5-1976

A Longitudinal Study, Part III: The Relationship of Weight, Health Status, Diet and Anxiety to Serum Cholesterol Levels in Adults

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A LONGITUDINAL STUDY, PART III: THE RELATIONSHIP OF WEIGHT, HEALTH STATUS, DIET AND ANXIETY TO SERUM CHOLESTEROL LEVELS IN ADULTS

by

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A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Nutrition and Food Sciences

UTAH STATE UNIVERSITY
Logan, Utah

1976

ACKNOWLEDGMENTS

Since the beginning of the third part of this longitudinal study in 1974 there have been many people who have given me help and encouragement when it was most needed. I wish to thank Dr. Hendricks for all the help he has offered me and for being so patient during the darkest hours.

I would like to extend a special thanks to my sister, Ann, who left her family to come and help with the typing of the text.

Lastly, I want to thank my husband, Walt, who acted as my mentor, my support and my technical advisor. Without Walt to help and advise me, the statistical portion of this thesis would have been incomplete.

Kristine S. Saunders

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ABSTRACT

A Longitudinal Study, Part III: The Relationship of Weight, Health Status, Diet and Anxiety to Serum Cholesterol Levels in Adults

by

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Over an 18-year period, beginning in 1955, a group of subjects has been studied six times to determine if any relationship exists among serum cholesterol levels, body weight, health status, diet quality and stress or anxiety. For the first four test periods, extending through ages 7 to 16 years, there were 321 subjects. Later, in 1968, 86 of the original 321 subjects, now aged 19-22 years, were able to participate in a follow-up study. The 1974 study was able to involve 30 of the original 321 subjects now aged 26-29 years. Findings show that from approximately the fifteenth year onward serum cholesterol levels in males continue to rise in an almost linear fashion, whereas females experienced a drop in serum cholesterol levels at ages 19-22 years which was followed by a rise when they reached 26-29 years. Persons who were classified as overweight in the sixth test period had higher serum cholesterol levels than persons classified as either desirable weight or underweight for both sexes. Anxiety levels as determined by the IPAT

anxiety scale questionnaire in the sixth test period showed that for males there was a positive relationship between serum cholesterol and anxiety but for women a negative relationship was shown. Subjects with serum cholesterol levels above 250 mg/100 ml consumed diets higher in saturated fats than the subjects with serum cholesterol levels below 250 mg/100 ml. In males a significant positive correlation was shown between serum cholesterol levels and smoking.

(70 pages)

INTRODUCTION

The causes of atherosclerosis and the means for its prevention have long been topics of intense interest to a wide range of researchers. Although many of the findings appear contradictory, most authorities agree that elevated serum lipids, especially elevated serum cholesterol, is a major factor contributing to the development of atherosclerosis.

The extensive body of findings relating atherosclerosis to coronary heart disease is well known and has led investigators to an intensive study of several so-called risk factors. In the current literature a few of the risk factors receiving most attention are smoking, hypertension, obesity, anxiety, sex, age, diet and exercise. A combination of these risk factors in conjunction with elevated serum cholesterol levels greatly increases the probability of developing coronary heart disease.

Although coronary heart disease and atherosclerosis are seen mainly when a person reaches middle age, more and more researchers and physicians are suggesting that the origin of atherosclerosis may occur in infancy or early childhood.

This being the case, preventive measures could begin in early life, perhaps with the early detection of risk factors. For example, data on risk factors such as obesity, sex and age contained in general health records and growth charts routinely kept by doctors could prove useful when predicting which children will develop

atherosclerosis as adults. Furthermore, if a risk factor such as obesity is found to be a dietary problem, perhaps by encouraging good dietary habits at an early age atherosclerosis during middle age may be prevented.

It is only quite recently that the scientific community has begun to search for predictive relationships between the occurrence of atherosclerosis in middle age and the occurrence of early origins or precursors in young children. The study reported here is of this predictive type. It was begun 20 years ago when the subjects were elementary school children. The results of the original study are reported in a thesis by Milligan (1965) in which she tried to determine if a relationship existed between body build, age and sex with serum cholesterol levels in preadolescents and adolescents. Five to six years later a follow-up study involving the same subjects who were now young adults was conducted. The results of that study were reported in a thesis by Wein (1969) in which she assessed the changes in serum cholesterol levels that had occurred in these young people and examined whether or not these changes were related to alterations in body weight, health status and dietary fat.

Five or six years have passed since the Wein follow-up study and it is again time to assess these same subjects, now aged 26-29 years, to determine changes in serum cholesterol levels and how these changes relate to body weight, dietary fat, and anxiety levels.

REVIEW OF LITERATURE

The majority of the literature reviewed here will be from the years 1967-1975. The subject material reviewed will include:

1. Atherosclerosis, Coronary Heart Disease and Serum Cholesterol
2. Prevalence of Coronary Heart Disease
3. Relationship of Age and Sex to Cholesterol Levels
4. Risk Factors
    a. Serum lipids
    b. Smoking
    c. Hypertension
    d. Anxiety
    e. Obesity
    f. Diet
    g. Exercise
5. Relationship of Hemoglobin to Serum Cholesterol Levels

An excellent review of the literature in the first, third and fifth areas is included by Milligan (1965) and Wein (1969). A summary of the literature reviews by the aforementioned authors in areas one, three and five will be included here.

Atherosclerosis, Coronary Heart Disease and Serum Cholesterol

A summary of the literature reviewed by Milligan (1965) and Wein (1969) in the areas of atherosclerosis, coronary heart disease and serum cholesterol follows.

In the recent past deaths from aortic heart disease have increased. More and more research is implicating elevated serum cholesterol levels in the increased risk of developing coronary heart disease.

Researchers believe that elevated serum cholesterol levels lead to a deposition of the excess cholesterol in the arteries. Recently, fatty patches containing cholesterol have been found in the aortas of children aged 6 months to 14 years. It is believed that these fatty patches may be related to the atheroma found in arteries in later years. Therefore, it would appear that if the formation of these fatty patches at an early age could be prevented, a cure for certain kinds of cardiovascular diseases would not be long in coming.

Prevalence of Coronary Heart Disease and Atherosclerosis

Diseases of the cardiovascular system have become the major cause of death in the developed nations. More and more people under the age of 65 are succumbing to cardiac death (Kritchevsky, 1967).

In the past 10-15 years the prevalence of coronary artery disease in the Peoples Republic of China has risen from fifth place to second place. Five conspicuous reasons are: 1. greater availability of electrocardiograms which help detect coronary artery disease earlier and in milder forms, 2. longer life expectancy, 3. changes in eating habits with resultant overnutrition and hypercholesterolemia, 4. lack of adequate physical exercise, and 5. changes in life style. The

northern part of the country which is more industrialized tends to have a greater prevalence of coronary heart disease among its population than the people who live in the south and are farmers and fishermen (Cheng, 1974).

To determine if the metabolism of cholesterol could be responsible for Japanese men having lower cholesterol levels than American men, Insull et al. (1967) compared serum and liver cholesterol levels from Japanese men, mean age 43 years, who had died suddenly to those of American men, mean age 39.5 years, who also had died suddenly. Test results revealed that serum cholesterol levels in the Japanese were significantly lower than in the Americans. However, the liver cholesterols were not significantly different for the two groups. These findings indicate that factors influencing serum cholesterol levels are independent of liver cholesterol concentrations and something other than the metabolism of cholesterol is responsible for the lower serum cholesterol levels seen in the Japanese men.

Relationship of Age and Sex to Serum Cholesterol Levels

Milligan (1965) and Wein (1969) have done excellent reviews of literature in the area of the relationship of age and sex to serum cholesterol lvels. The following is a summary of the aforementioned reviews.

Research has shown that the serum cholesterol level of the newborn is very low but rises to near-adult levels within a few days

of life. Until a child is about 13 years of age there is no significant relationship between serum cholesterol levels and age. After about the age of 13 years and continuing through adolescence girls generally have higher serum cholesterol values than do boys. However, after adolescence the serum cholesterol values of men generally increase with age, whereas the serum cholesterol levels of women stay low until approximately the fourth decade when their levels rise to essentially the same levels as for men. This offers a suggestion as to why there are more young men succumbing to cardiovascular problems than young women.

Risk Factors

Risk factors have been an important area of recent research. The California Society of Pediatric Cardiology and the California Heart Association (1975) have commented on several risk factors associated with the development of atherosclerosis and have suggested that modification of these risk factors in the general population would be of major importance in the prevention of the disease. These risk factors are elevated serum cholesterol, obesity, smoking, hypertension, and exercise.

Research that would aid man in the recognition of risk factors is always of special interest. In 1973, Wilhelmsen et al. concluded a nine-year study that implicated further some of the better known risk factors and refuted others. From a Swedish city, a population of men, all aged 50 years, was chosen for the purpose of investigating the probability of a 50-year old man developing coronary heart disease

when various risk factors were considered. Cholesterol levels, smoking, systolic blood pressure, dyspnea, intemperance, physical activity, hematocrit, triglycerides, and place of birth were the factors which were investigated. Wilhelmsen et al. (1973) concluded that the following factors were reliable predictors of coronary heart disease: cholesterol levels, systolic blood pressure, and smoking. Serum triglyceride values were found to be of minor importance when serum cholesterol levels were known.

It has been suggested that psychological variables may be important risk factors. Segers and Mertens (1974) conducted a study of 1,694 men between the ages of 20 and 60 years who had been screened for the presence of risk factors associated with the development of coronary heart disease. The sample population was divided into two age groups, those less than 45 years and those more than 45 years, and three weight categories: thin, normal, and obese. Bioclinical variables such as total blood lipids and blood pressure were compared to psychological variables that had been measured using the IPAT Anxiety Scale and the Depression Self-rating Scale.

Results indicate that obese subjects in both age categories exhibit higher bioclinical risks but lower psychological risks when compared to normal and thin subjects. Thin subjects exhibited lower bioclinical risks but higher psychological risks. And, normal subjects showed intermediate scores for psychological and bioclinical risk factors. Both thin and normal subjects showed an increase in psychological and bioclinical scores after the age of 45 years, thus leading one to believe that good physical and mental health after the

age of 45 years are important factors to persons in any weight category.

From the literature reviewed in this section it appears that most researchers view elevated serum lipids, smoking, hypertension, anxiety, obesity, diet and exercise as being the most important of the high risk factors.

Elevated serum lipids

Persons with high blood cholesterol are three times more susceptible to heart attack than those with a low blood cholesterol (Armstrong, 1967; Kim and Goldberg, 1969). According to recent research, serum cholesterol values over 180 mg/dl appear to be the lower threshold for the formation of arterial atheromas (Dock, 1974) and serum cholesterol values above 250 mg/dl are considered to constitute high risk (Armstrong, 1967).

Baladimos et al. (1968) conducted a study to determine how serum cholesterol levels of a population change over a 20-30 year period. Original serum cholesterol determinations were done between 1930 and 1938 on 1,674 persons between the ages of 20 and 60 years. Twenty to 30 years later 505 of these original patients were available for clinical evaluation of their serum cholesterol levels. Of the 505 original patients, a control group was chosen composed of those persons showing no sign of having a vascular disease. Comparisons of original serum cholesterol values and present serum cholesterol values showed that persons comprising the control group had serum cholesterol levels that fell within the normal range in both the

original study and the follow-up study. However, those persons having vascular disease tended to have high serum cholesterol levels both in the initial study and in the follow-up study.

Even though findings reported in the literature point to elevated serum cholesterol as being a precursor to atherosclerosis and coronary heart disease the odds are that not everyone with elevated cholesterol levels will develop a heart disease.

Since lowering blood lipids with the hopes of preventing a heart disease will most likely be a life-long undertaking, it would be helpful to know what chances any individual has of actually preventing a heart attack once blood lipids have been lowered. Whyte (1975) has taken data from the Framingham study and manipulated it in such a way that estimates can be made concerning the odds of preventing a heart disease if the plasma cholesterol were lowered over a 20-year period. In addition to elevated serum cholesterol, smoking to any degree, left-ventricular hypertrophy, hypertension and glucose intolerance were treated as factors constituting additional risk in the development of coronary heart disease.

Whyte's (1975) results suggest that if 100 men aged 35-45 years lowered their cholesterol from 310 mg to 260 mg per 100 ml with the other risk factors being absent, 6 could potentially avoid a coronary, 94 would probably not benefit and 8 would have an attack within 20 years anyway. According to Whyte (1975), as a man gets older the odds are smaller that lowering blood cholesterol will prevent coronary heart disease than for a younger man. However, potential benefit increases with cholesterol level decreasing if other risk factors are

present. For example, 57 out of 100 men in the high risk category with cholesterol levels of 310 mg per 100 ml could expect to develop coronary heart disease in a 20-year period. But, by lowering cholesterol levels to 210 mg per 100 ml, 29 of them could expect to have prevented a coronary.

Smoking

There is abundant evidence in the literature suggesting a relationship between smoking and coronary heart disease. The risk of sudden death due to heart attack among heavy cigarette smokers may be five times as high as that among nonsmokers (Armstrong, 1967). Doyle et al. (1964) found that the risk of myocardial infarction in men who smoked an average of 20 or more cigarettes per day to be about three times greater than in nonsmokers, former cigarette smokers, or pipe and cigar smokers.

Boyle et al. (1968) conducted a study to determine the effect of smoking, weight and age on serum cholesterol levels. In all cases it was found that smokers maintained serum cholesterol levels equal to nonsmokers 3 to 5 years older. This finding is in agreement with Doyle et al. (1964) and Armstrong (1967).

Whether or not an individual stops smoking after one near fatal heart attack may influence his survival after a second attack. Recently Mulcahy and Hickey (1974) studied survival factors of 474 male patients who had survived one myocardial infarction. Findings show that the patients who followed the rehabilitiation program had a significant drop in serum cholesterol levels and smoking. Also,

the patients who quit smoking after their initial attack had a significantly lower mortality rate after a second attack than those who continued.

Hypertension

Although hypertension has not been directly tied to elevated serum cholesterol levels, hypertension is frequently associated with vascular problems (Boyle et al., 1968). Data from the Framingham study (McKee et al., 1971) indicate that hypertension, especially hypertension accompanied by coronary artery disease, is associated with congestive heart failure. It appears that systolic blood pressures of 160 mg Hg or above constitute high risk (Armstrong, 1967).

Anxiety

There is some evidence in the literature indicating that as anxiety increases so does the serum cholesterol level. Rahe and Ransom (1967) examined anxiety and serum cholesterol levels by observing a group of young men throughout a 4-month period during which they were engaged in underwater demolition training. During an initial period of strenuous exercise serum cholesterol levels remained at a relatively low level. However, at the beginning of a week of extreme psychological stress, serum cholesterol levels increased significantly only to return to pre-stress levels almost immediately after the period of psychological stress had ended. A year later Rahe et al. (1968) conducted the same experiment again on a new group of underwater demolition trainees. Their findings

confirm the results of the pilot study which were that serum cholesterol levels increase significantly with unpleasant, anxiety-provoking, and often body-chilling activities and declines in serum cholesterol levels are associated with periods of physical activity without undue challenge from difficult course material.

In another study Kasl et al. (1968) observed the effect that anticipation of job loss had on serum cholesterol. They found that the period of anticipation before actual job loss had no effect on serum cholesterol levels and if the person found a new job immediately serum cholesterol levels were not affected. However, when anticipation of job loss was followed by unemployment, serum cholesterol levels increased significantly.

Paper-pencil tests that proport to assess anxiety or specific facets of anxiety are commonly used to quantify anxiety levels of research subjects. For example, in their seven-year longitudinal study Bruhn et al. (1969) administered the Welsh depression and Bendig anxiety subscales of the Minnesota Multiphasic Personality Inventory bimonthly to 77 subjects for one and one-half years. Blood samples were taken at the same time. A comparison of controls, who were free of any clinical evidence of coronary heart disease, with patients who had survived at least one myocardial infarction showed that the patient group had more depression and anxiety than the control group and that serum cholesterol levels were significantly higher in the patient than in the control group.

In another investigation which used paper-pencil measures, O'Leary et al. (1968) found that anxiety test scores failed to

differentiate cardiac from noncardiac patients. The anxiety scales used were the Welsh A and R scales from the MMPI, the Catell IPAT, and the General Anxiety Scale. The tests were administered to patients who had been admitted to a Florida hospital for a variety of reasons. Even though the anxiety test scores could not distinguish between cardiac and noncardiac patients, personal interview data showed a significant difference in the amount of fear produced by the illness. Heart patients were more frightened by their illnesses than were the other medical patients, thus indicating that perhaps paper-pencil tests are more objective than a person-to-person interview can be.

Obesity

There is much research indicating that elevated serum lipids are often found in persons who are obese (Albrink and Meigs, 1964; Waxler and Craig, 1964; Anonymous, 1968; Baladimos et al., 1968; Boyle et al., 1968). Blood samples from chronically obese females were taken by Waxler and Craig (1964) and analyzed for total lipids, cholesterol and triglyceride levels. Comparison of the values obtained for the obese women with those determine for women of ideal weight showed that the obese women had higher levels of total lipids and triglyceride than did the normal women. However, the presence or absence of obesity did not affect the cholesterol level.

A common method for determining obesity is to take a measure of skinfold thickness at various places on the body. A study that used skinfold thickness as a measure for obesity was performed by Albrink and Meigs (1964). They found significant correlations between

serum triglycerides and skinfold thickness at various sites but no such correlation with serum cholesterol which is in agreement with Waxler and Craig (1964). In addition, Albrink and Meigs (1964) found that skinfold thickness in the trunk suggested obesity was acquired during adult life, whereas skinfold thickness of the upper arm suggested life-long obesity. For men with slender upper arms, serum triglycerides increased as trunk skinfold thickness increased. However, for men with fat upper arms serum triglyceride levels remained essentially unchanged as trunk skinfold thickness increased. The findings from this research suggest that only obesity acquired during adult life affect serum lipid concentrations.

Rifkind et al. (1968) were interested in determining if both serum cholesterol and serum triglyceride levels are independently related to adiposity. To do this, 161 men who showed no evidence of coronary heart disease were studied. Using a regression analysis of relative body weight, triglyceride and cholesterol, the authors determined that when the triglyceride level is known, knowing the cholesterol level is of no value in predicting relative body weight, and cholesterol levels are not independently related to relative body weight but triglyceride levels are.

How weight loss affects serum cholesterol levels is just one area considered in the national diet-heart study. A report from that study (1968) stated that the men who had the largest weight loss experienced the largest drop in serum cholesterol. Furthermore, these men maintained a low cholesterol value even after their weight had stabilized. In fact, the serum cholesterol values for the men

who lost weight remained lower than the cholesterol values for other men in the same weight category. It would appear that "obesity is a preventable hazard to cardiovascular health" (Armstrong, 1967, p. 498).

Diet

Diet is also a risk factor that may influence the incidence of coronary heart disease, as Dock (1974, p. 468) has said, "...incidence [of atherosclerosis] is determined primarily by diet." Also, diet seems to be of prime importance with regards to elevated serum cholesterol.

It has long been known that consumption of large amounts of saturated fats in the diet will cause serum cholesterol levels to rise, whereas serum cholesterol levels can be lowered by substituting vegetable, fish, and marine oils (polyunsaturated fats) for saturated fats in the diet (Jolliffe, 1961). But, Jolliffe qualifies the aforementioned fact by stating that when P/S ratio is calculated trans isomers cannot be used because cholesterol lowering by these isomers has not been demonstrated. He further states that only linoleic acid or its biological equivalents can be included as a polyunsaturated fatty acid. However, as recently as 1975, Mattson, Hollenbach and Kilgman conducted a study that demonstrated that the cholesterol lowering effect of polyunsaturates is not contingent upon its isometric form but on its fatty acid composition. For their study Mattson et al. (1975) used 33 male prisoners aged 24-41 years. These prisoners were fed for 21 days a calculated formula diet that provided 38 percent of their calories as fat. All 33 men started on the same diet which had a fatty acid composition of 25 percent saturates, 16 percent polyunsaturates and 58 percent monounsaturates

with all of the unsaturates in the cis form. Later, half of the group continued on the same diet while the other half were fed a diet where 80 percent of the fat was replaced with a hydrogenated fat. The unsaturates in this latter diet were in the trans form.

At the conclusion of the Mattson et al. study it was found that there was no noticeable difference in either the serum cholesterol or triglyceride levels between the two groups. Therefore, it was concluded that the lowering of cholesterol and triglyceride by unsaturates is due to the fatty acid composition and not its isometric form.

There has been some controversy among researchers concerning whether or not serum lipids fluctuate with the seasons. To determine if a seasonal fluctuation could be demonstrated, Fleishman, Hayton and Bierenbaum (1967) studied 100 young men for a period of six years. All of the young men were coronary patients who were on a 30 percent controlled fat diet. The group was divided into two sections with one section consuming 14.4 percent of their total calories as linoleate while the other section consumed only 3.3 percent of their calories as linoleate. Serum cholesterol levels showed no seasonal fluctuations. However, serum triglycerides did show a distinct rise during the warm months, thus leading one to assume that triglyceride levels are affected by the seasons, whereas serum cholesterol levels are not.

Exercise

A regular exercise program seems to be instrumental in the lowering of serum lipids. The observations of Naughton and McCoy (1966) confirm this view. They studied a total of 48 men, 24 who

were healthy and 24 who had recovered from myocardial infarction, to determine if physical activity, independent of diet or weight loss, significantly lowered serum cholesterol levels. The 48 men were divided into four groups: 1. healthy men who remained sedentary, 2. healthy men who volunteered for a regular program of physical activity, 3. cardiac patients who remained sedentary, and 4. cardiac patients who followed a regular program of physical activity.

After eight months, the serum cholesterol levels for all subjects were significantly reduced. In all cases, those subjects who volunteered for physical conditioning had lower serum cholesterol levels than their sedentary partners.

Armstrong (1967) has stated that increased physical activity helps to prevent overweight, to lower serum lipids, lower blood pressure, and reduce cardiac work loads.

Relationship of Hemoglobin to Serum Cholesterol Levels

A summary of the reviews on the relationship of hemoglobin to serum cholesterol levels by Milligan (1965) and Wein (1969) follows.

Hemoglobin levels have been considered a convenient indication of health status for many years. High hemoglobin levels have always been synonymous with good health. However, there is some research indicating that persons with low hemoglobins have a low incidence of coronary heart disease. For example, women before monopause have low hemoglobin values and a low incidence of coronary heart disease.

Since elevated serum cholesterol levels seem to be related to the increased incidence of coronary heart disease, it is interesting

to note that persons with anemia will also have a low serum cholesterol value. In many cases, hemoglobin values will parallel cholesterol values, leading one to believe that some factors causing elevated serum cholesterol levels may also cause increased hemoglobin values.

METHODS AND PROCEDURES

Selection of Subjects

In the original Milligan study (1965), there were 321 subjects. For the present study, approximately 18 years later, contact was made with as many of the original 321 subjects as could be located employing the following procedures. If the subject's name could not be found in a local telephone book, then a letter (Appendix A), with an addressed postcard enclosed, was sent to the parents asking the present address and telephone number of their son or daughter. Subjects still in Cache Valley were then contacted by letter (Appendix B). Letter response was very poor so follow-up contact was made by telephone. Initial contact with the subjects living in Brigham City was made by letter (Appendix B) with follow-up telephone contact being necessary. Blood samples were finally collected for 30 subjects, 14 males, 16 females and four pregnant women (not included in the 30). Questionnaire data only were received from an additional 36 subjects via the mail (Appendix C).

Questionnaire

Subjects were asked to complete two questionnaires before blood samples were taken. The first questionnaire concerning general health and diet (Appendix D) is basically the same used by Wein (1969) with the addition of questions 38, 39 and 40, which asked about the use of hard or soft water for consumption, whether or not they drank coffee,

and if they smoked a high or low tar cigarette. Question one and three had a second part added inquirying further into personal exercise programs and how long they had been smokers.

The diet portion of the questionnaire was evaluated by classifying the first 15 items most frequently consumed into eight groups which are: 1. leafy green and yellow vegetables, 2. citrus fruit and vegetables, 3. other fruit and vegetables, 4. bread and cereal, 5. poultry, fish and meat, 6. organ meats, 7. eggs and milk, and 8. cheese and ice cream. Each group was rated two, one, or zero with two being given when the frequency of consumption matched that recommended by the basic four food groups. A rating of good was given a diet if the total score was 16 to 13, fair if the total score was 12 to 9, and poor if the total score was 8 or below. This scoring system is the same as used by Wein (1969) with the following exception. When she evaluated a diet, that diet had to have scored at least one for milk to receive a good or fair rating. Under her system a diet was automatically classified as poor if the score for milk was zero regardless of other foods consumed. In the present study, milk was not considered by itself but included in the total score for the diet. For example, if any diet received a total score between 16 and 13, it was rated as good regardless of the score for milk. The present scoring was handled this way because even though milk is an excellent addition to the diet, it is not a dietary essential provided the rest of the diet is adequate.

To determine if a diet was high or moderate in animal fat, the following system as described by Wein (1969) was used. From the

questionnaire, the following foods and frequency of use were considered: eggs or cheddar cheese used four to seven times a week or more; half and half cream used more than twice a day; whipping cream, sour cream, pie or pastry, gravy and French fries used one to three times a week or more; and cream and butter, more than two tablespoons per day. The two following factors were also considered, if visible fat is not trimmed off meat and if animal fat is mainly used in cooking. When diets included five or more of the aforementioned foods or factors, it was rated as high in animal fat while those fewer than five were rated as moderate in animal fat.

A second questionnaire was also administered to each subject. This questionnaire, the IPAT Anxiety Scale Questionnaire (Cattell and Scheier, 1963) is designed to measure free anxiety levels. The following raw scores were used to determine low, average or high anxiety levels according to the table of the general population found in the Handbook for the IPAT Anxiety Scale Questionnaire (1963). For men, a score from 0 to 20 was considered low anxiety, 21 to 38 average anxiety and 39 to 80 high anxiety. For women, 0 to 17 was low anxiety, 18 to 40 average anxiety and 41 to 80 high anxiety (Cattell and Scheier, 1963).

Weight and Blood Pressure Determinations

Height and weight was determined for each subject in stocking feet. The ideal weight of a person for a specific height was designated as the weight midway between allowable extremes for a person of

medium frame as recommended in the Metropolitan Life Insurance Company standard height and weight tables (1959).

Before blood samples were taken, blood pressure determinations were made.

Collection of Blood Samples

From each of 30 subjects a fasting blood sample was taken in the early morning between 5:00 a.m. and 10:00 a.m. from a fingerstick. To aid blood circulation and help dilate the veins, each subject soaked his or her hand and arm in warm water before the fingerstick was made. Blood was collected in capillary tubes approximately 2 mm in diameter and 12 cm long and sealed with pyseal and a rubber stopper. To separate the cells from the serum portion of the blood, the capillary tubes were centrifuged at 2500 rpm for 20 minutes. The serum was then transferred to small vials, sealed with parafilm and frozen at -5 C until cholesterol analyses could be made.

Blood for hemoglobin determinations was drawn directly into a 20 microliter capillary pipette and transferred into a test tube containing Drabkins solution at the time of the initial fingerstick.

Cholesterol Determination

Serum was analyzed for total cholesterol employing a colorimetric method described by Kim and Goldberg (1969) using a stable Liebermann-Burchard reagent (Appendix E). The cholesterol determination for each subject was performed in duplicate. Standards containing known amounts of cholesterol were determined each time a new assay was

performed. All cholesterols were determined using a Bausch and Lomb spectrophotometer which was zeroed at 625 nm using Liebermann-Burchard reagent as a blank.

Hemoglobin Determination

Hemoglobin levels were determined by the cyanomethemoglobin method which utilizes Drabkins solution. All hemoglobins were determined at 540 nm using a Bausch and Lomb spectrophotometer within two hours after the blood had been taken. A commercially prepared standard containing a specified amount of hemoglobin was used each time hemoglobin determinations were made. Drabkins solution was used as a blank.

Statistics

Variables were classified and coded as described in Table 1. Diet quality and animal fat intake were rated according to the method described in the questionnaire section of Methods and Procedures.

Pearson product moment correlation coefficients were calculated for both sexes for the variables described in Table 1. Means and standard deviations were also determined for the same variables.

Table 1. Classification and coding of the variables

Classification	Coding
Height	Inches
Weight	Pounds
Age	Years
Hemoglobin	ml/100 ml blood
Systolic blood pressure	mm mercury
Diastolic blood pressure	mm mercury
IPAT	Raw scores
Diet quality	Good, 1; fair, 2; poor, 3
Animal fat intake	High, 1; moderate, 2; low, 3
Regular exercise	Yes, 1; no, 2
Smoking	Yes, 1; no, 2
Pulse	Beats/min.
Cholesterol	mg/100 ml blood

RESULTS AND DISCUSSION

For approximately the past 18 years, beginning in 1955, a group of people have had their serum cholesterol levels, height, weight, age and hemoglobin values monitored. In addition to the aforementioned bioclinical factors, dietary factors, general health and stress factors or anxiety levels have been measured since 1968 to determine if a trend exists in some particular area that would be an accurate predictor of coronary artery disease.

Serum Cholesterol Levels

When the study began in 1955 and for the following seven years the serum cholesterol levels of 321 subjects were monitored. At that time these subjects were school children with their ages ranging from 7-9 years in the first year, continuing until they were aged 13-16 years, seven years later. In 1968, approximately five years later, 86 of these original 321 subjects were able to participate in a follow-up study. Their ages were now between 19 and 22 years. Again in 1974 these same 321 subjects were contacted for a sixth time and asked to participate in another follow-up study. For the 1974 study, only 30 subjects could participate. They have now reached an age, 26-29 years, when the chance of a heart attack is increased, especially for the males.

Serum cholesterol levels have been an important indicator in connection with the development of atherosclerosis and coronary heart disease (Kim and Goldberg, 1969; Friedman and Goldberg, 1973; Shattil

et al., 1975; Whyte, 1975). Table 2 shows the changes in mean cholesterol levels for males and females in each test period.

Table 2. Changes in the mean total cholesterol for males and females for each test period

Test period	Year	Age	Mean total cholesterol mg/100 ml	
			Male	Female
1	1955	7- 9	188	189
2	1958	9-12	192	187
3	1960	11-14	174	184
4	1962	13-16	182	200
5	1968	19-22	212	164
6	1974	26-29	240	215

For the males, the cholesterol level shows an increase starting at approximately the 11-14 age group and continuing through the 26-29 age group. The research done by Boyle et al. (1968), McKee et al. (1971), Segers and Mertens (1974) and Whyte (1975) confirms the fact that serum cholesterol levels rise with advancing age. This phenomenon is true for men, but for women only after menopause (Whyte, 1975).

Figure 1 displays the mean cholesterol levels for each of the six test periods. Note that for the first three test periods the means behave in an almost linear fashion. Starting at the fourth test period and continuing through the sixth test period a sharp rise in mean cholesterol levels is seen for the males. At the fifth test

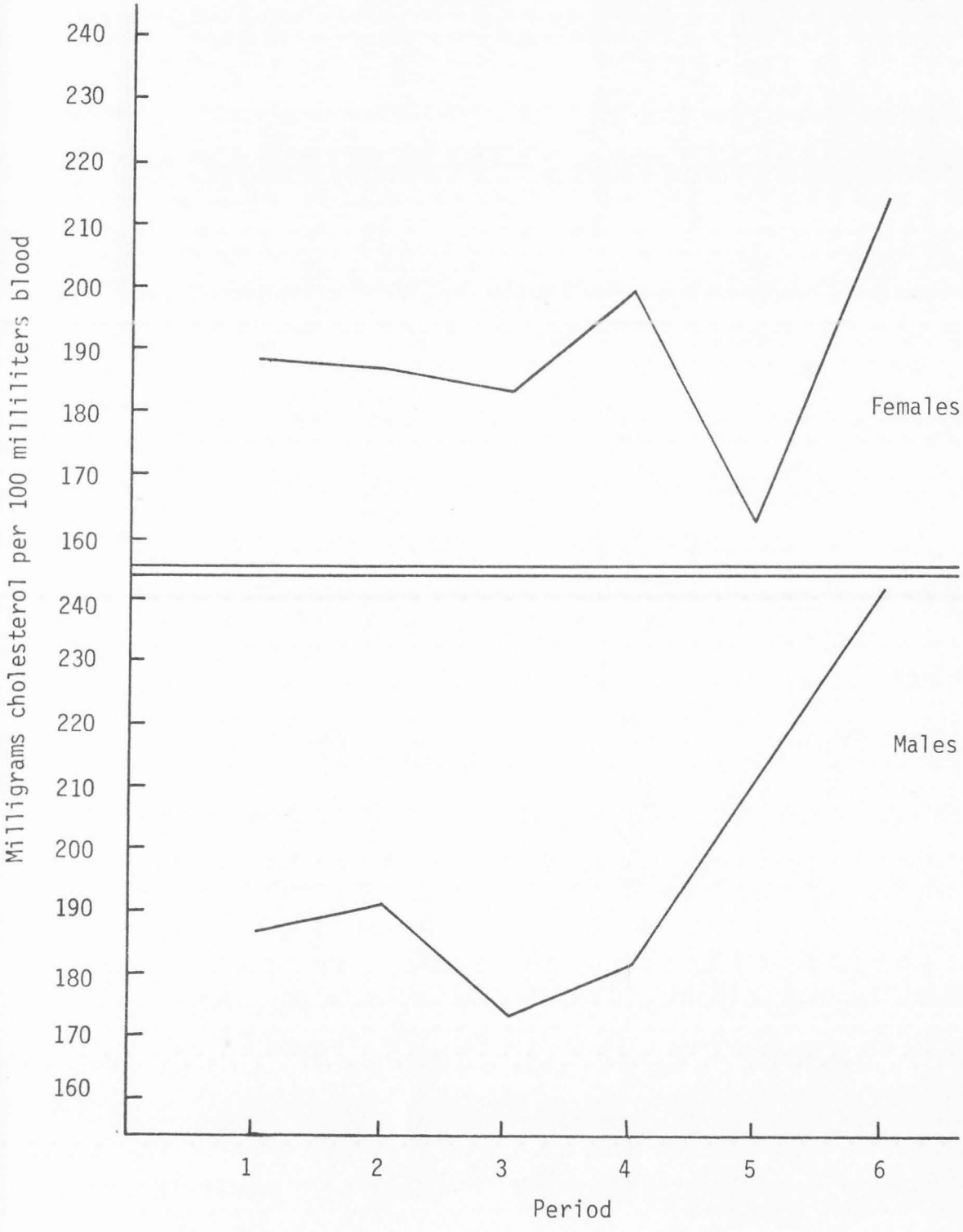

Figure 1. Mean serum cholesterol values for each test period

period the females experience a sharp drop in the mean cholesterol level followed by a sharp rise during the sixth test period. Wein (1969) attributes the sudden decrease in the mean cholesterol levels for the females during the fifth test period to a change in lifestyle. She suggests that these women may be more physically active at this age, 19-22 years, since they are college students who walk to school instead of being bussed and homemakers with young children to care for. However, this author is more inclined to attribute this decrease in serum cholesterol seen in young women at ages 19-22 years to a period of weight consciousness. Women in this age group are typically figure conscious; therefore, losing weight and keeping it off is of prime importance.

Hemoglobin Levels

It has been hypothesized that hemoglobin levels and cholesterol levels are related. From the means given in Table 3, it would appear that there is no apparent relationship between the two factors even though the values for hemoglobin and cholesterol did rise for both sexes in the sixth test period.

Comparison of Figure 1, mean cholesterol values, with Figure 2, mean hemoglobin values, shows this simultaneous rise in cholesterol and hemoglobin in the sixth test period and the lack of any relationship in the previous test periods.

Table 3. Mean serum cholesterol and hemoglobin values for 30 subjects for each test period

Hemoglobin, g/100 ml blood	1	2	3	4	5	6
WOMEN	12.0	12.1	13.7	13.6	11.6	13.9
MEN	11.8	12.2	13.6	14.5	11.7	16.4
Cholesterol, mg/100 ml blood						
WOMEN	189	187	184	200	164	215
MEN	188	192	175	183	212	240

Body Build

For the first four test periods the subjects were classified into weight categories using the Wetzel grid. In the 1968 study, subjects were classified as underweight, desirable weight and overweight using the Metropolitan Life Insurance Company tables of standard weights (1959). The present study has used the same weight classification as the 1968 study.

Table 4, which was taken from Wein (1969) with the corresponding data added for period 6, shows the numbers and percentages of subjects falling into each of three weight categories. For period 6 the percentage of persons falling into the desirable weight category fell markedly from previous years while there was a marked rise in the percentage of persons who were overweight. Figure 3 compares the percentage weight change for both sexes that occurred during each test

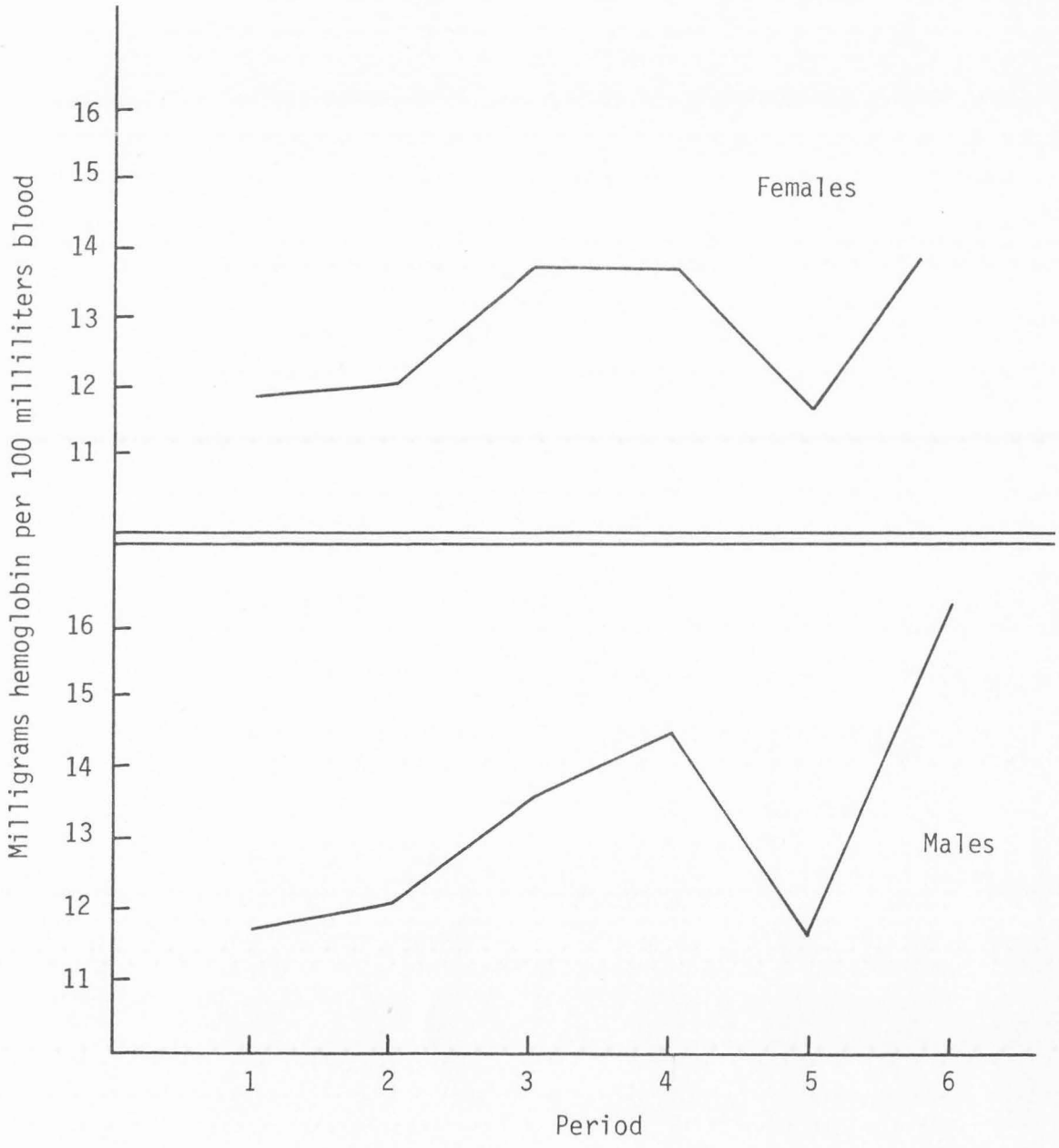

Figure 2. Mean hemoglobin values for each test period

Table 4. Incidence of underweight, desirable weight, and overweight by year and sex, as shown by number of subjects

Year	Underweight				Desirable Weight				Overweight			
	Male	Female	Total		Male	Female	Total		Male	Female	Total	
	Number	Number	Number	Percent	Number	Number	Number	Percent	Number	Number	Number	Percent
1	18	13	31	36	23	25	48	56	1	6	7	8
2	20	15	35	41	18	23	41	48	4	6	10	12
3	20	14	34	40	16	23	39	45	6	7	13	15
4	12	12	24	28	24	20	44	51	6	12	18	21
5	6	5	11	13	29	32	61	71	7	7	14	16
6	5	6	11	37	0	2	2	7	9	8	17	57

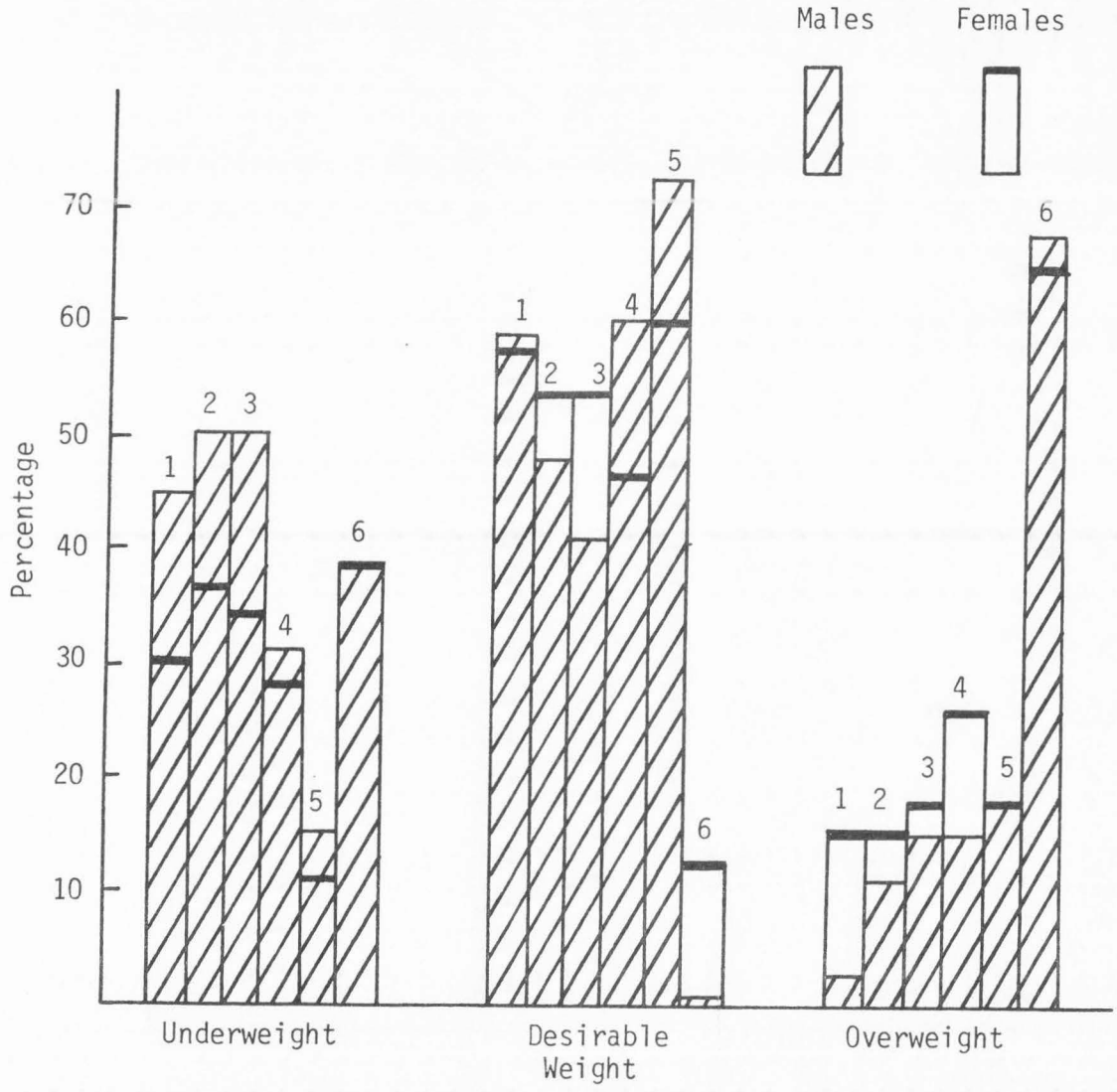

Figure 3. Comparison of percent change between males and females in each weight class for each test period

period in the underweight, desirable weight and overweight categories. Note that for the sixth test period the percentage of females falling into the desirable weight category was greater than that for males and the percentage of males falling into the overweight category was slightly greater than that for females. Perhaps the greater percentage of overweight males during the sixth period is due to the fact that all of the male subjects were married with wives to prepare regular meals and their occupations generally provide little exercise. The female subjects who were married all had young families to care for which could account for many of the female subjects being classified as either underweight or desirable weight.

The greater incidence of overweight in males during the sixth test period could in part be responsible for the rise in serum cholesterol seen during the sixth test period. Table 5 shows that the mean serum cholesterol for both sexes is higher in the overweight category than either the underweight or desirable weight category.

The research findings of many authors correlate overweight and obesity with elevated serum cholesterol levels (Albrink and Meigs, 1964; Waxler and Craig, 1964; Armstrong, 1967; Anonymous, 1968; Baladimos et al., 1968).

Anxiety

The findings of Rahe and Arthur (1967), Kasl et al. (1968), O'Leary et al. (1968), Rahe et al. (1968, Bruhn et al. (1969), and Segers and Mertens (1974) have pointed to increased anxiety levels as a factor causing elevated serum cholesterol levels. Figure 4 compares

Table 5. Mean cholesterol values for the sixth test period for both sexes and three weight categories

	Mean cholesterol (mg/100 ml)		
	Underweight	Desirable Weight	Overweight
WOMEN	203	199	231
MEN	203	---	264

the mean anxiety levels as determined by the IPAT anxiety scale questionnaire of the 30 subjects participating during the sixth test period to the mean serum cholesterol levels for the same 30 subjects classified as having low, average or high anxiety levels. The most striking characteristic of Figure 4 is that the cholesterol-anxiety relationship for males is approximately the inverse of the cholesterol-anxiety relationship seen for females.

The research that has been done with anxiety levels and their effect on serum cholesterol levels has involved either a combination of men and women considered as a single group or men as the only subjects considered. The fact that women showed a decrease in anxiety with increasing serum cholesterol levels in the study being reported here is a topic that merits further research.

Questionnaire Data

Table 6 relates some of the questionnaire findings to serum cholesterol levels determined for the sixth test period.

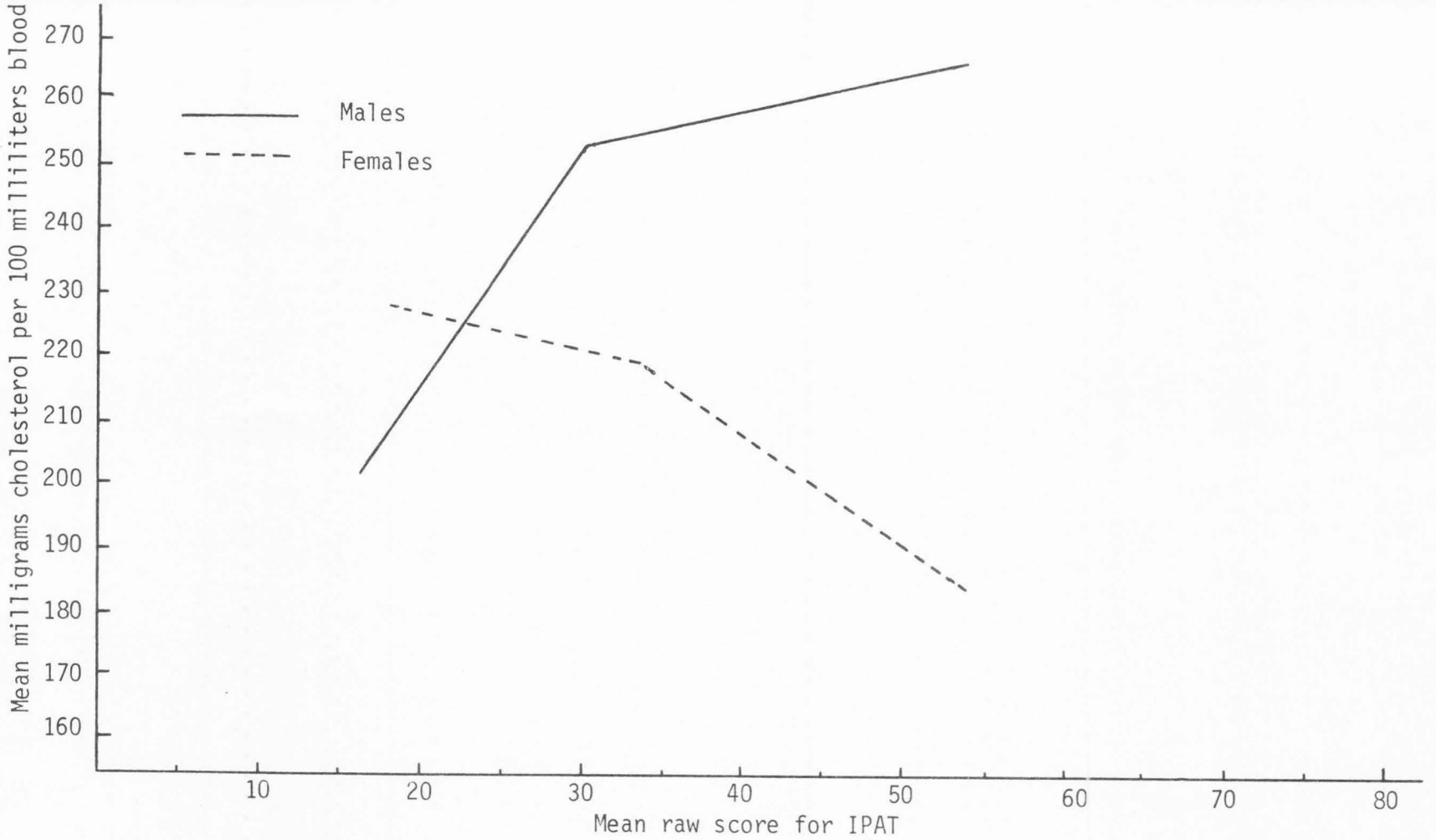

Figure 4. Mean cholesterol levels compared to mean IPAT anxiety raw scores for males and females. For males low anxiety included scores from 0-20, average anxiety 21-38 and high anxiety 39-80. For females low anxiety included scores from 0-23, average anxiety 24-40, and high anxiety 41-80.

Table 6. Questionnaire data comparing factors influencing serum cholesterol levels for the sixth test period

	Cholesterol, mg/100 ml	
	Over 250	Under 210
Anxiety, IPAT raw score (mean)		
Male	30.5	18.8
Female	33.6	37.4
Weight, percent overweight		
Male	86	40
Female	80	20
Regular exercise routine, percent		
Male	50	40
Female	40	40
Fat in diet, percent high unsaturated		
Male	50	20
Female	60	40
Change in cholesterol, percent increased		
Male	46.1	30.8
Female	31.2	50

The information in Table 5 points out that serum cholesterol levels are influenced by many factors. The questionnaire data will be discussed more thoroughly in the following section.

Statistical Analyses

Variables considered for statistical analysis are height, weight, age, hemoglobin levels, systolic blood pressure, diastolic blood pressure, IPAT anxiety test scores, quality of the diet (good, fair or poor), high, medium or low fat diet, whether or not a subject had a regular exercise routine, whether or not a subject smoked, pulse rate and serum cholesterol levels. Tables 7 and 8 give the means and standard deviations of each variable for males and females. The large standard deviation shown for cholesterol level in Table 7 could be because a cholesterol level of 400 mg/100 ml was determined for one man.

Pearson product moment correlation coefficients were calculated for each of the aforementioned variables. Tables 9 and 10 show the matrix of correlation coefficients for males and females. As would be expected, significant correlations were found between systolic and diastolic blood pressures for both males and females ($p < .001$).

For females, significant negative correlations were found between height and cholesterol ($p < .01$), weight and diet quality ($p < .01$) and hemoglobin and diet quality ($p < .05$). The significant negative correlation between hemoglobin levels and diet quality is the opposite of the accepted hypothesis which states that the better the diet the higher the hemoglobin levels are likely to be. However, the system

Table 7. Means and standard deviations for both bioclinical and questionnaire data for males

Variable	Mean	Standard deviation
Height	70.08	2.56
Weight	177.77	27.53
Age	27.00	0.91
Hemoglobin	23.42	5.94
Systolic blood pressure	107.38	33.40
Diastolic blood pressure	70.08	22.08
IPAT	24.15	11.36
Diet	12.33	1.46
Fat	1.92	0.76
Exercise	2.23	0.60
Smoking	2.23	1.17
Pulse	64.38	22.34
Cholesterol	269.38	130.99

Table 8. Means and standard deviations for both bioclinical and questionnaire data for females

Variable	Mean	Standard deviation
Height	63.75	2.29
Weight	134.44	32.20
Age	27.44	1.09
Hemoglobin	12.90	3.82
Systolic blood pressure	101.06	29.04
Diastolic blood pressure	70.75	22.42
IPAT	33.69	9.86
Diet	8.95	2.35
Fat	1.63	0.62
Exercise	2.13	0.34
Smoking	1.94	0.25
Pulse	75.50	8.94
Cholesterol	216.50	56.32

Table 9. Pearson product moment correlation coefficients for males subjects for sixth test year. Correlations are for height, weight, age, hemoglobin (HB), systolic blood pressure (SYST), diastolic blood pressure (DYST), IPAT, diet quality (DIET), animal fat in the diet (FAT), exercise regularly (EXERCI), smoking (SMKNG), pulse and serum cholesterol (CHOL).

	HEIGHT	WEIGHT	AGE	HB	SYST	DYST	IPAT	DIET	FAT	EXERCI	SMKNG	PULSE	CHOL
HEIGHT	1.0000	0.5031*	0.2492	-0.2134	-0.2659	-0.3166	0.3913	0.2484	-0.2534	-0.2837	-0.0064	0.0576	-0.1239
WEIGHT			0.4145	0.2951	0.2982	0.2714	0.4897*	-0.0677	-0.4911*	-0.0824	-0.1514	0.3814	0.0151
AGE				-0.1613	0.0765	0.0248	-0.0241	0.3126	-0.2404	0.1524	0.0783	0.1635	0.0348
HB					0.7793***	0.7353**	0.0523	-0.7851***	-0.5388**	-0.0321	-0.3522	0.6687**	-0.1135
SYST						0.9709***	-0.0318	0.4714*	-0.5571**	-0.2796	0.0082	0.8700**	0.2144
DYST							-0.0661	-0.4078	-0.4369	-0.3102	0.0705	0.8053	0.2873
IPAT								-0.1893	0.0208	-0.1280	-0.1602	0.2401	0.0432
DIET									0.4379	-0.2365	0.3822	-0.4833**	0.3904
FAT										-0.1409	-0.0724	-0.5924**	0.0012
EXERCI											-0.0826	-0.4617*	-0.2603
SMKNG												-0.0229	0.7944***
PULSE													0.1289
CHOL													1.0000

*p < .05 **p < .01 ***p < .001

Table 10. Pearson product moment correlation coefficients for female subjects for sixth test year. Correlations are for height, weight, age, hemoglobin (HB), systolic blood pressure (SYST), diastolic blood pressure (DYST), IPAT, diet quality (DIET), animal fat in the diet (FAT), exercise regularly (EXERCI), smoking (SMKNG), pulse and serum cholesterol (CHOL).

	HEIGHT	WEIGHT	AGE	HB	SYST	DYST	IPAT	DIET	FAT	EXERCI	SMKNG	PULSE	CHOL
HEIGHT	1.000	0.0729	-0.0598	-0.0547	0.1523	0.1749	0.1671	0.0286	0.1642	0.2126	-0.0290	0.1300	-0.5906**
WEIGHT			0.3502	0.0023	0.3712	0.2468	-0.0218	-0.5208**	0.2462	-0.0296	0.2190	-0.2225	0.3566
AGE				0.0845	-0.0786	-0.0605	-0.2646	0.1318	0.3569	0.3793	0.3505	-0.4536	0.0287
HB					0.0200	-0.0789	0.3433	-0.4689*	0.2647	0.0868	-0.0767	0.0185	-0.2610
SYST						0.9105***	0.2272	-0.3469	0.2906	0.0865	-0.0637	-0.1884	0.2660
DYST							0.1437	-0.1904	0.1561	0.2568	0.0565	0.0053	0.1694
IPAT								-0.3481	-0.0205	-0.1459	-0.0355	0.1418	-0.1736
DIET									0.0215	-0.0545	-0.1188	0.0258	-0.2471
FAT										-0.0788	-0.1615	-0.1687	-0.1032
EXERCI											0.0976	0.0437	-0.1941
SMKNG												-0.1641	0.2817
PULSE													-0.1566
CHOL													1.0000

*$p < .05$ **$p < .01$ ***$p < .001$

for evaluating diet quality could be at fault in this instance because the amount of iron in any diet was not taken into account when a diet was rated good, fair, or poor; therefore, hemoglobin levels may not be a reflection of diet quality in this study.

Even though the number of males participating in the present study is smaller than the number of females, the males had more significant correlations. There were significant positive correlations between weight and height ($p < 0.05$), weight and IPAT ($p < .05$), hemoglobin with systolic blood pressure ($p < .001$), hemoglobin with diastolic blood pressure ($p < .01$), hemoglobin with pulse ($p < .01$), systolic blood pressure with pulse ($p < .01$) and smoking with cholesterol levels ($p < .001$). Significant negative correlations were found between weight and animal fat in the diet ($p < .05$), hemoglobin with diet quality ($p < .001$), hemoglobin with animal fat in the diet ($p < .05$) ($p < .05$), systolic blood pressure with diet quality ($p < .05$), systolic blood pressure with animal fat in the diet ($p < .01$), animal fat in the diet with pulse rate ($p < .01$) and exercise with pulse rate ($p < .05$).

It is interesting to note the positive correlation between weight and IPAT anxiety scores. Figure 3 shows a marked rise in the percentage of males who were overweight in the sixth test period and Figure 4 shows a rise in serum cholesterol levels with increased anxiety in males. This information suggests that maybe there is an interrelationship between weight, anxiety and serum cholesterol levels.

The positive correlation between smoking and cholesterol is in agreement with the findings of Doyle et al. (1964), McKee et al. (1971)

and Mulcahy and Hickey (1974). However, the reader is reminded to bear in mind the post hoc fallacy when evaluating the correlation between smoking and cholesterol.

SUMMARY AND CONCLUSIONS

For approximately 18 years 30 subjects comprised of both sexes have been studied six times to determine if there was a relationship among serum cholesterol levels, body weight, age, sex, hemoglobin, diet, general health and stress or anxiety levels.

From the past five test periods, beginning at age 7 and going through age 22 years, it was determined that beginning in approximately the fourteenth year serum cholesterol levels begin to rise. This rise was seen for males through the sixth test period but females experienced a drop in serum cholesterol levels in the fifth test period, 19-22 years of age, followed by a rise during the sixth test period, 27-29 years of age.

The incidence of overweight in 1974 has increased for both sexes. This increase in percent overweight was accompanied by elevated serum cholesterol levels, with the average cholesterol level for overweight males being 264 mg/100 ml and for overweight females 231 mg/100 ml.

High anxiety levels also influenced serum cholesterol levels. For males, as the anxiety level increased, so did serum cholesterol levels; but females showed a decrease in serum cholesterol levels with increasing anxiety.

When serum cholesterol levels and dietary fat were compared, it was found that a greater percentage of subjects whose diet was rated as being high in animal fat had serum cholesterol levels above 250 mg/100 ml. Those subjects whose diet was rated as being moderate to low

in animal fat generally had serum cholesterol levels below 250 mg/ 100 ml.

The relationship between overweight and serum cholesterol increases with progressing age, although serum cholesterol levels are greater for overweight adult males than overweight adult females.

The positive relationship between serum cholesterol levels and anxiety seen in the males is in agreement with various research; but the negative relationship between serum cholesterol and anxiety for women is something that has not been reported before. Therefore, it is recommended that IPAT anxiety tests be administered to and serum cholesterol levels determined for another group of female subjects in the age range 27-29 years to determine if the negative relationship between serum cholesterol and anxiety can be repeated.

The objective of this longitudinal study has been to determine if there is a relationship between various risk factors thought to cause atherosclerosis and coronary heart disease and serum cholesterol levels originating during childhood. Based on the results of the previous studies (Milligan, 1965; Wein, 1969) and the results of the present study, it can be concluded that the process of preventing atherosclerosis and coronary heart disease is primarily an educational one, namely, the establishment of good habits during childhood that will carry over to adulthood. For example, if a person is taught good dietary habits as a child, chances are that those good habits will last a lifetime. The establishment of good habits and the initiation of a change process to help prevent coronary artery diseases may perhaps begin with children educating parents.

Obesity is most often the result of overeating and lack of exercise which often results in elevated serum cholesterol. If a regular (daily) exercise program can be established, most of the time appetite is affected in such a way that overeating is eliminated, thereby controlling obesity and lowering serum cholesterol levels.

It would appear that the factors which constitute high risk when referring to atherosclerosis and coronary heart disease are interrelated. Therefore, a person must be assessed according to the presence or absence of many risk factors rather than looking at each risk factor separately.

As the subjects evaluated in this research advance in age, a great many of the recognized risk factors will become more apparent. Therefore, it is recommended that a follow-up study involving the same subjects reported on herein be conducted in 10-15 years' time to assess what changes, if any, have occurred that would further aid in the prediction of atherosclerosis and coronary heart disease. It is also recommended that serum triglyceride values be assessed, since there is increasing evidence in the literature indicating that elevated serum triglyceride levels are as important as elevated serum cholesterol levels when identifying predictors of atherosclerosis and coronary heart disease.

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APPENDIXES

Appendix A

SAMPLE LETTER

Department of Nutrition and Food
Sciences, UMC 29
November 1, 1973

Dear

In the past years your sons or daughters have cooperated in a cholesterol study conducted by the Department of Nutrition and Food Sciences at Utah State University. It has been five years since they were last contacted, and since this is a longitudinal study, we would appreciate their help again.

Using the enclosed post card, would you please inform me of the present addresses and phone numbers of:

I need to get in touch with them as soon as possible. If you would return the post card with the requested information at your earliest convenience, I would appreciate it very much.

Thank you so much for your help.

Sincerely,

Kris Saunders

Deloy G. Hendricks, Ph. D.

Appendix B

SAMPLE LETTER

Department of Nutrition and
Food Sciences, UMC 29
November 1, 1973

Dear

It has been five years since you were last contacted concerning your participation in a cholesterol study conducted by the Department of Nutrition and Food Sciences at Utah State University. Since this is a longitudinal study, your help is required once again. We sincerely appreciated your cooperation in the two previous studies, the first during your elementary and high school days and the second in 1968. The success of the present project depends on your help and cooperation, and the information obtained will be used to complete a Master's thesis.

As before, we will need a sample of your fingertip blood and your present height and weight. Also, there will be two questionnaires to complete, one dealing with your general health and diet and the other dealing with anxiety levels.

We need to know as soon as possible if you will be able to come to _____ on _____.

Breakfast will be served here after blood samples have been taken, so please do not eat anything before that time.

Please return the enclosed post card at your earliest opportunity and include the following information:

1. Whether or not you are able to participate.
2. Day and time you are able to participate.
3. Maiden name.

Thank you so much for your time and cooperation.

Sincerely,

Kris Saunders

Deloy G. Hendricks, Ph. D.

Appendix C

SAMPLE LETTER

Department of Nutrition and Food
Sciences, UMC 29
March 6, 1974

Dear

Our records show that in the past, during your elementary and high school years and possibly after, you have been involved in a cholesterol study conducted by the Department of Nutrition and Food Sciences at Utah State University.

This project has been "earmarked" as a longitudinal study; therefore, we need your help again. A longitudinal study of this nature could prove valuable in pin-pointing problems relating to coronary heart disease. In the next few years many of the persons involved in this study will be reaching the age when heart attacks most frequently occur. Consequently, your participation is vital.

Enclosed please find two questionnaires, one dealing with diet and general health and the other dealing with anxiety. Please complete these questionnaires, leaving nothing blank, and return them in the stamped, addressed envelope provided at the earliest opportunity. Also, if you know your present serum cholesterol and/or serum triglyceride level, please include them.

The information you will provide will be combined with previous data and used for a Master's thesis.

Thank you for your time and your cooperation.

Sincerely,

Kris Saunders

Deloy G. Hendricks, Ph. D.

Appendix D

Questionnaire

UTAH STATE UNIVERSITY--LONGITUDINAL CHOLESTEROL STUDY

SECTION 3--1973

GENERAL HEALTH AND DIET QUESTIONNAIRE

Name _____

Maiden Name _____

Address _____

_____

Phone _____

Parent's Name _____

Parent's Address _____

_____

Which elementary school did you attend?

_____ Central School (Brigham City)

_____ Garland School (Garland)

_____ Ellis (Logan)

_____ Woodruff (Logan)

_____ Lincoln (Hyrum)

_____ Summit (Smithfield)

GENERAL HEALTH QUESTIONNAIRE

Date _____ Occupation _____

Sex _____ Are you pregnant at present? Yes__

No __

Age _____

Height _____ Expected date of delivery _____

Weight _____ Number of children you have _____

For the following questions please place a check mark after the appropriate word.

1. What level of activity best describes your daily routine?

   1. Mostly sedentary ___ 2. Moderate ___ 3. Strenuous ___

   Do you have a regular routine of physical activity?

   1. Yes ___ 2. No ___

2. Do you feel you are under stress in your everyday work?

   1. A great deal ___ 2. Moderate ___ 3. Very little ___

3. Do you smoke?

   1. Yes ___ 2. No ___

   If yes, regularly ___ or occasionally___ ?

   If yes, how long? ____ years ___ months

4. Have you had any infectious disease in the past six-eight years?

   1. Yes ___ 2. No ___

   Measles: Red___ German ___

   Mumps ___

   Strept throat ___

   Rheumatic fever ___

   Bronchitis ___

Contact with persons who have T.B. or a positive T.B. skin test ___

Other (please specify) _____

5. Do you have any allergies?

   1. Yes ___ 2. No ___

   Do you have asthma?

   1. Yes ___ 2. No ___

6. Have you had any surgical operations in the past 6-8 years?

   1. Yes ___ 2. No ___

   If yes, what type? _____

7. Are you presently taking any medication?

   1. Yes ___ 2. No ___

   If yes, what type? _____

8. How frequently do you visit your doctor?

   1. Less than once a year ___ 2. 1-2 times a year ___

   3. More than 2 times a year ___

   How frequently do you visit your dentist?

   1. Less than once a year ___ 2. 1-2 times a year ___

   3. More than 2 times a year ___

9. Have you ever been overweight?

   1. Yes ___ 2. No ___

   If yes, for how long?

   1. Several years ___ 2. Several months ____

   If yes, at what age? _____

   Have you ever experienced chronic weight loss?

   1. Yes ___ 2. No ___

   If yes, at what age? _____

How long did it last?

1. Several years ___ 2. Several months ___ 3. Several weeks ___

10. Have you had any heart trouble?

1. Yes ___ 2. No ___

11. Do you have one or more grandparents living?

1. Yes ___ 2. No ___

12. Have any of your grandparents, parents, aunts or uncles died of a heart attack?

1. Yes ___ 2. No ___

If yes, which? 1. Grandparents ___ 2. Parents

3. Aunts or uncles ___

If yes, at what age? Under 60 ___ 80-90 ___

60-69 ___ 90 and over ___

70-79 ___

DIET QUESTIONNAIRE

How often do you eat the following foods? Please place a check mark in the appropriate column.

	Never or practically never	Less than once a week	1 to 3 times a week	4 to 7 times a week	More than once a day	More than twice a day
1. Leafy green vegetables such as lettuce, spinach, broccoli						
2. Yellow vegetables						
3. Citrus fruit or juice such as oranges, grapefruit, tomatoes, raw cabbage						
4. Potatoes (white)						
5. Other vegetables						
6. Other fruit						
7. Bread						
8. Cereals						
9. Poultry						
10. Fish and sea food						
11. Meat: Beef						
Pork						

	Never or practically never	Less than once a week	1 to 3 times a week	4 to 7 times a week	More than once a day	More than twice a day
Organ meats such as liver						
Other meat						
12. Eggs						
13. Milk--Whole						
Low fat (2%)						
Skim						
14. Cheese-cottage						
15. Ice cream						
16. Cream--Half and Half or coffee cream						
Whipping						
Sour						
Dried non-dairy substitute						
17. Pie or pastry						
18. Other flour products such as cake, muffins, pancakes, macaroni, etc.						
19. Butter						
Margarine						

	Never or practically never	Less than once a week	1 to 3 times a week	4 to 7 times a week	More than once a day	More than twice a day
20. Gravies and sauces made with fat						
21. Salad dressings						
22. French fries and potato chips						
23. Peanut butter and nuts						
24. Sweets such as sugar, jam, jelly, honey, syrup, candy, etc.						
25. Soft drinks						
26. Tea, coffee						
27. Alcoholic beverages						

28. Approximately how much sugar do you consume each day (in coffee, on cereals, on fruit, etc.)? _____ tbsp.

29. How much cream do you consume each day? _____ tbsp.

30. How much butter do you consume each day? _____ tbsp.

31. How much margarine do you consume each day? _____ tbsp.
What brand of margarine do you use? _____

32. Do you generally trim the visible fat off your meat?
1. Yes ____ 2. No ___

33. What kind of fat do you use mainly in cooking?
1. Animal fat such as lard, butter cream, bacon drippings _____
2. Solid vegetable shortening such as Crisco, Spry, margarine ___
3. If margarine, please specify brand _____
4. Vegetable oils such as Wesson, Mazola, etc. _____

34. Have you consciously made any shift from your usual use of fats to the more polyunsaturated fats in the past few years?
1. Yes ___ 2. No ___
If yes, what specific food changes have you made ? _____

_____

If yes, why? Advertising ____ On doctor's advice _____
Cooking preference or flavor preference ____

35. Are there any foods which are limited in your diet?
1. Yes ____ 2. No ___
If yes, which foods? _____
If yes, why? _____

36. Do you take vitamin and/or mineral supplements?
1. Yes ___ 2. No ___
If yes, how often? 1. Less than once daily ___
2. Once daily ____
3. More than once daily ___

37. Have you ever been on a therapeutic (or special) diet, such as an ulcer diet, a weight control diet, prescribed by a doctor?
1. Yes ___ 2. No ___
If yes, what type of diet? _____
If yes, for how long? 1. Several months ___ 2. Several weeks___
If yes, at what age? _____

38. Is the water you use for consumption and cooking hard ___ or soft ____?

39. If you drink coffee, how many cups do you drink per day?
1. 1-2 cups __ 2. 3-5 cups ____ 3. 6 and over ____

40. If you smoke, do you smoke a high or low tar cigarette? _____

Appendix E

SERUM CHOLESTEROL ASSAY

REAGENT: Liebermann-Burchard Reagent.

Cool acetic anhydride and concentrated sulfuric acid in ice water or in the freezer compartment. To a 500 ml amber glass bottle fitted with a polyseal cap, add 220 ml of cold acetic anhydride and 200 ml of glacial acetic acid. Mix by inversion and add 30 ml of cold concentrated sulfuric acid. The reagent is ready for immediate use and is stable for more than 6 months when stored at 4^{o} F in the dark. When stored at room temperature, the reagent shows signs of deterioration (darkening) after 1-2 weeks.

PROCEDURE:

1. Place 2.5 ml Liebermann-Burchard reagent in each test tube.
2. Add 40 microliters of the serum and mix well.
   a. For standards, use 0, 40 or 80 microliters of serum containing a known amount of cholesterol respectively to each of 3 test tubes.
3. Place in water bath at 37^{o} for 16 minutes.
4. Let stand to cool at room temperature for 5 minutes.
5. Read at 625 nm.
6. Take second readings 5 min. after the first.

VITA

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Candidate for the Degree of

Master of Science

Thesis: A Longitudinal Study, Part III: The Relationship of Weight, Health Status, Diet and Anxiety to Serum Cholesterol Levels in Adults

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