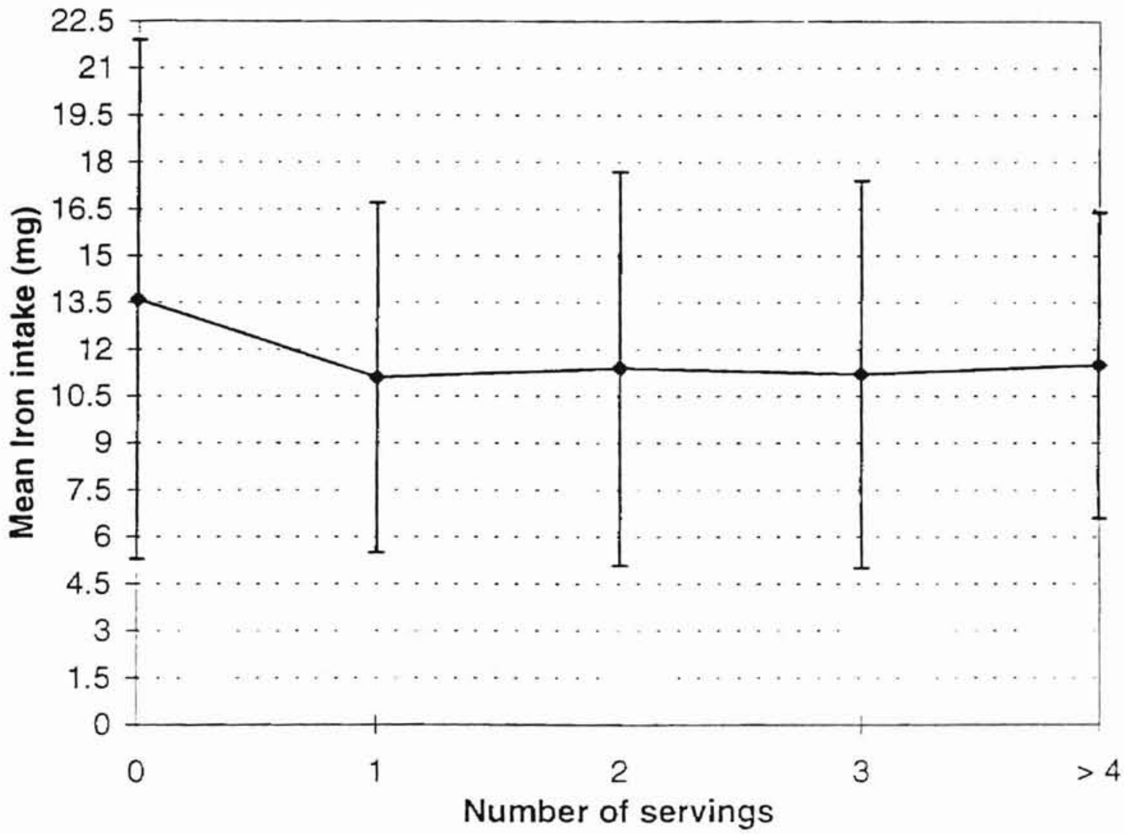


Figure 12: Relationship between mean iron intake and knowledge of number of servings of meat, poultry and fish

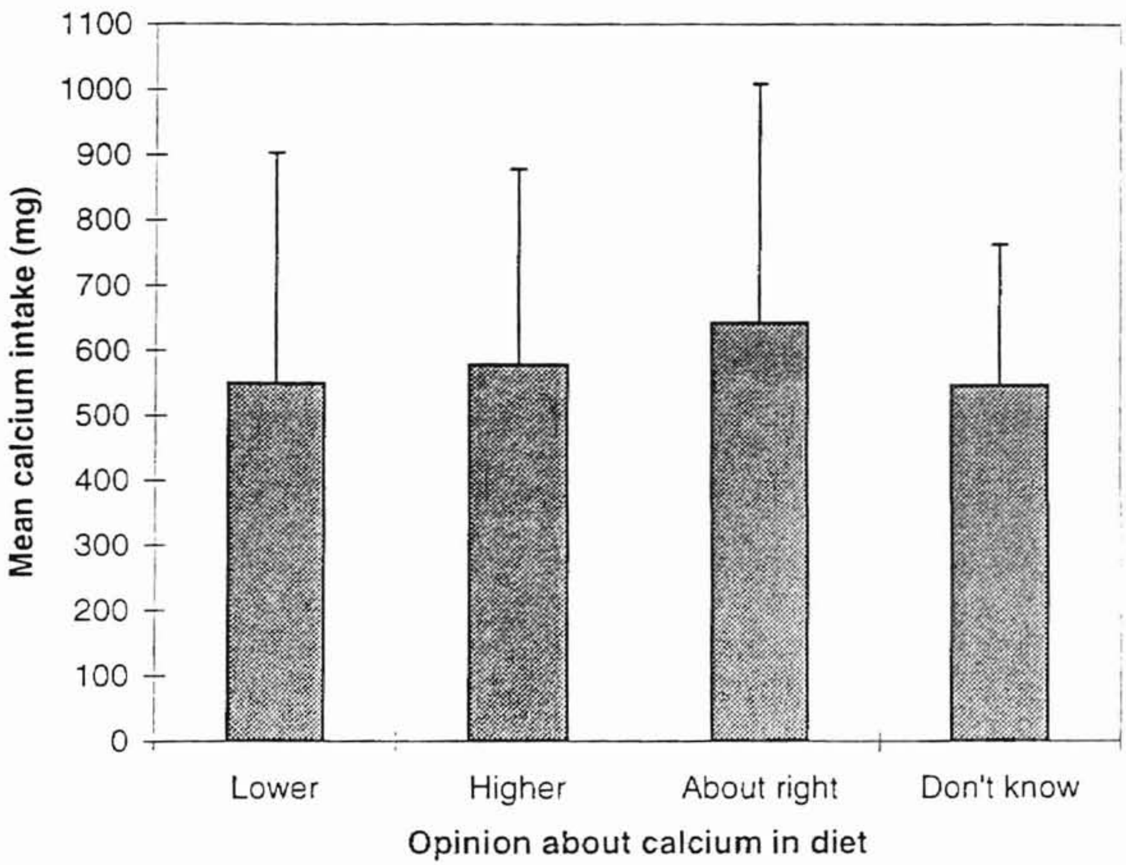


Figure 13: Relationship between opinion about diet and mean calcium intake

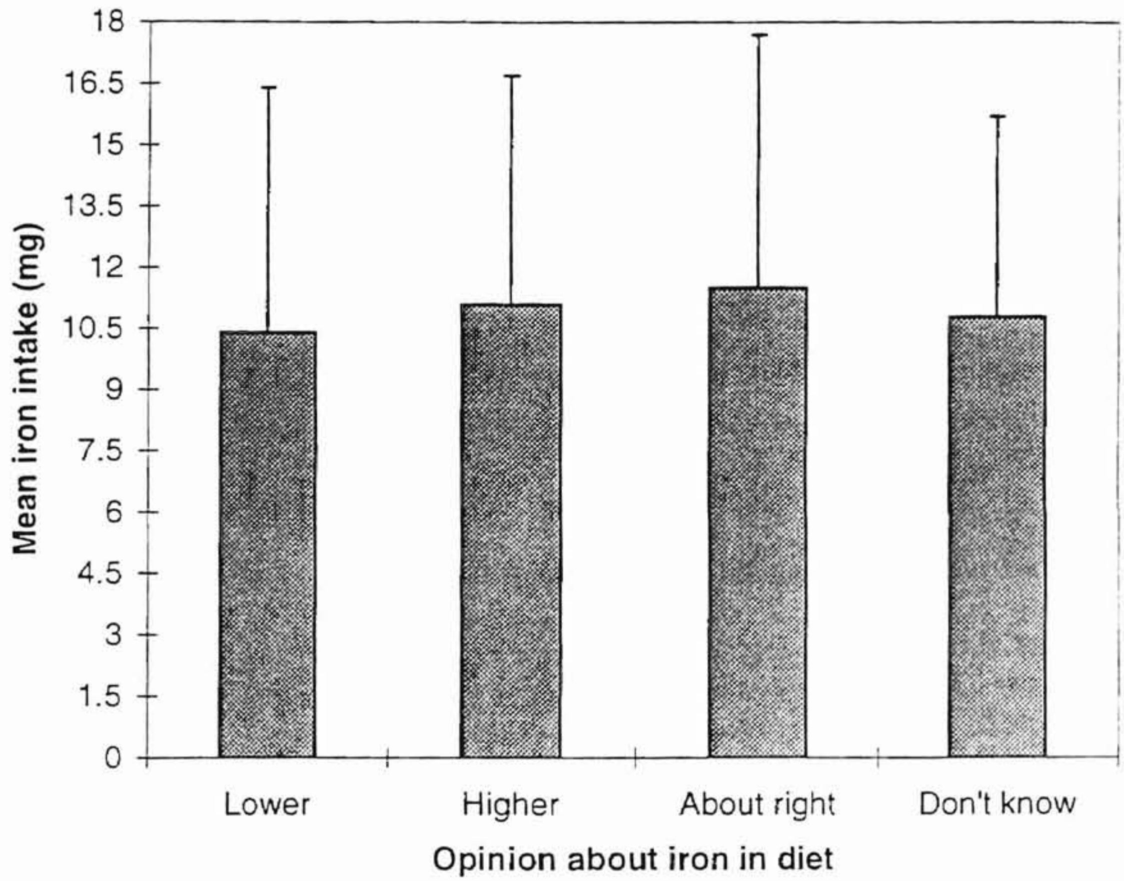


Figure 14: Relationship between opinion about iron in diet and mean iron intake

Similarly there was not much difference in the mean iron intake between the subjects who said that their diet should be higher in iron and the subjects who did not know.

### Awareness of health problems related to calcium

Respondents were asked if they had heard about any health problem that might be related to how much calcium a person eats. About 59% of subjects answered yes and 41% of subjects answered no. Subjects' responses and their mean calcium intake were compared using t-test. A significant difference in calcium intake ($p < 0.0001$) was found between the subjects who were aware of calcium related health problems and the subjects who were not (Figure 15). Subjects who were not aware of health problems related to calcium consumed about 86 mg of calcium less than subjects who were aware of health problems related to calcium.

Respondents were asked to name the health problems that were related to calcium intake. About 47% of subjects were aware of the relationship to osteoporosis, but less than 2% of the subjects were aware that calcium is related to hypertension. Subjects' responses and their mean calcium intake were again compared using t-test. Significant differences in mean calcium intake were found between the subjects who were aware of osteoporosis ($p = 0.0018$) and hypertension ($p = 0.0015$) and the subjects who were not. Subjects who were not aware that osteoporosis is related to calcium intake had about 91 mg less calcium than the subjects who were aware of the relationship to osteoporosis. But, it was interesting to notice that subjects who did not know that hypertension is related to calcium intake had about 165 mg more calcium than the few subjects who were aware of the relationship to osteoporosis (Figure 16).

**Awareness of health problems related to iron**

Respondents were asked if they had heard about any health problem that might be related to how much iron a person eats. About 48% of the subjects were aware of health problems related to iron and 52% of the subjects were not. Using t-test, a significant difference ($p = 0.0004$) in iron intake was found between the subjects who were aware of health problems related to iron and the subjects who were not (Figure 17). Subjects who were not aware that iron intake is related to health problems consumed about 0.8 mg less iron than subjects who were aware of relationship of iron to health.

Subjects were asked to name those health problems that may be related to iron intake. About 34% of the subjects answered that anemia/iron poor blood is associated with how much iron a person eats. T-test indicated a significant difference ($p < 0.0001$) in mean iron intake between the subjects who were aware of the association between iron intake and anemia/iron poor blood and the subjects who were not (Figure 18). Subjects who did not know that iron is related to anemia/iron poor blood had about 1.1 mg less iron intake than subjects who knew that iron is related to anemia/iron poor blood.

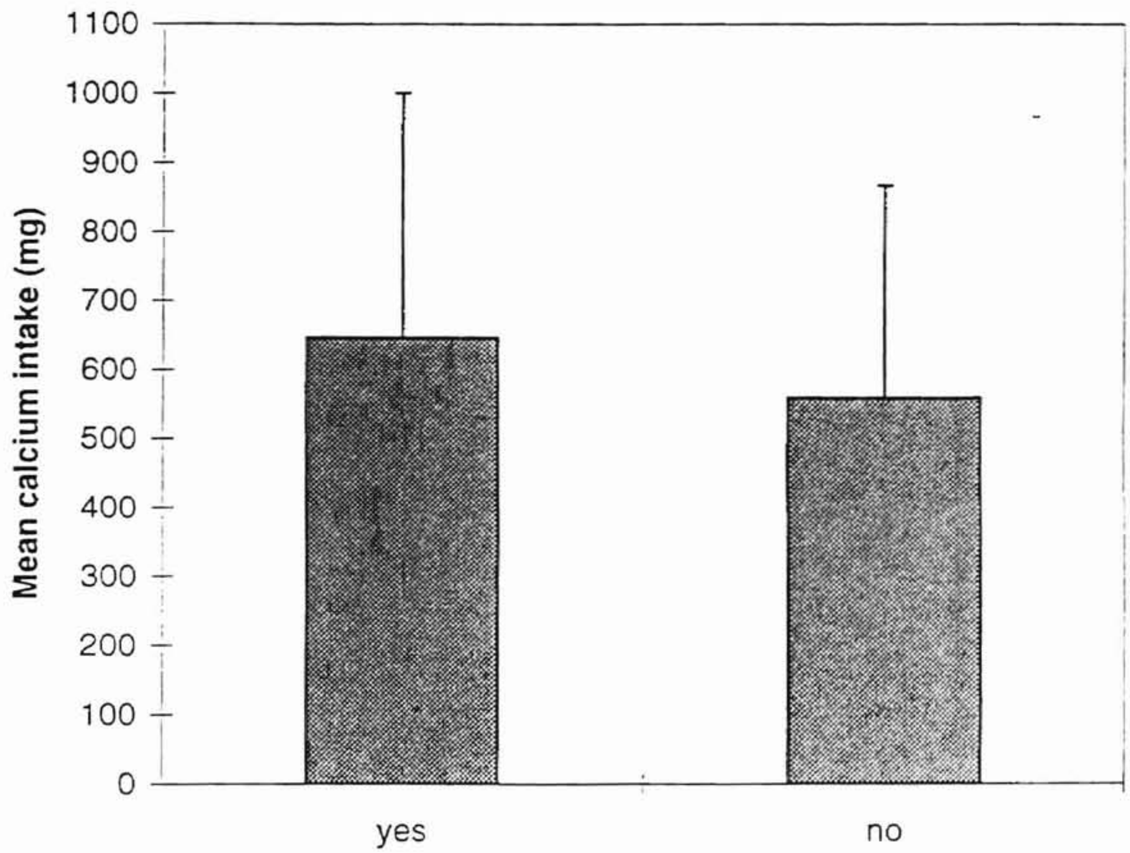


Figure 15: Relationship between mean calcium intake and awareness of any health problem related to calcium

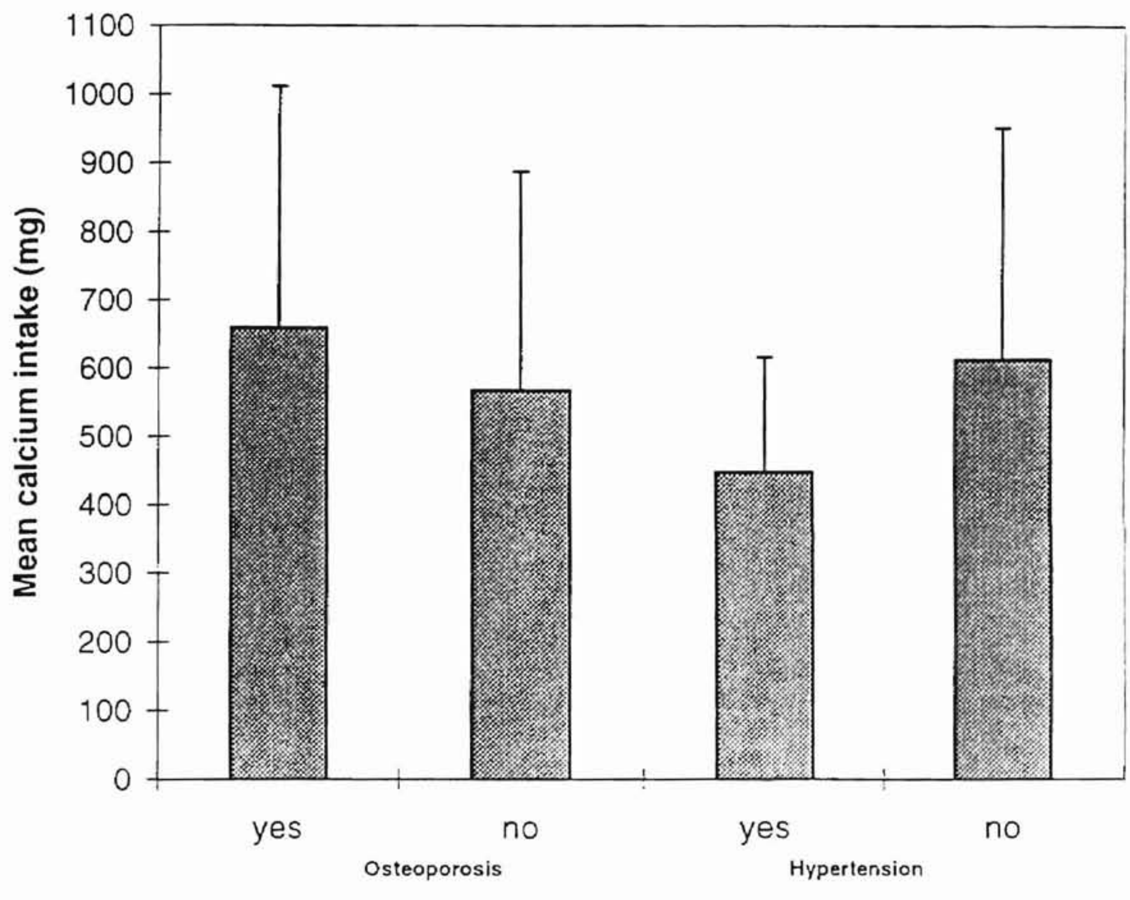


Figure 16: Relationship between knowing about diseases related to calcium and mean calcium intake

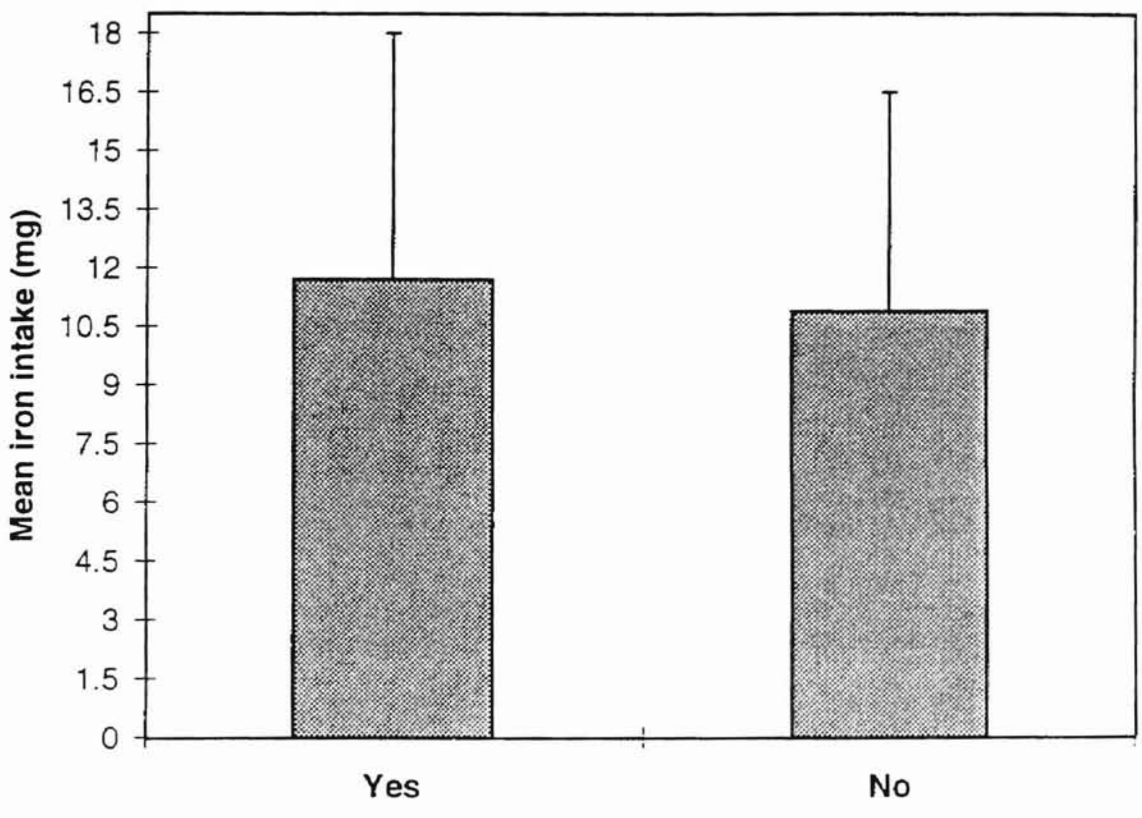


Figure 17: Relationship between mean iron intake and awareness of health problems related to iron

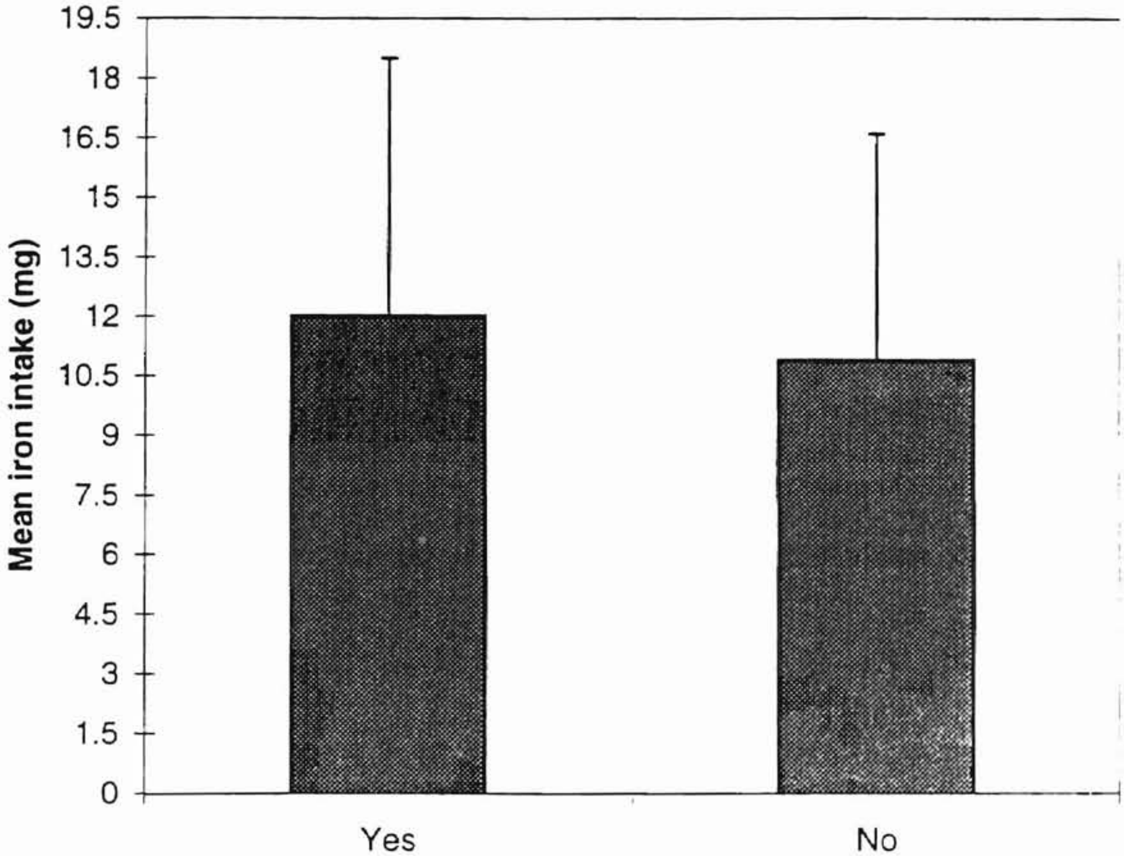


Figure 18: Relationship between mean iron intake and knowing about diseases related to iron

### Sources of cholesterol

Respondents were asked which foods contain cholesterol. Most subjects (53.1%) believed that cholesterol was in all foods containing fats and oils. Only 39% of the subjects knew that cholesterol was only found in animal products such as meat and dairy. Subjects' responses to this question were compared using analysis of variance. Subjects' knowledge about cholesterol in foods was not found to be associated with their mean calcium intake (Figure 19) ($F = 1.70$, $p = 0.17$). However a significant difference ($F = 5.57$, $p = .0008$) in mean iron intake was found. Subjects who responded that all foods with fat and oil contain cholesterol had a significantly lower mean iron intake than subjects who said cholesterol is found in all animal products (Figure 20).

## Influence of Women's Attitudes on Calcium and Iron Consumption

DHKS respondents were asked importance of nutrition while grocery shopping on a scale from 1 to 6, Where "1" was not at all important and "6" was very important. Most of the subjects (62%) felt that nutrition was important or very important while grocery shopping; only 0.8% responded that nutrition was not at all important. The relationship between subjects attitudes toward importance of nutrition while grocery shopping and their mean calcium and iron intake is depicted in Figures 21 and 22. Analysis of variance indicated a significant difference ($F = 3.26$, $p = 0.006$) between women's attitude toward nutrition while grocery shopping and calcium intake. The subjects who

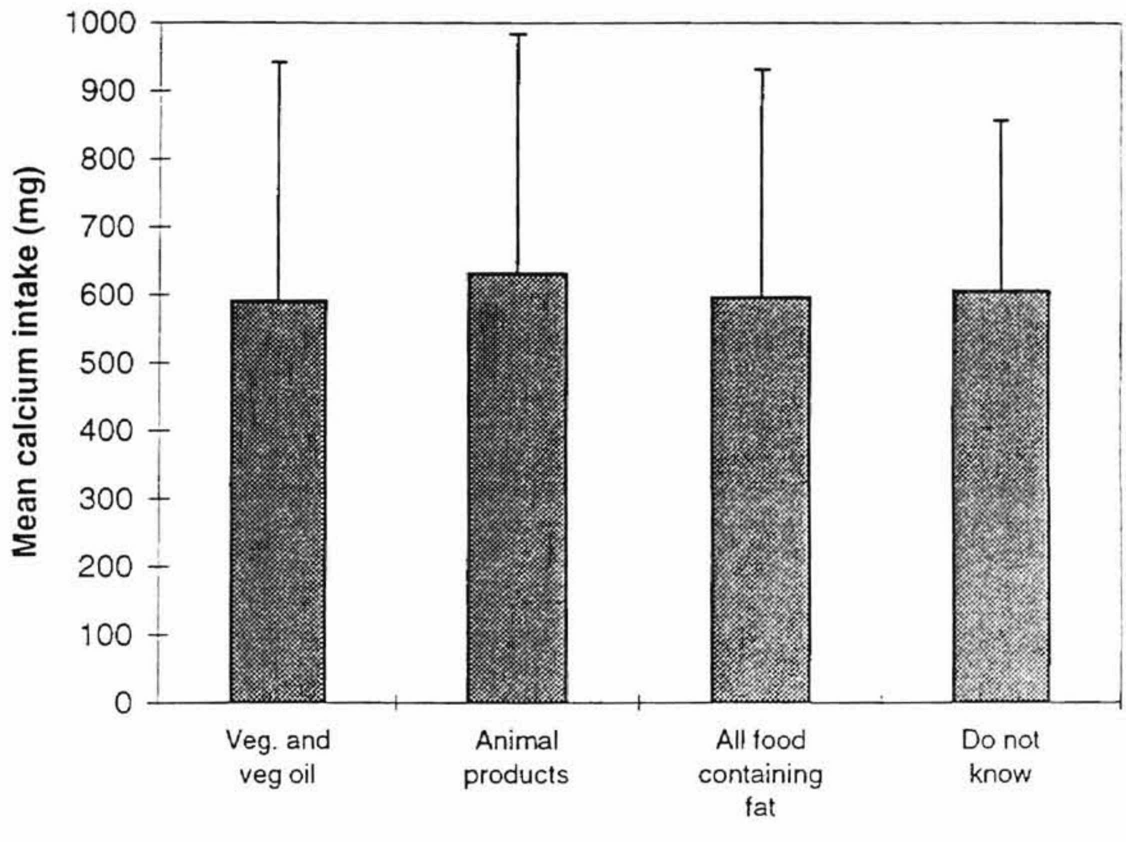


Figure 19: Relationship between knowledge about cholesterol in foods and mean calcium intake

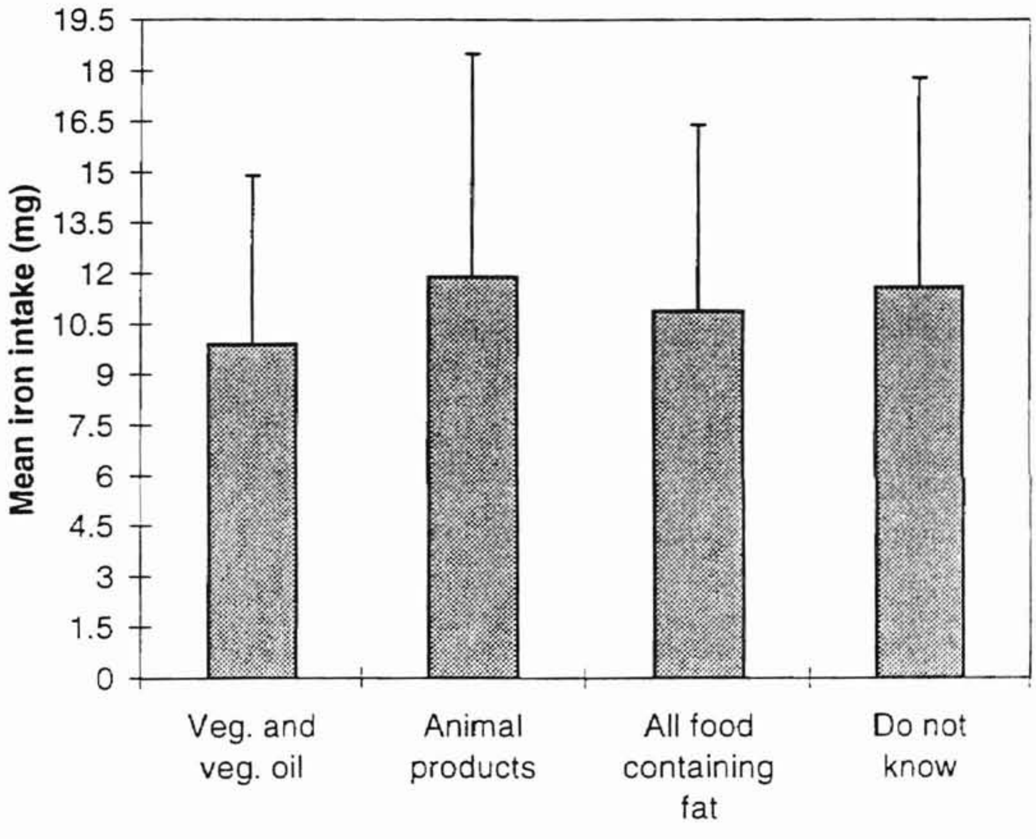


Figure 20: Relationship between knowledge about cholesterol in foods and mean iron intake

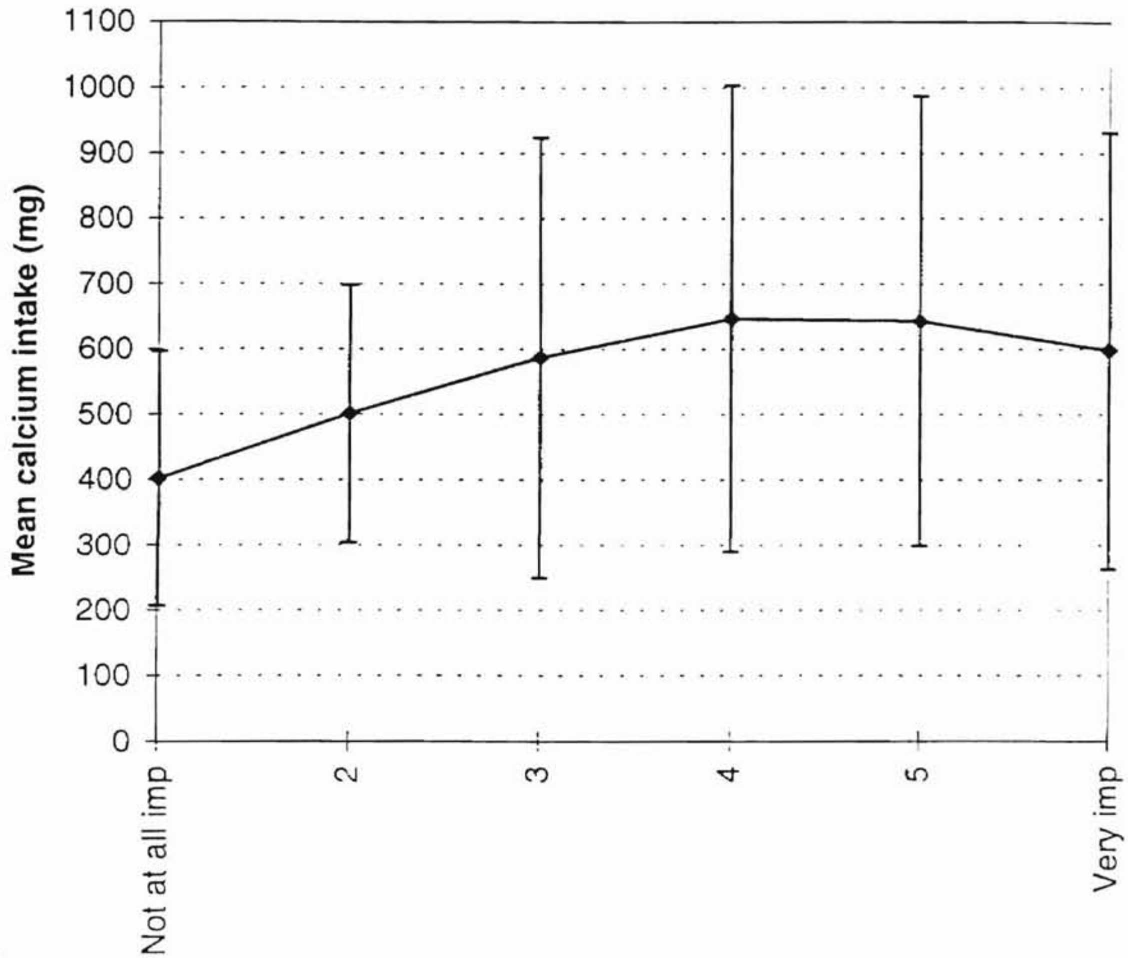


Figure 21: Relationship between subjects' attitudes toward importance of nutrition while grocery shopping and their mean calcium intake

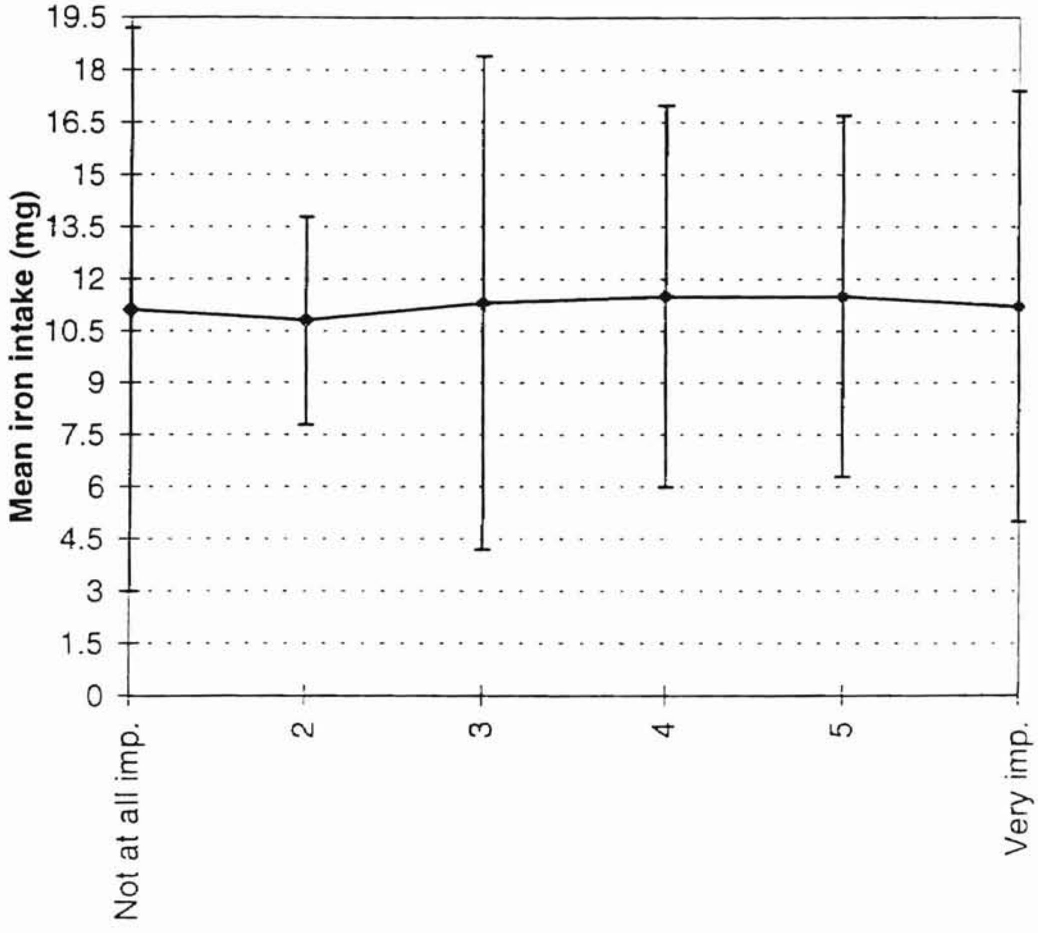


Figure 22: Relationship between subjects attitudes toward importance of nutrition while grocery shopping and their mean iron intake

responded that nutrition was important or very important while grocery shopping had significantly higher calcium intake than those who felt that it was not important at all.

Unlike calcium, no significant difference ($F = 0.16$, $p = 0.98$) was found in mean iron intake among subjects who rated the importance of nutrition while grocery shopping differently.

**Influence of Women's Behavior on Calcium and Iron Consumption**

DHKS respondents were asked if they personally avoided certain foods such as meat (beef or lamb), milk and cheese. About 13% of the women avoided all kinds of milk and 14% of the women avoided cheese. T-test was used to assess women's consumption of these foods and their calcium and iron intake (Figures 23 and 24). A significant difference ($p < 0.0001$) was found in mean calcium intake between the women who avoided all kinds of milk and the women who did not. Women who avoided all kinds of milk consumed about 166 mg less calcium than women who did not avoid milk. On the other hand, avoidance of cheese did not significantly influence mean calcium intakes.

About 19% of women avoided meat. T-test analysis indicated a significant difference ($p = 0.004$) in mean iron intake between the subjects who avoided meat and the subjects who did not. But it was interesting to note that subjects who avoided meat consumed more iron (0.4 mg) than the subjects who did not avoid meat.

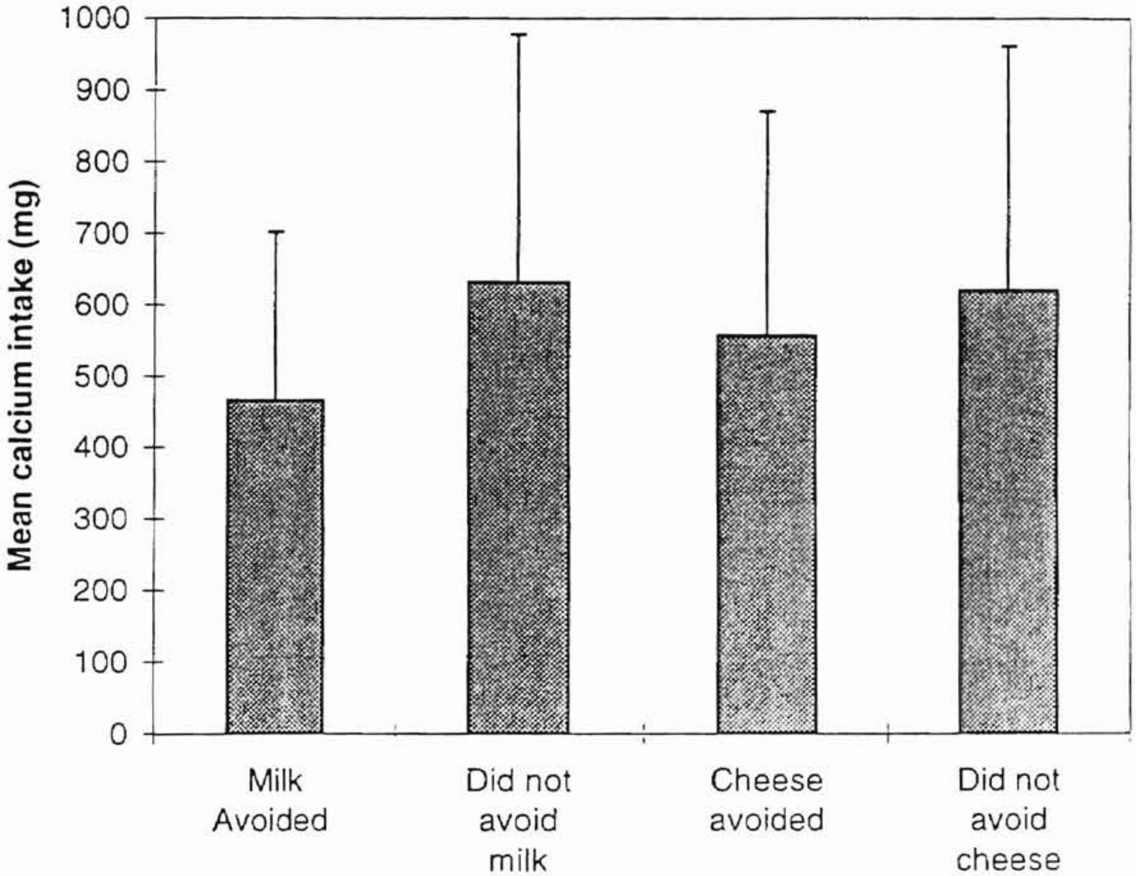


Figure 23: Subjects' mean calcium intake according to their consumption of milk and cheese

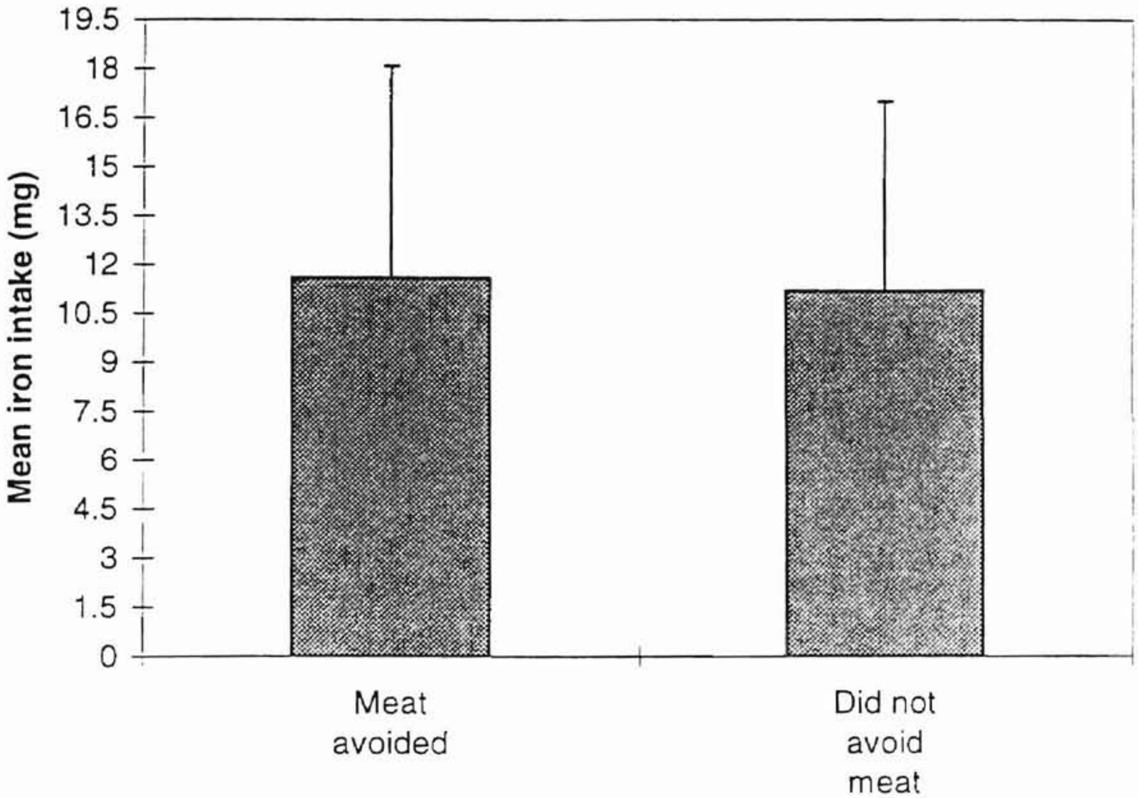


Figure 24: Subjects' mean iron intake according to their consumption of meat

**Influence of Women's Beliefs on Calcium and Iron Consumption**

Respondents were asked if eating a variety of foods each day gives them all the vitamins and minerals they need on a scale from 1 to 6, where "1" was strongly disagree and "6" was strongly agree. Very few subjects (0.8%) strongly disagreed or strongly agreed with the statement. There was no significant difference in subjects' responses to this question and their mean calcium and iron intake (Figure 25 and 26).

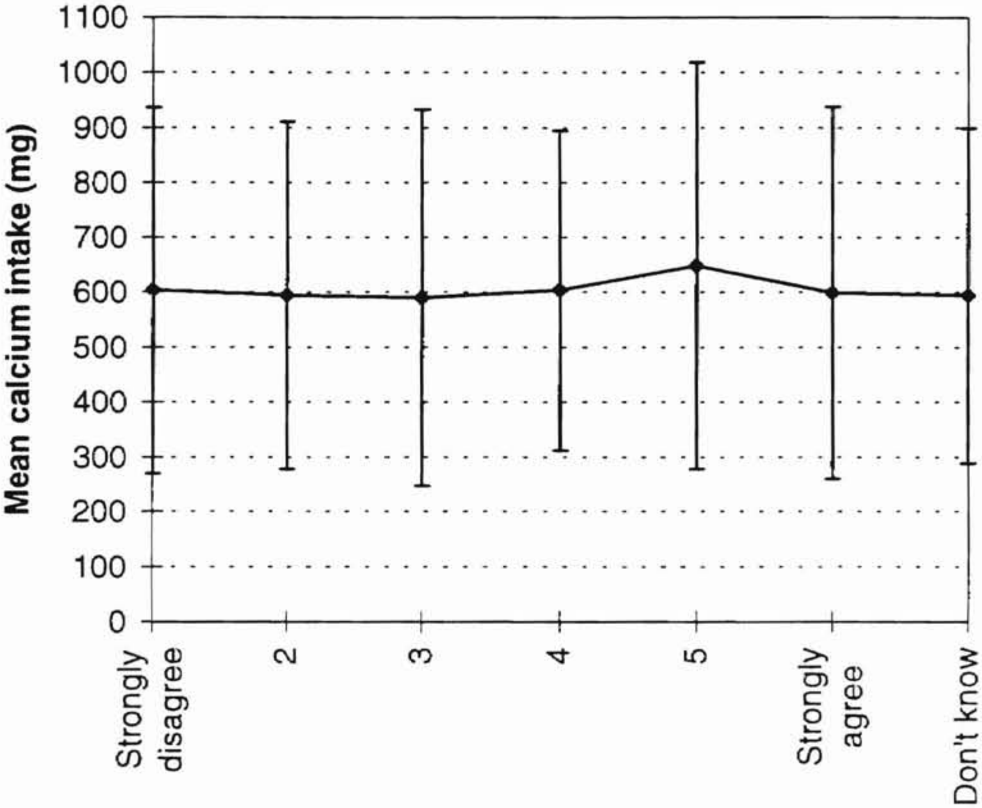


Figure 25: Relationship between subjects' beliefs regarding eating variety of foods and their mean calcium intake

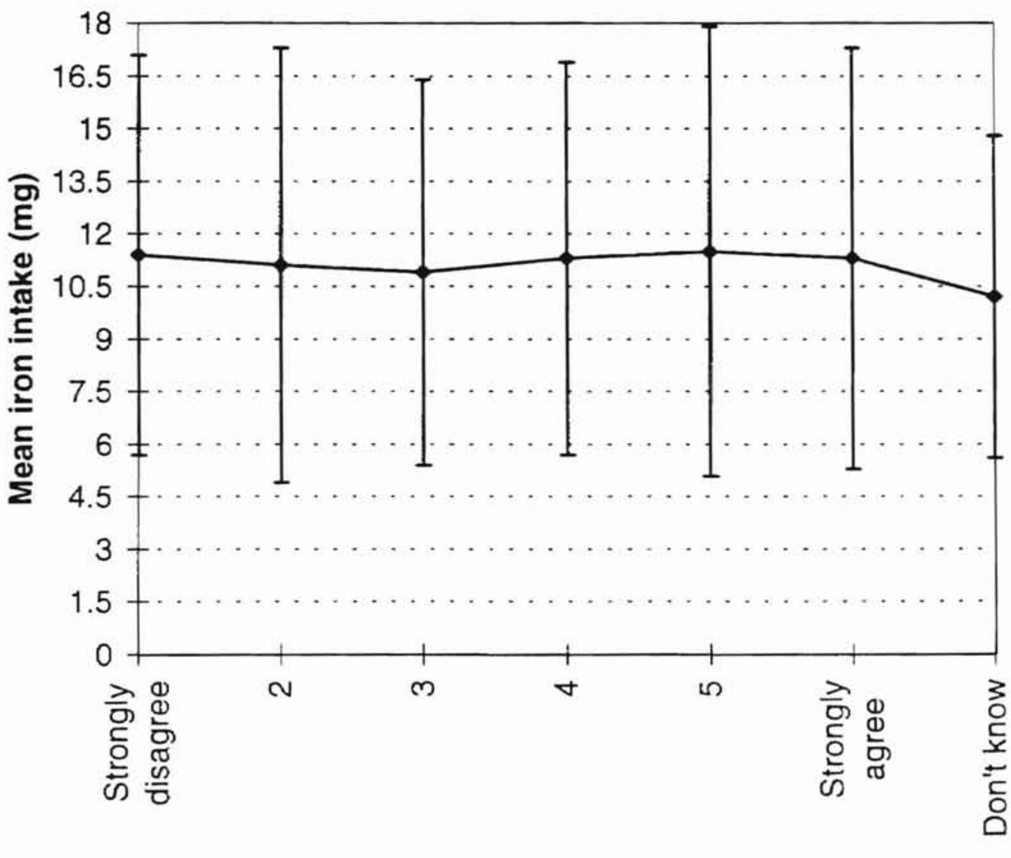


Figure 26: Relationship between subjects' beliefs regarding eating variety of foods and their mean iron intake

# CHAPTER V

# DISCUSSION

As described earlier, the purpose of the present study was to investigate the characteristics (knowledge, attitudes, beliefs, and demographic variables) that influence calcium and iron intake in women in the United States. The results of this study reinforce the findings of other researchers and also provide some new information that may be useful for nutrition educators who are seeking to improve the calcium and iron intake by women in the United States to meet the goals of Healthy People 2000 (1991).

## Age

Age was found to be significantly negatively correlated with mean calcium intake. One factor that may contribute to this finding is the decreasing need for calcium with age according to the 1989 RDA. However, this is not true according to the new AI (FNB, 1997). Mean calcium intake was found to be lower than the RDA and the AI for all age groups. Women who were 20 years old or younger had an average calcium intake only 56% of the RDA for their age group. If we compare their intake with the new AI their approximate calcium intake will contribute only 52%. It is very crucial to attain peak bone mineralization at this age because calcium retention increases to a peak from 9 through 18 years of age and then declines (Martin et al., 1997).

Other reports have also found that women in the United States consume less calcium than recommended for their age group. For example, Guthrie (1996) found that out of 2,261 women surveyed in the 1989-91 CSFII, 81% did not meet their RDA for calcium. Similarly, Fleming and Heimbach (1994) found decreased calcium intake with age in females. Alaimo et al. (1994) reported lower mean and median calcium intake than RDA for almost all female race ethnic groups. These studies support the results of the present study.

It was interesting to note that unlike calcium, iron intake was not found to correlate with age in our study. Overall iron intake remained constant with age. This finding may be attributed to the high consumption of meat which is a very good source of iron. Another reason might be an increase in the enrichment of the white flour with iron coupled with an increase in the use of flour and enriched cereals (Gerrior & Zizza, 1994). However, despite the fact that sufficient enrichment of iron in the U.S. food supply is available, the average iron intake of 20-50 year old women was 75% of the RDA. Women older than 50 met the lower RDA for this age group.

The low iron intake in this study is consistent with most of the national representative studies. For example, the results of CSFII (USDA, 1989-90) showed low iron intake in average women of age 20 and over. Similarly findings from the NHANES III, phase 1, 1988-91 also revealed the fact that women aged under 50 could not met the RDA for iron (Alaimo et al., 1994). Comparing our 1990-91 data to the results of 1995 CSFII some improvements may have occurred in iron intake. According to the 1995 CSFII, females aged 6-49 years had on an average 89% of the RDA for iron of their age group. Females age 50 and over consumed 130% of the RDA (13.0 mg) for their age group. An average mean daily iron intake for all age groups was found to be below 12.0 mg in our study. Recently Cleveland et al. (1997) reported that only 38% of the women aged 20-39 years met the recommendations for the meat group of the Food Guide Pyramid. Only 40% of the women aged 40-59 years and only 29% of the women aged 60 and older met the recommendations of the meat group of the Pyramid.

## Education

As expected, significant positive correlations were found between education and mean calcium and iron intake. Women with higher education level had higher calcium and iron intake in comparison to women with less education. Therefore, in this study positive consequences of education can be noticed on calcium and iron intake by women.

A significant positive impact of education level on calcium intake was also seen in the study conducted by Guthrie (1996). Holcomb (1995) reported a significant impact of education on calcium intakes by older women but education level did not show a significant impact on iron intake. Crawford et al. (1995) found a relationship between parental education level and calcium intakes of their 9 and 10 year old girls. No association was found between girls' iron intake and level of education of their parents. Looker et al. (1997) estimated iron deficiency and iron deficiency anemia using data from NHANES III based on education level in women. Iron deficiency was more common among less educated women.

## Income

Similar to education, subjects' income was also found to be significantly positively correlated to their mean calcium and iron intake. In this study women with higher household incomes had higher calcium and iron intake. Findings from Looker et al (1997) supported our findings; they found that iron deficiency was more common among poor women. Ballew and Sugerman (1995) found evidence of inadequate calcium and iron intake among low income Mexican women who were living in Chicago and Illinois.

However, it was interesting to note that Crawford et al. (1995) found an inverse relationship between household income and calcium and iron intake. Calcium intakes were lower in black girls with higher incomes. Iron intakes were observed to decrease with increasing income level for both black and white girls. Guthrie (1996) did not find a significant difference between income and calcium intake.

## Pregnancy and Lactation

Women who were pregnant or lactating had significantly higher mean intakes of calcium and iron than women who were not pregnant or lactating. These women may be motivated to consume a higher calcium and iron by their desire for a healthy infant.

However, the average calcium intake for all pregnant or lactating women was only 75% of the RDA. This study supports the findings of Mitchel and Learner (1991). They found that regardless of the positive attitude towards nutrition in a group of pregnant/lactating women some of the mothers (7%) did not meet the recommended number of Food Guide Pyramid servings of milk. According to the data from 1988-1991, NHANES III pregnant women of all ethnic groups were found to have mean daily calcium intake less than the 1989, RDA.

The pregnant or lactating women in this study met the RDA for iron. However, incidence of low iron intakes among pregnant or lactating women was detected by national studies (DHHS, NHANES III, 1988-1991). According to data collected in the 1992 Pregnancy Nutrition Surveillance System, 29% of the women were anemic by the third trimester of pregnancy (FASEB, 1995).

## Race

This study supported the findings from most of the studies that race is associated with dietary intake. White women in our study were found to have significantly higher calcium and iron intakes than women from other races. In this study "others" were defined as all non-whites (including black and American Indian) women.

Guthrie (1996) found that black women were less likely to meet the RDA for calcium than white women. Crawford et al. (1995) found higher calcium intake among white girls than black girls but no association was found between race and iron intake. Results from the 1989-1991, NHANES III studies showed the prevalence of iron deficiency was more than double in minority women compared to the white women (Looker et al., 1997). On the other hand, Harland et al. (1992) found no significant difference among racial groups in nutrient intake. They concluded that race alone does not predict dietary intake.

Guthrie and Fulton (1995) found that white women consumed fewer servings of meat and beans (foods that represent main sources of iron) compared to non-whites. But they might be getting enough iron if the grain group is included.

## Knowledge

The present study showed a significant positive correlation between the knowledge about dairy servings and mean calcium intake. Respondents were asked to identify the numbers of dairy and meat poultry or fish servings that people should eat each day for good health. Women who reported eating more servings of dairy products consumed higher calcium intake compared to the women who reported a lower number of servings. This study strongly supports the results of a similar study done by Guthrie and Fulton (1995). They also concluded that knowledge about number of servings of milk group was positively associated with consumption of the servings from milk group. Similarly, Fredrick and Hawkins (1992) reported a significant positive correlation between basic nutrition knowledge and the number of servings of calcium rich foods consumed. Mitchell and Lerner (1991) reported that intake of milk and milk products increased by at least one serving in pregnant women after obtaining general information regarding gestational weight gain and the food groups.

The present study did not find any correlation between knowledge of meat, poultry, and fish servings and iron intake. Women who reported that one should eat more servings of meat, poultry, and fish did not necessarily consume more iron. For example, women who reported that one should not take any servings of meat, poultry, or fish daily had higher iron intake compared to those who reported that one should consume at least one serving. Similar to our study, Houston (1997) found that nutrition knowledge did not appear to influence dietary intakes or iron status. In contrast, Guthrie and Fulton (1995) reported a positive association between consumption of servings of foods from the meat and beans group and the knowledge of serving sizes of the same group.

When subjects' opinion about their own diet regarding the intake of calcium and iron was compared, a significant difference was found between mean calcium intake and different opinion. Subjects who said that their diet should be lower, higher or about right in calcium had significantly higher calcium consumption compared to those who said they did not know. Guthrie (1996) reported that women who believed that they should consume more calcium had higher calcium intake than their counterparts.

However, iron intake was not found to be significantly different among the subjects with different opinions regarding the amount of iron in their diet. For example, subjects who reported that their diet should be lower in iron consumed almost the same amount of iron as the subjects who reported that their diet was about right in iron.

The present study also found a significant difference in calcium intake between the women who were aware of the relationship between calcium intake and some health problems. Most of the subjects were aware that calcium intake is related to osteoporosis but very few subjects (< 2%) knew that calcium intake is also associated with hypertension. Subjects who reported that calcium intake is associated with osteoporosis consumed significantly more calcium than the subjects who did not know that calcium intake is associated with osteoporosis. Guthrie (1996) also found similar results. Women who were aware of calcium related health problems were found to have significantly higher calcium consumption than the women who did not. Kasper et al. (1994) found no significant relationship between the respondents' beliefs about osteoporosis and their calcium intake.

Surprisingly, subjects who responded that calcium is related to hypertension had significantly lower calcium intakes than the subjects who did not know. Chapman et al. (1995) also reported a lack of awareness regarding the association of calcium with hypertension. In this study 97% of the women were aware of the relationship between calcium and osteoporosis but only 6% of the women were aware of the relationship between calcium intake and hypertension.

Similar to calcium, the present study also showed a significant difference in iron intake between the subjects who were aware of association between iron and iron related diseases and those who were not aware. Subjects who knew that iron intake is associated with health problems had significantly higher intakes of iron compared to the subjects who did not know.

Subjects were asked about their knowledge of cholesterol in foods. We found no significant difference in subjects' mean calcium intake and their knowledge about cholesterol in foods. This finding support the continuous effort of nutrition educators to emphasize the consumption of dairy products. However, a significant difference in mean iron intake was found. Subjects who indicated that all foods with fats and oil contain cholesterol had a significantly lower mean iron intake than subjects who responded that cholesterol is found in animal products. Subjects who chose other food groups did not show any significant difference in mean iron intake.

## Attitude

Previous studies have shown that attitude toward nutrition is a better indicator of dietary behavior than either nutrition training or nutrition knowledge (Carruth & Anderson, 1977). Our study found a significant difference between women's calcium intake and their attitude toward the importance of nutrition while grocery shopping. Chapman (1995) also found significant differences in the attitudes of women who consumed less calcium (< 60% of the RDA) and those who consumed more calcium (> 69% of the RDA). Women who consumed less calcium felt that milk upset their stomach and they knew that they did not meet the RDA for calcium. Women who consumed more calcium were concerned about their calcium intake and did not avoid milk.

Unlike calcium, the present study did not find any significant difference between women's iron intake and their attitude toward nutrition while grocery shopping.

## Behavior

The present study found a significant difference in calcium intake between the women who avoided all kinds of milk and the women who did not. However, mean calcium intake was not found to be significantly different between the women who avoided cheese and the women who did not. The present study supported the results from Guthrie (1996) who also found that subjects who avoided milk were less likely to meet their RDA for calcium. In contrast to the present study, Guthrie showed significantly lower calcium intake in women who avoided cheese. Chapman et al. (1995) indicated that beliefs about high calories and cholesterol content in dairy foods seemed to be discouraging women from consumption of adequate calcium.

Similar to calcium, the present study found a significant difference in daily mean iron intake between the subjects who avoided meat and the subjects who did not. But, it should be noted that subjects who avoided meat consumed more iron compared to the subjects who did not avoid meat. This finding may be attributed to the good fortification of grain products with iron in the food supply of the Unites States.

## Beliefs

No association between women's beliefs about eating a variety of foods and their calcium and iron intake was found. We hypothesized that women who strongly agreed that eating a variety of foods each day would provide them all minerals they need would be more likely to have an adequate calcium and iron intake than women who strongly disagreed. This hypothesis was stated because one of the component of the Health Belief Model (Rosenstock, 1990) is the perception of threat to health, which further leads into two dimensions. The first component is that an individual perceives that she is at risk of contracting a disease and is concerned that having the disease may have severe consequences. The second component of the model believes the expectation of certain outcome related to behavior. In other words a women's perception that eating a variety of foods each day will provide her all minerals she needs might influence her behavior and have an important impact on her calcium and intake.

## Summary

Similar to some of the previous studies, this study also found that several characteristics influence calcium and iron intake in women. Women with less education and lower incomes and or non-white women were more likely to consume inadequate calcium and iron. Although pregnant women had significantly higher calcium than non-pregnant women, their intake found to be lower than the RDA and AI. These results were supported by other studies.

It is important to note that subjects' calcium and iron intake were based on self reports of food intake using one food recall and two days of food records. According to Mertz et al. (1991) underreporting of dietary intake is much more likely than over reporting. Dietary knowledge did not necessarily lead to good dietary practices. In addition, women who held positive attitudes about the importance of nutrition while grocery shopping or positive beliefs regarding eating variety of foods did also not necessarily translate these into better food choices.

## Conclusion

Findings from the present study provide insights into more effective nutrition education for women. Women with less education, less income, women in minority groups and pregnant/lactating women should be given preference when educating women regarding importance of calcium and iron. Hence, nutrition educators should target these risk groups and develop some effective approaches to help these groups to meet their RDA for calcium and iron intakes. It seems there is still a gap between nutrition educators and consumers. Nutrition education messages should be provided in a way that can be translated into consumer's behavior. In conclusion, there is still a need to increase women's awareness regarding calcium and iron intake.

## Future Needs for Nutrition Education

Nutrition education is a process by which we assist people in making decisions regarding their eating practices by applying knowledge, having a positive attitude and sound behavior about diet and health.

We need to better understand how consumers acquire, organize and use nutrition information to make decisions about certain foods. Inventive techniques are needed for reaching different groups of women to teach them the importance of calcium and iron. Future research needs to be done regarding the women's beliefs and behaviors concerning dietary calcium and iron. A better understanding in these areas will help nutrition educators to develop the educational materials to change women's negative beliefs and behaviors regarding dietary calcium and iron. Determining the reasons why women hold certain beliefs and behaviors concerning dietary calcium and iron will be valuable to develop different educational approach regarding consumption of dietary calcium and iron. Since we could not find other studies regarding how women's beliefs can have an impact on their calcium and iron intake, it might be an important variable to look at in future studies. Since race was found to be an important factor in regard to calcium and iron intake, further investigation between the relationships of women's beliefs form different ethnic background and their calcium and iron intakes is recommended.

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Appendix

# what we eat in AMERICA 1994-96

WHAT WE EAT IN AMERICA: 1994-1996
CONTINUING SURVEY OF FOOD INTAKES BY INDIVIDUALS

Conducted for:

United States Department of Agriculture

Conducted by:

Westat
1650 Research Blvd.
Rockville, MD 20850

TIME STARTED ________________ AM / PM

1. Let's begin by talking about the number of servings from different food groups that a person should eat each day. How many servings from the (FOOD GROUP) would you say a person of your age and sex should eat each day for good health? (DO NOT ACCEPT A RANGE OF SERVINGS.)

What about the (NEXT FOOD GROUP)?

> IF ASKED, SAY: "Count as a serving whatever you consider a serving to be."

START AT "X"

| | FOOD GROUP | NUMBER OF SERVINGS | DON'T KNOW |
|---|---|---|---|
| | a. Fruit Group? | |__|__| | 98 |
| | b. Vegetable Group? | |__|__| | 98 |
| | c. Milk, Yogurt, and Cheese Group? | |__|__| | 98 |
| | d. Bread, Cereal, Rice, and Pasta Group? | |__|__| | 98 |
| | e. Meat, Poultry, Fish, Dry Beans, and Eggs Group? | |__|__| | 98 |

2. Now I am going to read some statements about what people eat. Please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the statement: (READ STATEMENT)

What about (NEXT STATEMENT)?

> IF NEEDED, SAY: "Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the statement?"

START AT "X"

| | STATEMENT | Strongly Agree | Somewhat Agree | Somewhat Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| a. | Choosing a healthy diet is just a matter of knowing what foods are good and what foods are bad. | 4 | 3 | 2 | 1 |
| b. | Eating a variety of foods each day probably gives you all the vitamins and minerals you need. | 4 | 3 | 2 | 1 |
| c. | Some people are born to be fat and some thin; there is not much you can do to change this. | 4 | 3 | 2 | 1 |
| d. | Starchy foods, like bread, potatoes, and rice, make people fat. | 4 | 3 | 2 | 1 |
| e. | There are so many recommendations about healthy ways to eat, it's hard to know what to believe. | 4 | 3 | 2 | 1 |
| f. | What you eat can make a big difference in your chance of getting a disease, like heart disease or cancer. | 4 | 3 | 2 | 1 |
| g. | The things I eat and drink now are healthy so there is no reason for me to make changes. | 4 | 3 | 2 | 1 |
| | STATEMENT | Strongly Agree | Somewhat Agree | Somewhat Disagree | Strongly Disagree |

3. Next, let's talk about your own diet. Compared to what is healthy, do you think your diet is too low, too high, or about right in (STATEMENT)?

What about (NEXT STATEMENT)?

> IF NEEDED, SAY: "Would you say your diet is too low, too high, or about right in that?"
>
> IF NEEDED, SAY: "The question is asking about nutrients from foods, not from vitamin pills."

START AT "X"

| | STATEMENT | Too Low | Too High | About Right | DON'T KNOW |
|---|---|---|---|---|---|
| | a. Calories? | 1 | 2 | 3 | 8 |
| | b. Calcium? | 1 | 2 | 3 | 8 |
| | c. Iron? | 1 | 2 | 3 | 8 |
| | d. Vitamin C? | 1 | 2 | 3 | 8 |
| | e. Protein? | 1 | 2 | 3 | 8 |
| | f. Fat? | 1 | 2 | 3 | 8 |
| | g. Saturated fat? | 1 | 2 | 3 | 8 |
| | h. Cholesterol? | 1 | 2 | 3 | 8 |
| | i. Salt or sodium? | 1 | 2 | 3 | 8 |
| | j. Fiber? | 1 | 2 | 3 | 8 |
| | k. Sugar and sweets? | 1 | 2 | 3 | 8 |
| | STATEMENT | Too Low | Too High | About Right | DON'T KNOW |

4. To you personally, is it very important, somewhat important, not too important, or not at all important to (STATEMENT)?

To you personally, how important is it to (NEXT STATEMENT)?

> IF NEEDED, SAY: "Is that very important, somewhat important, not too important, or not at all important to you personally?"
>
> IF NEEDED, SAY: "The question is not asking about your actual eating habits, it is asking about the importance of the statement to you personally."

START AT "X"

| | STATEMENT | Very Important | Somewhat Important | Not Too Important | Not At All Important | DON'T KNOW |
|---|---|---|---|---|---|---|
| | a. Use salt or sodium only in moderation? | 4 | 3 | 2 | 1 | 8 |
| | b. Choose a diet low in saturated fat? | 4 | 3 | 2 | 1 | 8 |
| | c. Choose a diet with plenty of fruits and vegetables? | 4 | 3 | 2 | 1 | 8 |
| | d. Use sugars only in moderation? | 4 | 3 | 2 | 1 | 8 |
| | e. Choose a diet with adequate fiber? | 4 | 3 | 2 | 1 | 8 |
| | f. Eat a variety of foods? | 4 | 3 | 2 | 1 | 8 |
| | g. Maintain a healthy weight? | 4 | 3 | 2 | 1 | 8 |
| | h. Choose a diet low in fat? | 4 | 3 | 2 | 1 | 8 |
| | i. Choose a diet low in cholesterol? | 4 | 3 | 2 | 1 | 8 |
| | j. Choose a diet with plenty of breads, cereals, rice, and pasta? | 4 | 3 | 2 | 1 | 8 |
| | k. Eat at least two servings of dairy products daily? | 4 | 3 | 2 | 1 | 8 |
| | STATEMENT | Very Important | Somewhat Important | Not Too Important | Not At All Important | DON'T KNOW |

START AT "X"

5. Have you heard about any health problems caused by (BEHAVIOR)?

(ASK QUESTIONS 5A - 5G AND 6 UNTIL COMPLETE, THEN GO TO QUESTION 7.)

6. What health problems are these? Any other problems? (DO NOT READ PROBLEMS)
(CIRCLE CODE IN THE APPROPRIATE ROW BELOW)

01 – Arteriosclerosis/Atherosclerosis
02 – Arthritis
03 – Bone problems/Rickets
04 – Breathing problems
05 – Cancer (All types)
07 – Cavities/Caries
01 – Clogged arteries
06 – Colitis/Colon problems
06 – Constipation
01 – Coronary disease
08 – Diabetes
06 – Digestive problems
06 – Diverticulosis
09 – Edema
10 – Fatigue
15 – Fat/Overweight
01 – Hardening of the arteries
01 – Heart problems/Heart attack
11 – High blood cholesterol
12 – High blood pressure
08 – High blood sugar
13 – Hyperactivity
12 – Hypertension
06 – Irregularity
14 – Kidney disease
10 – Lack of energy
15 – Obesity/Overweight
03 – Osteoporosis
14 – Renal disease
16 – Stroke
10 – Tiredness
07 – Tooth problems
09 – Water (fluid) retention
17 – HEALTH PROBLEMS NOT SPECIFIED
00 – Other disease/problem (SPECIFY)

| BEHAVIOR | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a. Eating too much fat? YES .......... 1 (Q6) NO .......... 2 (Q5b) | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 00 (SPECIFY) | \|_\|_\| |
| b. Not eating enough fiber? YES .......... 1 (Q6) NO .......... 2 (Q5c) | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 00 (SPECIFY) | \|_\|_\| |
| c. Eating too much salt or sodium? YES .......... 1 (Q6) NO .......... 2 (Q5d) | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 00 (SPECIFY) | \|_\|_\| |
| d. Not eating enough calcium? YES .......... 1 (Q6) NO .......... 2 (Q5e) | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 00 (SPECIFY) | \|_\|_\| |
| e. Eating too much cholesterol? YES .......... 1 (Q6) NO .......... 2 (Q5f) | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 00 (SPECIFY) | \|_\|_\| |
| f. Eating too much sugar? YES .......... 1 (Q6) NO .......... 2 (Q5g) | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 00 (SPECIFY) | \|_\|_\| |
| g. Being overweight? YES .......... 1 (Q6) NO .......... 2 (Q5a) | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 00 (SPECIFY) | \|_\|_\| |

7. Do you consider yourself to be:

| | |
|---|---|
| Overweight, | 1 |
| Underweight, or | 2 |
| About right? | 3 |

8. Based on your knowledge, which has <u>more saturated</u> fat: (READ EACH PAIR STARTING AT "X" AND THEN WAIT FOR AN ANSWER. DO NOT PROBE "DON'T KNOW" ANSWERS.)

START AT "X"

| | PAIR | |
|---|---|---|
| | a. Liver, or | 1 |
| | T-bone steak? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |
| | b. Butter, or | 1 |
| | Margarine? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |
| | c. Egg white, or | 1 |
| | Egg yolk? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |
| | d. Skim milk, or | 1 |
| | Whole milk? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |

9. Which has <u>more fat</u>: (READ EACH PAIR STARTING AT "X" AND THEN WAIT FOR AN ANSWER. DO NOT PROBE "DON'T KNOW" ANSWERS.)

START AT "X"

| | PAIR | |
|---|---|---|
| a. | Regular hamburger, or | 1 |
| | Ground round? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |
| b. | Loin pork chops, or | 1 |
| | Pork spare ribs? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |
| c. | Hot dogs, or | 1 |
| | Ham? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |
| d. | Peanuts, or | 1 |
| | Popcorn? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |
| e. | Yogurt, or | 1 |
| | Sour cream? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |
| f. | Porterhouse steak, or | 1 |
| | Round steak? | 2 |
| | THE SAME | 3 |
| | DON'T KNOW | 8 |

DO NOT PROBE "DON'T KNOW" ANSWERS FOR Q10-14.

10. Which kind of fat is more likely to be a liquid rather than a solid:

| | |
|---|---|
| Saturated fats, | 1 |
| Polyunsaturated fats, or | 2 |
| Are they equally likely to be liquids? | 3 |
| DON'T KNOW | 8 |

11. If a food has no cholesterol is it also:

| | |
|---|---|
| Low in saturated fat, | 1 |
| High in saturated fat, or | 2 |
| Could it be either high or low in saturated fat? | 3 |
| DON'T KNOW | 8 |

12. Is cholesterol found in:

| | |
|---|---|
| Vegetables and vegetable oils, | 1 |
| Animal products like meat and dairy products, or | 2 |
| All foods containing fat or oil? | 3 |
| DON'T KNOW | 8 |

13. If a product is labeled as containing only vegetable oil is it:

| | |
|---|---|
| Low in saturated fat, | 1 |
| High in saturated fat, or | 2 |
| Could it be either high or low in saturated fat? | 3 |
| DON'T KNOW | 8 |

14. If a food product is labeled "light," does that mean that compared to a similar product not labeled "light" it is lower in calories, lower in fat, or lower in calories and/or fat, or does it mean something else?

| | |
|---|---|
| LOWER IN CALORIES | 1 |
| LOWER IN FAT | 2 |
| LOWER IN CALORIES AND/OR FAT | 3 |
| SOMETHING ELSE | 4 |
| DON'T KNOW | 8 |

15. Now think about buying food. When you buy food, how important is (FACTOR) – very important, somewhat important, not too important, or not at all important?

What about (NEXT FACTOR)?

> IF NEEDED, SAY: "How important is (FACTOR) – very important, somewhat important, not too important, or not at all important?"

START AT "X"

| | FACTOR | Very Important | Somewhat Important | Not Too Important | Not At All Important | DON'T KNOW |
|---|---|---|---|---|---|---|
| | a. How safe the food is to eat? | 4 | 3 | 2 | 1 | 8 |
| | b. Nutrition? | 4 | 3 | 2 | 1 | 8 |
| | c. Price? | 4 | 3 | 2 | 1 | 8 |
| | d. How well the food keeps? | 4 | 3 | 2 | 1 | 8 |
| | e. How easy the food is to prepare? | 4 | 3 | 2 | 1 | 8 |
| | f. Taste? | 4 | 3 | 2 | 1 | 8 |

16. Now think about food labels. When you buy foods, do you use (SECTION) often, sometimes, rarely, or never?

What about (NEXT SECTION)?

IF NEEDED, SAY: "Do you use (SECTION) often, sometimes, rarely, or never?"

START AT "X"

| | SECTION | Often (Always) | Sometimes | Rarely | Never | NEVER SEEN | DON'T KNOW |
|---|---|---|---|---|---|---|---|
| | a. The list of ingredients? | 1 | 2 | 3 | 4 | 5 | 8 |
| | b. The short phrases like "low-fat" or "light" or "good source of fiber"? | 1 | 2 | 3 | 4 | 5 | 8 |
| | c. The nutrition panel that tells the amount of calories, protein, fat, and such in a serving of the food? | 1 | 2 | 3 | 4 | 5 | 8 |
| | d. The information about the size of a serving? | 1 | 2 | 3 | 4 | 5 | 8 |
| | e. A statement that describes how nutrients or foods and health problems are related? | 1 | 2 | 3 | 4 | 5 | 8 |

BOX 1

IS "NEVER" (4) OR "NEVER SEEN" (5) CIRCLED FOR ALL PARTS OF QUESTION 16?

YES .......................................... 1 (Q24)
NO .......................................... 2

17. When you look for nutrition information on the food label, would you say you often, sometimes, rarely, or never look for information about (STATEMENT)?

What about (NEXT STATEMENT)?

IF NEEDED, SAY: "Would you say you often, sometimes, rarely, or never look for information about that?"

START AT "X"

| STATEMENT | Often (Always) | Some-times | Rarely | Never |
|---|---|---|---|---|
| a. Calories? | 1 | 2 | 3 | 4 |
| b. Salt or sodium? | 1 | 2 | 3 | 4 |
| c. Total fat? | 1 | 2 | 3 | 4 |
| d. Saturated fat? | 1 | 2 | 3 | 4 |
| e. Cholesterol? | 1 | 2 | 3 | 4 |
| f. Vitamins or minerals? | 1 | 2 | 3 | 4 |
| g. Fiber? | 1 | 2 | 3 | 4 |
| h. Sugars? | 1 | 2 | 3 | 4 |

18. Now think about the types of food products you buy using food labels. When you buy (FOOD PRODUCT), do you look for nutrition information on the food label often, sometimes, rarely, or never?

What about (NEXT FOOD PRODUCT)?

IF NEEDED, SAY: "And when you buy (FOOD PRODUCT), do you use the label often, sometimes, rarely, or never?"

START AT "X"

| FOOD PRODUCT | Often (Always) | Some-times | Rarely | Never | NEVER SEEN | DO NOT BUY |
|---|---|---|---|---|---|---|
| a. Dessert items like cookies or cake mixes? | 1 | 2 | 3 | 4 | 5 | 6 |
| b. Snack items like chips, popcorn, or pretzels? | 1 | 2 | 3 | 4 | 5 | 6 |
| c. Frozen dinners or main dishes? | 1 | 2 | 3 | 4 | 5 | 6 |
| d. Breakfast cereals? | 1 | 2 | 3 | 4 | 5 | 6 |
| e. Cheese? | 1 | 2 | 3 | 4 | 5 | 6 |
| f. Fresh fruits or vegetables? | 1 | 2 | 3 | 4 | 5 | 6 |
| g. Salad dressings? | 1 | 2 | 3 | 4 | 5 | 6 |
| h. Table spreads like butter or margarine? | 1 | 2 | 3 | 4 | 5 | 6 |
| i. Raw meat, poultry, or fish? | 1 | 2 | 3 | 4 | 5 | 6 |
| j. Processed meat products like hot dogs and bologna? | 1 | 2 | 3 | 4 | 5 | 6 |
| FOOD PRODUCT | Often (Always) | Some-times | Rarely | Never | NEVER SEEN | DO NOT BUY |

19. Now think about the types of nutrition information on food labels. Do you think (SECTION) is very easy to understand, somewhat easy, or not too easy to understand?

What about (NEXT SECTION)?

> IF NEEDED, SAY: "Would you say that is very easy to understand, somewhat easy, or not too easy to understand?"

START AT "X"

| | SECTION | Very Easy | Somewhat Easy | Not Too Easy | NEVER SEEN | DON'T KNOW |
|---|---|---|---|---|---|---|
| | a. The list of ingredients? | 1 | 2 | 3 | 4 | 8 |
| | b. A short phrase like "low-fat" or "light" or "good source of fiber"? | 1 | 2 | 3 | 4 | 8 |
| | c. The number of calories in a serving? | 1 | 2 | 3 | 4 | 8 |
| | d. The number of calories <u>from fat</u> in a serving? | 1 | 2 | 3 | 4 | 8 |
| | e. The number of grams or milligrams of nutrients like fat and sodium in a serving? | 1 | 2 | 3 | 4 | 8 |
| | f. The percent of the daily value for each nutrient? | 1 | 2 | 3 | 4 | 8 |
| | g. A description like "lean" or "extra lean" on meats? | 1 | 2 | 3 | 4 | 8 |
| | SECTION | Very Easy | Somewhat Easy | Not Too Easy | NEVER SEEN | DON'T KNOW |

20. If a food label says a food is (DESCRIPTION), would you say you are very confident, somewhat confident, or not too confident that the description is a reliable basis for choosing foods?

What about (NEXT DESCRIPTION)?

> IF NEEDED, SAY: "How confident are you that the description is reliable? Would you say very confident, somewhat confident, or not too confident?"

START AT "X"

| | DESCRIPTION | Very Confident | Somewhat Confident | Not Too Confident | DON'T KNOW |
|---|---|---|---|---|---|
| | a. Low-fat? | 1 | 2 | 3 | 8 |
| | b. Low-cholesterol? | 1 | 2 | 3 | 8 |
| | c. A good source of fiber? | 1 | 2 | 3 | 8 |
| | d. Light? | 1 | 2 | 3 | 8 |
| | e. Healthy? | 1 | 2 | 3 | 8 |
| | f. Extra lean? | 1 | 2 | 3 | 8 |

21. As far as you know, does the government define and enforce the meaning of the phrase (PHRASE) on food labels? (DO NOT PROBE "DON'T KNOW" ANSWERS.)

What about the phrase (NEXT PHRASE)?

START AT "X"

| | | PHRASE | YES | NO | DON'T KNOW |
|---|---|---|---|---|---|
| | a. | Low-cholesterol? | 1 | 2 | 8 |
| | b. | Light? | 1 | 2 | 8 |
| | c. | Extra lean? | 1 | 2 | 8 |

22. Now think about the section of the food label that tells the amount of calories, protein, and fat in a serving of the food. If it showed that one serving of the food contained (AMOUNT OF NUTRIENT), would you consider that to be a low amount or a high amount? (DO NOT PROBE "DON'T KNOW" ANSWERS.)

What about (NEXT AMOUNT OF NUTRIENT)?

IF NEEDED, SAY: "Would you consider that to be a low amount or a high amount for one serving of food?"

START AT "X"

| | | AMOUNT OF NUTRIENT | Low | High | DON'T KNOW |
|---|---|---|---|---|---|
| | a. | 100 milligrams of sodium? | 1 | 2 | 8 |
| | b. | 20 grams of fat? | 1 | 2 | 8 |
| | c. | 15 milligrams of cholesterol? | 1 | 2 | 8 |
| | d. | 5 grams of fiber? | 1 | 2 | 8 |
| | e. | 10 grams of saturated fat? | 1 | 2 | 8 |

23. Now I am going to read some statements. Please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the statement: (READ STATEMENT)

What about (NEXT STATEMENT)?

> IF NEEDED, SAY: "Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the statement?"

START AT "X"

| | STATEMENT | Strongly Agree | Somewhat Agree | Somewhat Disagree | Strongly Disagree | NO OPINION |
|---|---|---|---|---|---|---|
| | a. The nutrition information on food labels is useful to me. | 4 | 3 | 2 | 1 | 0 |
| | b. I feel confident that I know how to use food labels to choose a healthy diet. | 4 | 3 | 2 | 1 | 0 |
| | c. The nutrition information on food labels is hard to interpret. | 4 | 3 | 2 | 1 | 0 |
| | d. Reading food labels takes more time than I can spare. | 4 | 3 | 2 | 1 | 0 |
| | e. I read food labels because good health is important to me. | 4 | 3 | 2 | 1 | 0 |
| | f. I would like to learn more about how to use food labels to choose a nutritious diet. | 4 | 3 | 2 | 1 | 0 |
| | g. Reading food labels makes it easier to choose foods. | 4 | 3 | 2 | 1 | 0 |
| | h. Sometimes I try new foods because of the information on the food label. | 4 | 3 | 2 | 1 | 0 |
| | i. When I use food labels, I make better food choices. | 4 | 3 | 2 | 1 | 0 |
| | j. Using food labels to choose foods is better than just relying on my own knowledge about what is in them. | 4 | 3 | 2 | 1 | 0 |
| | STATEMENT | Strongly Agree | Somewhat Agree | Somewhat Disagree | Strongly Disagree | NO OPINION |

GO TO Q26

24. Now I am going to read some statements about food labels. Please tell me if you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the statement: (READ STATEMENT)

What about (NEXT STATEMENT)?

> IF NEEDED, SAY: "Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the statement?"

START AT "X"

| STATEMENT | Strongly Agree | Somewhat Agree | Somewhat Disagree | Strongly Disagree | NO OPINION |
|---|---|---|---|---|---|
| a. I feel confident that I know how to use food labels to choose a healthy diet. | 4 | 3 | 2 | 1 | 0 |
| b. The nutrition information on food labels is hard to interpret. | 4 | 3 | 2 | 1 | 0 |
| c. Reading food labels takes more time than I can spare. | 4 | 3 | 2 | 1 | 0 |
| d. I would like to learn more about how to use food labels to choose a nutritious diet. | 4 | 3 | 2 | 1 | 0 |
| e. Using food labels to choose foods would be better than just relying on my own knowledge about what is in them. | 4 | 3 | 2 | 1 | 0 |
| STATEMENT | Strongly Agree | Somewhat Agree | Somewhat Disagree | Strongly Disagree | NO OPINION |

25. As far as you know, does the government define and enforce the meaning of the phrase (PHRASE) on food labels? (DO NOT PROBE "DON'T KNOW" ANSWERS.)

What about the phrase (NEXT PHRASE)?

START AT "X"

| PHRASE | YES | NO | DON'T KNOW |
|---|---|---|---|
| a. Low-cholesterol? | 1 | 2 | 8 |
| b. Light? | 1 | 2 | 8 |
| c. Extra lean? | 1 | 2 | 8 |

26. Now think about the foods you eat. Would you say you always, sometimes, rarely, or never (HABIT)?

What about (NEXT HABIT)?

> IF NEEDED, SAY: "Do you always, sometimes, rarely, or never (HABIT)?"

| HABIT | Always (Almost Always) | Some-times | Rarely | Never | DOES NOT APPLY |
|---|---|---|---|---|---|
| a. Eat lower-fat luncheon meats instead of regular luncheon meats? (IF NEEDED, SAY: "Examples of lower-fat luncheon meats are deli ham and turkey. Examples of regular luncheon meats are bologna and salami.") | 1 | 2 | 3 | 4 | 0 |
| b. Use skim or 1% milk instead of 2% or whole milk? | 1 | 2 | 3 | 4 | 0 |
| c. Eat special, low-fat cheeses, when you eat cheese? | 1 | 2 | 3 | 4 | 0 |
| d. Eat ice milk, frozen yogurt, or sherbet instead of ice cream? | 1 | 2 | 3 | 4 | 0 |
| e. Use low-calorie instead of regular salad dressing? | 1 | 2 | 3 | 4 | 0 |
| f. Have fruit for dessert when you eat dessert? | 1 | 2 | 3 | 4 | 0 |
| g. Eat fish or poultry instead of meat? (IF NEEDED, SAY: "Meat refers to beef, pork, or lamb." | 1 | 2 | 3 | 4 | 0 |
| HABIT | Always (Almost Always) | Some-times | Rarely | Never | DOES NOT APPLY |

27. When you eat baked or boiled potatoes, how often do you add butter, margarine, or sour cream? Would you say always, sometimes, rarely, or never?

ALWAYS (ALMOST ALWAYS) .......... 1
SOMETIMES .......... 2
RARELY .......... 3
NEVER .......... 4
DO NOT EAT BAKED OR BOILED POTATOES .......... 0

28. When you eat other cooked vegetables, do you always, sometimes, rarely, or never eat them with butter or margarine added?

| | |
|---|---|
| ALWAYS (ALMOST ALWAYS) | 1 |
| SOMETIMES | 2 |
| RARELY | 3 |
| NEVER | 4 |
| DO NOT EAT COOKED VEGETABLES | 0 (Q30) |

29. When you eat other cooked vegetables, do you always, sometimes, rarely, or never eat them with cheese or another creamy sauce added?

| | |
|---|---|
| ALWAYS (ALMOST ALWAYS) | 1 |
| SOMETIMES | 2 |
| RARELY | 3 |
| NEVER | 4 |

30. When you eat chicken, do you always, sometimes, rarely, or never eat it fried?

| | |
|---|---|
| ALWAYS (ALMOST ALWAYS) | 1 |
| SOMETIMES | 2 |
| RARELY | 3 |
| NEVER | 4 |
| DO NOT EAT CHICKEN | 0 (Q32) |

31. When you eat chicken, do you always, sometimes, rarely, or never remove the skin?

| | |
|---|---|
| ALWAYS (ALMOST ALWAYS) | 1 |
| SOMETIMES | 2 |
| RARELY | 3 |
| NEVER | 4 |

32. Would you describe the amount of butter or margarine you usually spread on breads and muffins as:

| | |
|---|---|
| None, | 1 |
| Light, | 2 |
| Moderate, or | 3 |
| Generous? | 4 |

33. About how many times in a week do you eat (FOOD) – less than once a week, 1-3, 4-6, or 7 or more times?

> IF ASKED, SAY: "A 'time' is any single eating occasion."

| FOOD | Less than once a week (Never) | 1-3 | 4-6 | 7 or More |
|---|---|---|---|---|
| a. Bakery products like cakes, cookies, or donuts? | 1 | 2 | 3 | 4 |
| b. Chips, such as potato or corn chips? | 1 | 2 | 3 | 4 |

34. And at your <u>main meal</u>, about how many times in a week do you eat beef, pork, or lamb. Would you say less than once a week, 1-2, 3-4, or 5-7 times?

LESS THAN ONCE A WEEK/NEVER ............ 1
1-2 TIMES ............ 2
3-4 TIMES ............ 3
5-7 TIMES ............ 4
DO NOT EAT MEAT ............ 0 (Q37)

35. When you eat meat, do you usually eat:

> IF ASKED, SAY: "The question is asking about meats, like beef, pork, or lamb."

Small, ............ 1
Medium, or ............ 2
Large portions? ............ 3
DO NOT EAT MEAT ............ 0 (Q37)

36. When you eat meat and there is visible fat, do you trim the fat always, sometimes, rarely, or never?

ALWAYS (ALMOST ALWAYS) ............ 1
SOMETIMES ............ 2
RARELY ............ 3
NEVER ............ 4
NEVER EAT MEAT WITH VISIBLE FAT ............ 0

37. How many eggs do you usually eat in a week – less than one, 1-2, 3-4, or 5 or more?

> IF ASKED, SAY: "The question is asking about plain eggs, <u>not</u> egg substitutes or eggs in mixed dishes or baked goods."

LESS THAN ONE/NONE ............ 1
1-2 ............ 2
3-4 ............ 3
5 OR MORE ............ 4

38. Before you eat fresh fruits and vegetables, do you or does someone else wash them always, sometimes, rarely, or never?

| | |
|---|---|
| ALWAYS (ALMOST ALWAYS) | 1 |
| SOMETIMES | 2 |
| RARELY | 3 |
| NEVER | 4 |
| DON'T KNOW | 8 |
| DO NOT EAT FRESH FRUITS/ VEGETABLES | 0 (Q42) |

39. When you eat fresh fruits with peels that can be eaten, do you eat the peel always, sometimes, rarely, or never?

| | |
|---|---|
| ALWAYS (ALMOST ALWAYS) | 1 |
| SOMETIMES | 2 |
| RARELY | 3 |
| NEVER | 4 |
| DON'T KNOW | 8 |

40. When you eat fresh vegetables with peels that can be eaten, do you eat the peel always, sometimes, rarely, or never?

| | |
|---|---|
| ALWAYS (ALMOST ALWAYS) | 1 |
| SOMETIMES | 2 |
| RARELY | 3 |
| NEVER | 4 |
| DON'T KNOW | 8 |

41. Do you eat the outer leaves of leafy vegetables like lettuce and cabbage?

IF NEEDED, SAY: "What do you do most of the time?"

| | |
|---|---|
| YES | 1 |
| NO | 2 |
| DON'T KNOW | 8 |
| DO NOT EAT LEAFY VEGETABLES | 0 |

42. Are you the person most responsible for planning or preparing the meals in your household?

| | |
|---|---|
| YES | 1 |
| NO | 2 |
| DON'T KNOW | 8 |

THANK YOU FOR YOUR TIME AND COOPERATION

TIME ENDED ________________ AM / PM

VITA

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