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Effects of Social and Demographic Characteristics, Knowledge of Coronary Heart Disease and Dietary Practices on the Level of Serum Cholesterol

Wendy Whanghea Kim
Utah State University

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EFFECTS OF SOCIAL AND DEMOGRAPHIC CHARACTERISTICS, 
KNOWLEDGE OF CORONARY HEART DISEASE AND 
DIETARY PRACTICES ON THE LEVEL 
OF SERUM CHOLESTEROL 

by 
Wendy Whanghea Kim 

A dissertation submitted in partial fulfillment 
of the requirements for the degree 
of 
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in 
Nutrition and Food Sciences 

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UTAH STATE UNIVERSITY 
Logan, Utah 

1979
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Wendy Whanghea Kim
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>viii</td>
</tr>
</tbody>
</table>

## Chapter

I. INTRODUCTION ............................................. 1
   Justification of the Study ......................... 5
   Objectives of the Study .......................... 8
   Significance of the Study ....................... 10

II. REVIEW OF LITERATURE ............................... 12
   Demographic Factors on Nutritional Knowledge,  12
   Changes in Attitude and Behavior ............... 12
   Behavior Patterns, Serum Cholesterol Concentration 18
   and Coronary Heart Disease ...................... 18
   Demographic and Social Variables, Physical Activity, 23
   Body Weight and the Changes in Blood Cholesterol Concentration ........ 23
   Presence of Disease(s) on Behavior Variables and 31
   the Blood Cholesterol Concentration .......... 31
   Dietary Lipids and Blood Cholesterol Concentration .. 34
   The Proposed Model Construction ............... 48
   Hypotheses .............................................. 52

III. DATA AND METHODS .................................. 56
   Selection of Sample and Data Collection ........ 56
   Operationalization of Variables ............... 58
   Method of Data Analysis ......................... 71

IV. ANALYSIS OF DATA .................................... 76
# TABLE OF CONTENTS (Continued)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics of Sample Population</td>
<td>76</td>
</tr>
<tr>
<td>Results and Discussion</td>
<td>83</td>
</tr>
<tr>
<td>V. SUMMARY AND CONCLUSIONS</td>
<td>123</td>
</tr>
<tr>
<td>Summary</td>
<td>123</td>
</tr>
<tr>
<td>Conclusions</td>
<td>125</td>
</tr>
<tr>
<td>Suggestions for Further Study</td>
<td>131</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>133</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>147</td>
</tr>
<tr>
<td>Appendix A. Cover Letter and Consent Form</td>
<td>149</td>
</tr>
<tr>
<td>Appendix B. Dietary Record Forms</td>
<td>152</td>
</tr>
<tr>
<td>Appendix C. Questionnaire</td>
<td>157</td>
</tr>
<tr>
<td>Appendix D. Metabolic Costs for Various Occupational and Leisure Tasks</td>
<td>170</td>
</tr>
<tr>
<td>VITA</td>
<td>172</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Distribution of Respondents by Socio-demographic Characteristics, Knowledge of Coronary Heart Disease, Dietary Practices, and Serum Cholesterol Level</td>
<td>78</td>
</tr>
<tr>
<td>2</td>
<td>Means and Standard Deviations of Socio-demographic Characteristics, Knowledge of Coronary Heart Disease, Dietary Practices, and Serum Cholesterol Level</td>
<td>81</td>
</tr>
<tr>
<td>3</td>
<td>Zero-Order Correlation Matrix, Means, and Standard Deviations of All Variables in the Model</td>
<td>84</td>
</tr>
<tr>
<td>4</td>
<td>Regression Coefficients of Independent Variables on Dependent Variables in the Model</td>
<td>85</td>
</tr>
<tr>
<td>5</td>
<td>Means and Standard Deviations of Independent Variables among Two Groups having Different Blood Cholesterol Levels</td>
<td>103</td>
</tr>
<tr>
<td>6</td>
<td>Discriminant Function Coefficients for the Model</td>
<td>105</td>
</tr>
<tr>
<td>7</td>
<td>Classification Results of Blood Cholesterol Level Using the Discriminant Function Analysis for the Sample</td>
<td>106</td>
</tr>
<tr>
<td>8</td>
<td>Zero-Order Correlations, Means, and Standard Deviations of All Variables in the Model for Males and Females</td>
<td>108</td>
</tr>
<tr>
<td>9</td>
<td>Residual Sums of Squares, Degree of Freedom, and Residual Mean Squares for Unconstrained and Constrained Models</td>
<td>110</td>
</tr>
<tr>
<td>10</td>
<td>Test of Significance of the Difference for Each Regression Equation between Male and Female Samples</td>
<td>111</td>
</tr>
<tr>
<td>11</td>
<td>Regression Coefficient of Independent Variables on Dependent Variables in Male and Female Samples</td>
<td>113</td>
</tr>
<tr>
<td>12</td>
<td>Means and Standard Deviations by Independent Variables among Two Groups having Different Blood Cholesterol Levels for Males and Females</td>
<td>119</td>
</tr>
</tbody>
</table>
## LIST OF TABLES (Continued)

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>Discriminant Function Coefficients for Males and Females</td>
<td>121</td>
</tr>
<tr>
<td>14.</td>
<td>Classification Results of Blood Cholesterol Level Using Discriminant Function Analysis for Male and Female Sample</td>
<td>122</td>
</tr>
<tr>
<td>15.</td>
<td>Summary Table</td>
<td>124</td>
</tr>
<tr>
<td>16.</td>
<td>Metabolic Cost of Occupational Activities</td>
<td>170</td>
</tr>
<tr>
<td>17.</td>
<td>Metabolic Cost of Leisure Time Activities</td>
<td>171</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Diagramatic Representation of the Relationship between Variables in the Proposed Model</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Path Diagram Illustrating Results of Empirical Assessment of Direct Effects in the Model</td>
<td>87</td>
</tr>
<tr>
<td>2.</td>
<td>Diagramatic Representation of the Relationship between Variables among Males</td>
<td>115</td>
</tr>
<tr>
<td>3.</td>
<td>Diagramatic Representation of the Relationship between Variables among Females</td>
<td>116</td>
</tr>
</tbody>
</table>
ABSTRACT

Effects of Social and Demographic Characteristics, Knowledge of Coronary Heart Disease, and Dietary Practices on the Level of Serum Cholesterol

by

Wendy Whanghee Kim, Doctor of Philosophy

Utah State University, 1979

Major Professor: Dr. Deloy G. Hendricks
Department: Nutrition and Food Sciences

The purpose of this study was to examine the effects of socio-demographic characteristics, knowledge of coronary heart disease and behavior variables on blood cholesterol concentration among 218 selected subjects in northern Utah communities.

The data were obtained from physicians' medical charts and a survey specifically designed for this study. A model was developed from an intensive review of literature and the current state of theoretical and empirical knowledge and was tested by means of path analysis. The model contained fourteen variables including familial coronary heart disease heredity, sex, age, the presence of disease(s), educational attainment, special dietary regimen, occupation, knowledge about coronary heart disease, Type A/B behavior patterns, attitude toward low-fat, low-cholesterol diets, saturated fat calorie intake, energy expenditure, relative body weight, and blood cholesterol.
concentration. The model was evaluated for the entire sample as well as two subsamples of males and females.

It was found that there was a strong causal relationship between the level of education and knowledge about coronary heart disease (CHD), and between its knowledge and attitude toward low-fat, low-cholesterol diets (less atherogenic diets). Furthermore, it was observed that a favorable positive attitude toward low-fat, low-cholesterol diets served directly to decrease the relative body weight. On the other hand, estimated expenditure of total energy was increased with increasing knowledge about coronary heart disease and in physically active occupations. There was a negative association between the estimated total energy expenditure and blood cholesterol concentration, while a weak positive relationship of relative body weight and saturated fat intake on cholesterol concentration in the blood was observed.

Not only knowledge about coronary heart disease had a direct influence on attitude, but also age had a positive causal effect on attitude toward low-fat, low-cholesterol diets. The direct association of familial coronary heart disease heritability on blood cholesterol concentration was the strongest among other variables, followed by special diets, age, total energy expenditure, and saturated fat intake.

About 28% of the variations in the blood cholesterol concentration among the entire sample could be explained by eleven variables combined compared with 36% for females and 23% for males.
It was shown in the likelihood ratio test that the influence of social and demographic characteristics, knowledge about coronary heart disease, and behavior variables on blood cholesterol concentration was not significantly different between male and female samples.

In conclusion, this research suggests the direction and magnitude of causal relationships between socio-demographic characteristics, knowledge of coronary heart disease and behavior variables and serum cholesterol concentration. Therefore, the findings of this study indicate the potential value of educational programs for the coronary heart disease prevention.

(172 pages)
CHAPTER I
INTRODUCTION

This study is concerned with socio-demographic and behavioral factors and risk conditions of coronary heart disease. Specifically, it is intended to measure the effects of social and demographic characteristics, knowledge of coronary heart disease, and dietary practices on the level of serum cholesterol among a selected sample in northern Utah communities. It is also intended to study whether there is any differences between males and females as to the influences of these factors on cholesterol levels.

Considerable evidence that social and demographic factors, knowledge of coronary heart disease, and behavior variables, are involved in an important way with the increased blood cholesterol level has accumulated during recent years. Among the more intensively studied theories are those of atherogenic dietary habits (Grande, 1974; Leren, 1966; Whyte and Havenstein, 1976), occupational factors (Cassel et al., 1971; Keys, 1975; McDonough et al., 1965), physical inactivity (Hickey et al., 1975; Mann et al., 1955; Morris et al., 1973), and "coronary-prone behavior patterns" (Friedman et al., 1960; Friedman and Rosenman, 1975).

During this century, cardiovascular diseases, which are defined as any disease of the heart or blood vessels, have become the greatest single killer in the developed countries. Coronary heart disease is considered one of the major cardiovascular diseases. The term coronary heart disease (CHD) includes three distinct, but overlapping,
syndromes in middle-age; myocardial infarction, angina pectoris, and sudden death (Nutrition Society of Great Britain, 1972). Virtually all coronary heart disease occurs on the basis of severe atherosclerosis, although not every person with severe atherosclerosis suffers from coronary heart disease. It is often not recognized until revealed by disasterous events in middle or later life. The pathologic changes underlying the disease begin in early life and are influenced over many years by personal characteristics, patterns of living, and other environmental factors. There is considerable experimental, clinical, and epidemiological evidence to suggest that most of the lethality of a high fat diet and physical inactivity, and/or catalytic influence of stressful living in developed societies, frequently results in high blood cholesterol levels among individuals (Simborg, 1970). In other words, the diet high in fats and cholesterol encourages the development of hypercholesterolemia (elevated blood cholesterol levels). Sedentary life style, physical inactivity, or lack of proper exercise, with resultant poor cardio-pulmonary fitness has been implicated as a coronary risk factor contributing to hypercholesterolemia (Morris, et al., 1973). There is also strong evidence that both emotional and physical stress can trigger one or more mechanisms which may vary from platelet aggregation, to hypercholesterolemia, or to myocardial ischemia. For example, personal behavior patterns related to psychosocial tension and/or those inherent in cultural circumstances have long been suspected as factors related to premature coronary heart disease in our society (Rosenman et al., 1975). Serum cholesterol level has been considered
one of the most important risk factors contributing to premature coronary heart disease. The well known Framingham Study and the National Pooling Project (Stamler and Epstein, 1972) showed a dramatic increase in cardiovascular risk with increasing cholesterol levels in the blood. There was nearly a four-fold increase in the risk of first coronary events between those with cholesterol levels less than 175 mg percent and those with cholesterol concentration exceeding 300 mg percent. A similar result has been found in the Seven Countries Study (Keys, 1970) where it was shown that the correlation between blood cholesterol concentration and the age standardized incidence rate of all coronary heart disease cases was 0.84. Thus, atherogenic dietary habits, physical inactivity, and coronary-prone behavior patterns of individuals are often closely associated with the elevated blood cholesterol level, independently or in combination with other risk factors. These factors seem to be positively related to the increase-incidence and recurrence of coronary heart disease.

Since some of the risk factors of coronary heart disease are known, self-management in health care has been increasingly emphasized. Therefore, the introduction of the educational program for prevention of CHD to patients and the public has become an important task. Social and behavior variables are the acquired behavior of human beings. Several studies in the possible intervention among these factors and coronary heart disease have been conducted. We now have evidence available that suggests that the control of certain factors, notably, increasing dietary knowledge among the population (Stern and Taylor, 1975), increasing physical energy expenditure, stopping smoking, and reducing blood pressure levels, and also reducing body weight and
stress can, in fact, favorably affect the outcome of this disease (Stamber and Epstein, 1972). Limited experiments in nutrition and health education suggest the need for teaching better selection of food and improved dietary practices (Podell et al., 1975; Rosenberg, 1971). In spite of such promising and potential benefits to patients and the public, not enough emphasis has been given to this area. Patients are overwhelmed with medications while continuing to practice harmful dietary habits. Health care costs have risen at an alarming rate, and Rosella (1976) indicates that the inflation of health care costs have occurred at a rate considerably in excess of the nation's general inflation. Rosenberg (1971) indicates that health care costs can be reduced by patient and public education. The Inter-Society Commission for Heart Disease Resources (1970), recommended a long-term, nationwide effort to prevent coronary heart disease through specific changes of these risk factors, either singly or in combination.

Many studies have appeared in which the role of blood cholesterol in the production of coronary heart disease has been discussed. However, in these discussions it is not often sufficiently realized that high blood cholesterol is a condition of multifactorial origin and that dietary factor is only one of the several factors which influence the blood cholesterol level. Furthermore, other factors, such as educational level and CHD knowledge may have a direct or indirect effect on behavior of dietary compliance and physical activity. While occupational factors, physical activity, and
"coronary-prone behavior patterns" may exert a direct or indirect influence on blood cholesterol level, other variables, such as age, sex, and educational level may also have an inevitable relationship to occupational status, energy expenditure, and "coronary-prone behavior patterns." Despite the importance of blood cholesterol concentration to the causation and progression of coronary heart disease, no reports of systematic investigation of a theoretical framework which could measure the relationships among social and demographic characteristics, knowledge of coronary heart disease, and behavior factors associated with blood cholesterol levels have appeared. Also, the causal relation of these factors has yet to be specified. Therefore, in this study, path analysis method is used to elucidate the potential effect of different variables on blood cholesterol level. This study will deal exclusively with the relationships among social and demographic characteristics, CHD knowledge, behavior variables, and cholesterol levels in the blood.

Justification of the Study

With the increasing scientific knowledge about coronary heart disease and its risk factors available to the public, the blood cholesterol level should correspond fairly closely to behavior patterns when other variables are controlled. In other words, the coronary heart disease knowledge, attitude toward less atherogenic diet, dietary compliance, and physical energy expenditure, would influence the blood cholesterol level directly or indirectly.
Some risk factors such as advancing age, coronary heart disease heredity, and sex cannot be modified, while others such as underlying disease, stress, and personality traits, may be difficult to adjust. Still others such as education, knowledge, attitude, hypertension, dietary compliance, and body weight, are amenable to alteration.

The American Heart Association states that persons with high cholesterol levels in the blood (greater than 250 mg/100 ml) are approximately twice as susceptible to premature coronary heart disease as those with lower levels; thus questions about blood cholesterol level became a practical issue for reducing and preventing premature incidence of coronary heart disease.

There are problems related to the knowledge, attitude, and compliance among patients and the public. Specifically, these problems are:

1) Hypercholesterolemia seems to be a behavioral and social and demographic related illness when the physical factors are controlled; thus, the level of blood cholesterol may be reduced by educational preventive measures. However, there are gaps between the scientific knowledge of these risk factors and its awareness by patients or public. A recent survey of public beliefs (Shekelle and Liu, 1978) concerning the causes and prevention of heart attacks in persons younger than 60 years of age in the Chicago area indicated that only 28% named cigarette smoking, 21% named high blood pressure, and 13% named cholesterol and fat in the diet or blood as coronary heart disease risk factors. The study indicated that half did not name any of these risk factors and only 1% named all three. Seventy-five percent believed that heart attacks are preventable.
Many people do not understand the importance of, nor how to properly select, purchase, and prepare foods which will reduce blood cholesterol levels and control overweight, hypertension, and diabetes, all risk factors closely associated with coronary heart disease.

2) The explanation of how blood cholesterol levels are calculated is very complicated and modern science cannot yet answer this question precisely. It is understood that the blood cholesterol level is primarily affected by heredity, age, and sex; however, the stability of blood cholesterol concentration over long periods of time is influenced by continuity and consistency of the individual's lifestyle, behavior patterns, and other environmental factors. Connor and Connor (1972) schematically conceptualized states and critical factors on the development of coronary heart disease. They indicated that diet and heredity, aggravated by obesity, produces stage 1, which is hypercholesterolemia.

In the behavior context, the argument that increased knowledge in nutrition, health, and disease would lead to a change of attitude toward a better compliance or practice has recently been advanced. It appears that one of the most influential factors in increasing this knowledge and developing a positive health attitude is education. Education itself is related to other factors associated with it, such as sex difference and age, which has a direct bearing on educational attainment. Consequently, education or knowledge would influence blood cholesterol levels and, in turn, incidence of coronary heart disease. It seems that one explanation for the development and progression of elevated blood cholesterol may be the consequence of a time-dose-product of social and demographic variables, knowledge.
of coronary heart disease, and behavior factors. Because these parameters are found to be continuous variables in the population, they did not, at any arbitrary level, suddenly become risk factors.

Recently, it was shown in the Stanford Study (Maccoby et al., 1977) that there was a correlation of the changes between knowledge and behavior at the end of two years of an intervention program of cardiovascular diseases. These people, both men and women, who reduced their intake of cholesterol and saturated fat by 20-40% had the greatest change in knowledge and behavior.

Therefore, it is not only important to determine the blood cholesterol levels but also to investigate the causal relationships among various factors affecting the blood cholesterol level prior to designing effective educational programs.

Although there is no doubt concerning the statistical association of many factors with an increased level of blood cholesterol, no causal relationships have been established on the population basis.

**Objectives of the Study**

The general objectives of this study are to create a causal model which relates social and demographic characteristics, CHD knowledge, and behavior variables to blood cholesterol concentration, and to test this model among selected sample populations in northern Utah communities. Furthermore, the analysis will be carried out separately, in order to see if blood cholesterol levels are influenced differently for males and females by social and demographic characteristics, coronary heart disease knowledge, and behavior variables.
Social and demographic variables include sex, age, coronary heart disease heredity, body weight, certain disease presence, educational attainment, and occupation. CHD knowledge level, special diets, attitude toward less atherogenic diets, fat intake, physical energy expenditure, and Type A/B behavior patterns are treated as behavior variables. This is done with the use of a path model.

Specifically, this study has the following objectives:

1. To assess the direct effects of age, sex, coronary heart disease heredity on the presence of certain diseases, education-occupation, and on behavioral variables.

2. To measure the direct effects of educational-occupational factors on the various knowledge-attitude-compliance variables.

3. To gauge the direct effects of social and demographic, knowledge of coronary heart disease, and behavior variables on blood cholesterol level.

4. To evaluate the total model for the sample as a whole, as well as for male and female separately, to examine if blood cholesterol levels are influenced differently for males and females by social and demographic characteristics, knowledge of coronary heart disease, and behavior variables.

5. To identify the known characteristics that best distinguish between hyper- and normo-cholesterolemia among the whole sample.
6. To identify the known characteristics that best distinguish between hyper- and normo-cholesterolemia among male and female samples.

**Significance of the Study**

The study of the relationships among social and demographic characteristics, knowledge of CHD, and behavior variables and the changes in serum cholesterol levels has its significance in developing preventive CHD educational programs and policy formulations. Such an investigation contributes to a greater understanding of factors relating to blood cholesterol levels. Thus far, studies relating to the differential analysis in coronary heart disease risk factors have been plagued by direct mechanistic interpretations without considering the causal relationships.

The process model being proposed here enables a better understanding of the factors involved in blood cholesterol and how the variables are interrelated.

This investigation also produces a frame of reference conducive to more effective and systematic nutrition education policies related to coronary heart disease. Coronary prevention programs, without substantive underpinning, can be expected to have only limited usage.

Although numerous studies have contributed to the understanding of coronary heart disease risk factors and the relationship to developing premature coronary heart disease, most of the empirical studies have failed to analyze factors within the framework of a process-model. The Stanford Three Community Study (Maccoby et al., 1977), for example, has suggested that there is a positive relationship between nutrition-education and behavior changes. However,
the process by which various factors are interrelated was not explained in their study. The process model which is proposed in this study provides the means for a conceptual and an empirical examination of the pattern and degree of relationships among the variables and blood cholesterol levels.

A better understanding of these relationships, hopefully provided by this study, may assist in clarifying existing ambiguity in the necessity of nutrition education in general, and in giving direction to coronary heart disease prevention programs. Specifically, the results of this study would provide information for the coronary heart disease preventive programs for this community, and further, for other communities in the state of Utah as well as other communities in the country.
CHAPTER II
REVIEW OF LITERATURE

This chapter contains three sections. The first section presents a literature review relevant to socio-demographic factors, educational-occupational, and behavioral variables relating to blood cholesterol concentration and coronary heart disease. The second section presents a hypothetical model (process-model) of blood cholesterol formation within the selected variables of framework. Finally, hypotheses are derived from the process-model which is based on the literature review.

Demographic Factors on Nutritional Knowledge, Changes in Attitude and Behavior

The importance of nutrition and health knowledge of coronary heart disease has been recognized for a long time. However, because of the lack of patient's nutritional knowledge, poor dietary practices (poor food habits), and poor communication of available information to the patient, no satisfactory decline in incidence and mortality due to coronary heart disease has been observed. Public knowledge of nutrition and dietary practices differ widely, depending on age, sex, level of socio-economic status, education-occupation and/or the relationship of nutrition information.

Several investigators have focused on the relationship of demographic factors on nutritional knowledge. Sims (1976) found that the nutritional knowledge of mothers of preschool children who were most knowledgeable about nutrition had higher socio-economic status, were
younger, and felt that nutrition was very important for the child. In general, the occupational and educational levels of parents in this study were more important predictors of the nutrition knowledge of mothers than was the level of family income alone. Earlier, Young et al. (1956) found similar results among housewives. He indicated that nutritional knowledge was greatest in the younger, better educated, and higher income housewives. Other studies also showed that nutritional knowledge is highly correlated with educational attainment (Cosper, 1975; Morse et al., 1967). Regardless of the level of higher educational attainment, the classes in nutrition were directly beneficial to the score attained by a group of mothers on nutritional knowledge (Morse et al., 1967). The nutritional knowledge among teenagers was also greatly improved through mass media (Axelson and Delcampo, 1978).

White (1976) has stated that a good knowledge of nutrition is essential for the maintenance of health, especially when food habits temporarily or permanently deteriorate—as in dieting, illness, old age, and poverty, and when an educational base might fail, leading to "faddish experimentation."

Nutrition and health related knowledge appears to have a positive effect on one's attitudes and practices. Evidence suggests that there was a significant and direct positive relationship between nutritional knowledge and attitudes (the strongest relationship), knowledge and practices (the weakest relationship), and attitudes and practices among Canadian Public Health Nurses (Schwartz, 1976).
Similar findings were reported in a study of the nutritional knowledge, attitude, and practices of high school graduates in the state of Ohio (Schwartz, 1975).

Knowledge of nutrition is no guarantee of application, but the rationale of this assumption was that more knowledge may be helpful in eventually selecting better diets (Duyff et al., 1975) and better compliance or behavior changes. This approach has been supported by Expanded Food and Nutrition Education Program (EFNEP) which resulted in an increased knowledge of nutrition (Green et al., 1972; Napier and Wharton, 1974) and improved diets (Gassie and Jones, 1972; Bowering et al., 1976). Regardless of the educational method, whether it is a direct method of education or through mass media, nutrition education had a direct positive influence in increasing knowledge of nutrition and in changing food habits and food consumption toward a positive direction (Cerqueira et al., 1979).

The more impressive studies addressing areas of chronic diseases—diabetes and cardiovascular disease—have been noted. These studies revealed that one's general knowledge of the disease improves the management and control of the disease. Diabetic patients who know, in general, about diabetes manage better than those who do not (Watkins et al., 1967). The correlation coefficient of overall knowledge with overall management was found to be statistically significant at the 1% level. Fifty percent of the hospital admissions for diabetic coma could be eliminated if patients had access to pertinent information and education. Similar results were noted from the asthmatic patients who were placed in discussion groups that focused on
factors contributing to asthma attacks that could be altered by patient behavior (educational intervention). It resulted in significantly reduced usage of emergency service compared to the control group. In fact, the control group had twice the cumulative total visits at the end of four months (Rosenberg, 1976).

Regarding the effects of risk factor intervention programs on cardiovascular patients, a medical model as well as a community model has been suggested. Congestive heart patients (Rosenberg, 1976), all of whom were diagnosed as having congestive heart failure and attending the outpatient service at St. Peters General Hospital in New Brunswick, were given an education consisting of group discussion, formal instruction, and individualized counseling, by members of the health care team. It was also noted that study-patients increased their knowledge significantly concerning drugs, diet, and the disease process. This increased knowledge resulted in a marked reduction of 75% of the patient admittance to the hospital, while the direct cost of hospital-based care had been reduced by as much as 60%. In a study by Rosenberg (1971) one hundred congestive heart patients were given a broad range of education and counseling regarding diet, medications, and disease process. It was found that these patients had one-third as many readmissions, adhered more faithfully to the diet and medication regimen, and had a lower intake of sodium in their diet compared to those who had no such education. Podell (1975) conducted a public seminar called "Fit not Fat—the low cholesterol way to long life" as a nutrition education approach and found that half of the participants had relatively unfavorable perceptions about low cholesterol, low saturated fat foods; low cholesterol diets being viewed as
difficult to prepare, generally tasteless, and too expensive. Three months after the seminar, these perceptions had improved markedly, and most participants reported actually limiting their intake of dietary cholesterol and saturated fats. The most recent studies done in the United States on a large scale is a community-based study supplemented by a medical model (Maccoby et al., 1977). The results indicated that there was an orderly relationship among the knowledge of risk, the changes in behavior, and the physical variables in risk at the end of two years in intervention program of cardiovascular disease. It illustrated the correlation of the changes between knowledge and behavior. According to this study, 26 to 41% improvement in knowledge was seen among the two campaign communities after 2 years of campaign programs while only 6% of improvement was seen in the control community. Moreover, 54% of improvement was achieved among those who received intensive instruction. It indicated, also, that saturated fat and cholesterol consumption declined 20 to 40% over the 2-year period in the campaign communities, a substantially greater drop than in the control community. The drop was especially large among high risk men who received intensive instruction. It was found that the mean change in blood cholesterol was highly correlated with the self-reported changes in dietary behavior (Stern et al., 1976). The likewise decline in cigarette smoking among campaign communities (7 to 24%) and among those who received intensive instruction (42%) was a great contrast to those of 2.5% in the control community. They
found that the risk for coronary heart disease declined 15 to 20% among the campaign communities, whereas it actually increased more than 5% in the control community during the 2-year period of study. Other studies in Finland and rural Mexico City have shown similar results. According to North Karelia Project of Finland (Puska, 1978), there was a decline in cigarette smoking, an increase in the use of low-fat milk, an increased care of hypertensive therapy which was neglected previously, and actual decrease in blood pressure after 4 1/2 years of the intervention program. Results also indicated a considerable decline in the annual incidence of strokes from 3.6 per 1000 males in 1962 to 1.9 in 1975 and from 2.8 per 1000 females to 1.8.

Similar results were found in the study of rural Mexico City by using two different approaches to nutrition education (Cerqueira et al., 1979). Nutrition concepts were learned equally well using the direct method of education or the mass media. The direct education group showed a 53% increase in their learning scores. In this group, the mothers increased their knowledge of infant nutritional needs by more than 70%. The mass media showed similar results. With the mass media techniques, the increment in their final learning scores was 54%. A survey to measure the changes in food habits as a result of nutrition education, indicated a positive change in the food consumption in both the mass media and the direct education group. An increase in the intake of fish, vegetables, and fruits was observed while the control group indicated a negative response by increasing their consumption of popular, but low nutritive value foods.
Thus, self-care through increasing knowledge of nutrition, disease, and diet has been successful in both promoting behavioral changes and, at the same time, reducing the costs of medical care.

**Behavior Patterns, Serum Cholesterol Concentration and Coronary Heart Disease**

Despite the warnings, for decades, against the risks of obesity, hypertension, hypercholesterolemia, and physical inactivity, heart attack fatalities have risen by 14% since 1950 in this country, particularly among young men under the age of 60 years (Russek, 1974).

Evidence that social and psychological factors are involved in an important way with the etiology of coronary heart disease have accumulated in recent years. Russek (1974) stated in his review that "before the turn of the century, Osler described the typical patient with coronary heart disease as 'a keen and ambitious man, the indicator of whose engines is always set a full speed ahead.'" Similarly, Simborg (1970) stated in his review that "in the 1940's Flanders Dunbar wrote extensively about coronary personality or coronary profile, as 'these patients had a distinguished appearance, a high educational level, a marked tendency to complete whatever academic work undertaken, identified with authority figures and strove to become super authorities.'"

Among the more intensively studied theories is that of the "coronary-prone behavior pattern" or "behavior Type A" by Rosenman and his associates (Brand et al., 1976; Rosenman et al., 1970, 1975). They have stressed the prevalence of intense ambition, competitive drive, sense of time urgency and preoccupation with deadlines among persons
predisposed to clinical coronary disease. In contrast, Type B behavior pattern was characterized as more relaxed and less hurried. These Type B subjects had a lesser degree of basic coronary atherosclerosis with less subsequent incidence of clinical coronary heart disease. Russek (1974) found restlessness during leisure hours and a sense of guilt during periods of relaxation among the most characteristic traits of the young coronary patients. The leisure time he did possess was frequently regimented by obligatory participation in an assortment of social, civic, or educational activities.

There is strong evidence that both emotional and environmental stress could trigger one or more biochemical mechanisms in the body, which may range from platelets aggregation to hyperlipidemia or to myocardial ischemia. For example, Friedman and Rosenman (1970) observed that the group of coronary-prone subjects not only exhibited abnormally high plasma triglyceride and cholesterol values, but also a hyperinsulinemia response to a glucose challenge. Nineteen male subjects exhibiting distinct, fully developed behavior pattern A, and 14 subjects exhibiting distinct pattern B who were similar in age, height, weight, amount of average exercise, average cigarette smoking, and food intake in terms of calories, fat, protein, carbohydrates, and alcohol, were selected from the group of 125 male volunteers. The average serum cholesterol concentration of the 19 male Type A subjects was 287 mg/100 ml, a value significantly greater than the 218 mg/100 ml observed in the 14 Type B subjects (P < 0.001) Sixty-three percent of the 19 Type A subjects were hypercholesterolemic. Of the 19 Type A subjects, 42% exhibited a hyperinsulinemic response
following oral ingestion of glucose. The 12 hypercholesterolemic
subjects (all Type A) showed a very high incidence of hypertrigly-
ceridemia (92%) and a moderately high incidence of hyperinsulinemia
when compared with the 21 normocholesterolemic subjects. Other
studies also demonstrated that men exhibiting a specific overt
behavior pattern (Type A) exhibited higher serum cholesterol
levels (Friedman et al., 1960; Glass, 1977), a more rapid clotting
time (Friedman et al., 1959, 1960), and elevated serum norepinephrine
levels, immediately before, during, and after a stressful compe-
titive situation (Friedman et al., 1975), a considerable more
norepinephrine excretion in urine during active working hours
(Friedman et al., 1960) and a far greater incidence of clinical
coronary artery disease than men exhibiting converse behavior traits
(Type B) (Friedman et al., 1959).

This relationship has been found in autopsy studies. In the
six-year course of Western Collaborative Group Study (Friedman et
al., 1968), 82 of the 3295 men at risk died, and 51 men were examined
at autopsy. It was found that subjects who, while living, exhibited
a particular Type A behavior pattern, died from coronary artery di-
sease six times more frequently than subjects who exhibited a con-
verse Type B during their lifetime. Irrespective of the actual
cause of death, Type A persons also exhibited severe basic coronary
atherosclerosis six times more frequently than the latter subjects.
Also, those who died of coronary heart disease had exhibited, during
life, a significantly greater average serum cholesterol, triglyceride,
and low/high lipoprotein ratio than those who died of extracardiac
causes.
In human subjects, atherogenic neural factors are largely inferential and rest on demonstrationable relationships of hyperlipidemia and the increased prevalence of ischemic heart disease to behavior response elicited by psycho-social conditions (Gutstein et al., 1976). For example, Wolf et al. (1962) demonstrated such serum lipid changes in relation to emotional stress during rigid control of diet and exercise. Rahe et al. (1974) reported on the close association of myocardial infarction and abrupt coronary death with recent life changes in certain groups of individuals. Thus, response to stressful stimuli involved physiological changes which, if sustained or repetitive, may lead to pathophysiological readjustment and consequences.

There is a constellation of physiological responses related to cardiac function following stressful stimulation. During the stress, the sequence of events inside the body always followed the same pattern (Eliot et al., 1977). Stress registers inside the body simultaneously in the neocortex, the highest and most advanced center of the brain, and in the limbic system, the repository of our feelings. From there, messages flash along nerve cells to the hypothalamus. The hypothalamus signals the nearby pituitary gland and the autonomic nervous system to begin secreting chemical messengers. Epinephrine and norepinephrine are pumped throughout the body; corticosteroid hormones flood from the outer layer of the adrenal glands; and the thyroid and pancreas release their stored hormones. Excessive levels of epinephrine and norepinephrine released are known to be associated with hypertension, intravascular clotting, and hence vascular wall damage, platelet aggregation, and
myocardial damage, thus contributing to cardiovascular disease (Haft, 1974). Cholesterol and fats are mobilized in the bloodstream. It appears that any psychological agent that increases these hormones in the blood may be a potential pathogen for cardiovascular function.

Because of clinical and epidemiological interest in A/B behavior patterns, the Jenkins Activity Survey (JAS), a self-administered test, was developed to measure this pattern (Jenkins et al., 1965). With a simple scoring method, it validly identified the behavior pattern with over 70% accuracy (Zyzanski, 1970).

The relationship between behavior patterns and coronary heart disease was performed by the Western Collaborative Groups (Rosenman et al., 1970, 1975). It was found that the behavior patterns bore a significant association with the incidence of coronary heart disease. It was also seen that behavior type and serum cholesterol were strongly and independently related to the risk of coronary heart disease. They were generally consistent in isolating the characteristics of overt Type A patterns among the subjects. According to this study, the Type A men had over twice the coronary heart disease risk of Type B men even when serum lipids, blood pressure, smoking, obesity, and other influences were statistically held constant. The impact of the coronary-prone behavior pattern remained highly significant in the 39-49 year old age group. However, in the older age group, 50-59, the difference between Types A and B was no longer statistically significant. It was also found from this data that there was no difference in the distribution of serum
cholesterol levels between Type A and B subjects (Rosenman et al., 1970). However, in other studies, Type A individuals had a higher cholesterol level than Type B and reacted to various environmental and social stresses with a greater increment in their serum cholesterol levels (Friedman et al., 1970). The statistical analysis of the Western Collaborative Study data (Brand et al., 1976) suggested that behavior pattern A was an independent risk factor associated with increased incidence of coronary heart disease, irrespective of the classic risk factors.

Demographic and Social Variables, Physical Activity, Body Weight and the Changes in Blood Cholesterol Concentration

Shekelle et al. (1969), in their study of social status and incidence of CHD, observed that the incidence of angina pectoris was greatest in the upper educational strata, decreased to a minimum in stratum 4, and increased again in the lower strata. The incidence of myocardial infarction and death from CHD followed the opposite pattern. The lowest incidence was found in the upper educational strata, increasing to a maximum in stratum 5, and appeared to decrease again in strata 6-7. The incidence of these clinical forms bore a similar relationship to occupational status, although in this sample, the differences were not statistically significant. This agreed with the findings of Hinkle et al. (1968). Men with a college education had lower rates of disabling events and death from CHD than did men who did not have a college education. However, differences among
the educational strata were not statistically significant for mean values of serum cholesterol. This study also found that incidence of CHD was higher among men whose educational status was less than that of their wives. The generalization of these results beyond the specific social groups in which they were observed, should be approached very cautiously. The Framingham study (Dawber et al., 1959) also found a lower incidence of CHD among the better educated subjects during its first 6 years of follow-up. The trend remained, but was not statistically significant after correction of age.

Other social factors may have also been implicated to myocardial infarction (MI) or sudden death. A Swedish study (Carlson and Lindstedt, 1969) indicated that low social class, social alcoholic problems, low income, and lack of education were factors of importance for the later occurrence of MI or sudden death. A study of the New York Anti-Coronary Club (Archer et al., 1967) indicated that the Cosmopolitan group (urban, independent, worldly, scientific, etc.) had significantly fewer drop-outs compared to Parochial groups (ethnic, in-group oriented, traditional, close religious and friendship ties, etc.).

Contrary to these findings, a survey in Evans County, Georgia, revealed that, among Caucasian men, the higher social classes had a higher prevalence of CHD than the lower classes. McDonough et al. (1965) suggested that these differences could be explained on the basis of occupational differences. The most relevant aspect of occupation appeared to be physical activity. The relationship of the higher stratum of society and the higher serum cholesterol level
was observed in other studies (Faulkner, 1969; Keys, 1975). This is a marked contrast to the poorer sections of society where types of work and mode of life demanded a greater amount of physical activity. Recently, Ancel Keys (1975) indicated in his review of CHD that 2,447 male workers in England, aged 40-54, showed that men in social class I (professionals and businessmen) and II (intermediate between social class I and III, III includes craftsman and skilled workers) had serum cholesterol values averaging 10 mg/dl greater than the men in classes IV (intermediate between III and V) and V (unskilled workers), class III men being intermediate. Keys indicated that a difference of 10 mg/dl would be associated with a difference of about 10% in the incidence of MI and CHD death.

The effect of occupation or physical activity or exercise on serum cholesterol level seems particularly confusing, because many factors other than physical activity affect cholesterol metabolism; age, diet, genetics, sex, obesity, the presence of diabetes, and hypertension. This relationship became less confusing when the intensity, duration, and the type of physical activity were considered. It appeared that these differences in serum lipid levels among different physical activities were related to caloric balance of the body. For example, four medical students participated in the 10 week experimental program which consisted of four phases: Phase I, normal caloric intake, normal activity; Phase II, double the normal caloric intake with normal fat intake, and an increase in physical activity to maintain body weight ± 5 lb; Phase III,
a caloric intake as in Phase II with a decrease in physical activity to control levels to allow weight gain; Phase IV, caloric restrictions with normal physical activity to allow weight loss. The results showed that serum cholesterol, serum phospholipid, and low-density lipoprotein levels decreased in Phase II, increased in Phase III, and decreased to control values in Phase IV (Mann et al., 1955). These observations suggested that young men consuming high caloric diets were able to maintain their serum lipid levels as long as excess energy was dissipated as exercise. Similar findings were observed in the study of Nigerian men (Mann et al., 1960), Bantu men in Africa (Merskey et al., 1960), Samburu people of Northern Kenya (Shaper et al., 1961), lumberjacks in five camps in Eastern Finland (Karvonen et al., 1961), hard-working West Indian Community people (Stuart et al., 1962), and the Navajo population (Fulmer and Roberts, 1963).

It appears that the mobilized fat can be utilized during physical exercise. Rochelle’s (1961) study supported this argument. He observed that the blood cholesterol concentrations of six experimental subjects during a 5-week exhaustive exercise program (timed two-mile run, 5 days a week) were significantly reduced (11% reduction). It was found that there was a temporary increase in blood cholesterol during the exercise phase, which was believed to be due to fat mobilization. Four weeks after the detraining period, the blood cholesterol levels returned to the pretraining levels.

Rochelle suggested that physical activity, by increasing metabolism, speeded up the process of cholesterol excretion and also prevented synthesis of this sterol. This supported the argument that during
physical activity, the output of cholesterol and bile acids into the bile increases, and this probably leads to higher fecal losses of sterols. Thus, the increased amount of bile acids returning to the liver during exercise may also depress the hepatic synthesis of cholesterol. This may cause the lower cholesterol level in the blood when exercise is repeated regularly (Simko, 1978). Glomset and Norum (1973) argued that preferential release of unsaturated fatty acid from the adipose tissue during exercise and the linoleic acid-dependent LCAT enzyme (Lecithin:Cholesterol Acyltransferase) may be partly responsible for this effect of exercise. LCAT enzyme transports plasma cholesterol by esterifying free cholesterol. This activity is dependent on the availability of high-density lipoprotein. These unsaturated fatty acids promote the transport of other lipid material, increase its utilization in peripheral tissues, and the degradation of cholesterol in the liver (Simko, 1970).

Gynteberg and Ohlsen (1973) related the physical activity patterns of 370 middle-aged, normal males to serum cholesterol values. The physical activity patterns studied were fitness, expressed as indirectly measured maximal oxygen uptake, leisure time physical activity, and occupational physical activity. A weak, but significant, inverse relationship was found between physical fitness and serum cholesterol \( (r = 0.13, P < 0.05) \). Leisure time physical activity exhibited an equally weak, but significant, inverse relationship \( (P < 0.05) \), while no statistically significant relationship between occupational physical activity and serum cholesterol values could be demonstrated. The following year, Gyntelberg (1974) found that
there was a highly significant relationship between physical fitness and leisure time physical activity. More recently, Hickey et al. (1975) investigated the physical activity of 15,171 men aged 25 to 74 years, both at work and during leisure, and found that heavy leisure activity was associated with lower mean serum cholesterol levels and blood pressure. Different degrees of physical activity at work were not associated with any differences in these risk factors, nor did the level of exercise at work seem to influence the negative association between leisure activity and risk factors.

Similarly, animal experiments also indicated the same relationship as in human subjects. Rats subjected to 78 days (Simko and Kelley, 1976) of regular exercise had significantly lower red blood cell cholesterol. In this experiment, an increase in the LCAT induced by exercise was probably responsible for the transport of cholesterol from the peripheral cells to the liver (Glomset, 1970) and may promote the degradation of cholesterol in the liver (Simko, 1970). Thus, it appeared that despite a high fat diet, the high degree of physical activity is an important factor in maintaining low blood cholesterol levels.

On the other hand, there are other studies in which no significant changes between the initial and post-training level of serum cholesterol was found (Cooper et al., 1966; Lopez et al., 1975; Malhotra, 1967; Taylor et al., 1957). Closer examination of these data reveal that either the pretraining cholesterol level was within the lower limits of the physiologic range, or the exercise program was not vigorous enough for that age group. It also
revealed that the duration of exercise was too short, dietary factors were not controlled, or a combination of these factors.

There appears to be an inverse relationship between physical activity and relative body weight, and between serum cholesterol and relative weight. Hickey (1975) noted in his study of 15,171 men that there was negative association between leisure activity and relative weight. Relative weight is associated with various coronary heart disease risk factors. In the Framingham study (Gordon et al., 1977), a relationship was shown between relative weight and a higher low-density lipoprotein cholesterol (r = 0.05) or triglyceride level (r = 0.17), and a lower level of high-density lipoprotein cholesterol (r = -0.25) in women. Elevated high-density lipoprotein is considered to be a protective factor against CHD (Enger et al., 1979). Similar relations were seen in men. Relative body weight was also positively related to systolic blood pressure and diabetes in this sample population.

In the Tecumseh study (Epstein, 1965), when comparing the upper 20% in relative weight to the lower 80%, the prevalence of CHD was 1.7 times higher in men, and the same in women. Contrary to this finding, a 10-year prospective study of Los Angeles businessmen (Chapman and Massey, 1964) and a prospective study in Chicago (Paul et al., 1963) showed no relation of CHD to relative weight.

Health statistics (1967) in the United States indicate that the average blood cholesterol level increases with age in both men and women until approximately age 40. It then levels off in men older than 40 to approximately 230 mg/dl. In women, it continues to increase almost linearly until about age 60 and levels off at approximately 260 mg/dl. Twenty-three percent of men aged 35-64 in the United States
had blood cholesterol levels above 259 mg/dl. This percentage was roughly the same across all ages within this range.

Let us now examine sex difference on CHD incidence-rate and on serum cholesterol level. The incidence of myocardial infarction and sudden death was 4-6 times higher in white men than white women aged 45-64, and two times greater in ages 65-75. Black women also had a lower incidence of myocardial infarction and sudden death than black men (Kuller, 1976). Kuller (1976) pointed out in his review that the Framingham and other studies have shown that the risk of myocardial infarction is substantially higher for men than women at equivalent levels of the major risk factors. The most likely explanation for the sex difference in incidence and mortality is that hormonal factors are protective for women. However, Kuller pointed out that the simple protective effect of higher levels of estrogen is an unlikely explanation because of the increased risk of heart attack among men taking estrogen and the reported excess risk among women on oral contraceptives (Dean and Jones, 1971). More likely, cyclical variations and interaction between hormones, and possibly with lipoprotein patterns, are part of a protective effect for women.

Regardless of the difference in the incidence of MI and CHD among sexes, the serum cholesterol level showed no obvious difference between sexes. This relationship was shown in studies of Walden et al. (1964), West and Hays (1968) and Taylor et al. (1976).
Presence of Disease(s) on Behavior Variables

and the Blood Cholesterol Level

According to the health belief model (Becker, et al., 1978) whether or not a person undertakes a recommended health action depends on his perceptions of the threat of illness, the potential benefits of health action and physical, psychological, and financial factors to initiating or continuing the advocated behavior. In the model, a cue to action or stimulus that triggers the appropriate behavior by making the person consciously aware of his feelings about the health threat can be internal (for example, perception of physical sensations) or external (for example, mass media campaigns, interpersonal interactions). Becker and Maïman (1975) hypothesized that persons would generally not attempt to diagnose or prevent a condition unless they possessed minimal levels of relevant health motivation and knowledge. Stanley Rosenberg (1976) reviewed several studies which support the assumption that planned and organized patient education programs modify behavioral compliance.

Recent surveys indicate that half of the hypertensives in the United States go unrecognized, half of those identified go untreated, and half of those treated are inadequately treated (Paffenbarger, 1972). In the Framingham study (Kagan et al., 1962) the increasing level of blood pressure (BP) was associated with increasing risk of development of coronary heart disease. The study in Evans County, Georgia indicated that the prevalence of CHD was 2.3 times higher in people whose blood pressure was greater than 160/90 compared to those below
this level (McDonough, 1965). Similar results were found in other studies (Paffenbarger et al., 1966, Rosenman et al., 1966). Cornfield (1962) has performed a discriminant function analysis of the Framingham data and has calculated that a 1% difference in systolic BP is associated with a 4.62% difference in risk of CHD at a BP level of 110 mm Hg. A 1% difference in systolic BP is associated with a 2.57% difference in risk of CHD at a BP level of 175 mm Hg. Williams et al. (1975) demonstrated that hypertension was associated with intracranial atherosclerosis, even in the absence of high fat intake and high serum cholesterol.

Often blood pressure can be lowered by the reduction of body weight (Christakis, 1966). Although far from clearly established, there is some evidence that exercise lowers blood pressure (Harris et al., 1967). Certainly BP can be lowered with the use of drugs.

Despite the evidence showing the association of elevated BP and the increasing risk of developing CHD, there is no clear evidence that suggests the positive relationship between serum cholesterol and increased BP in younger people. However, evidence from pathological studies indicated that hypertension enhances the progression of coronary atherosclerosis in the presence of high serum cholesterol (Rickert et al., 1968). Even in older people (60-90 years), Vavrik (1974) found no association between serum cholesterol and the level of systolic and diastolic BP. This study also indicated that serum cholesterol concentrations above 250 mg/dl were more common in diabetic than in non-diabetic females (P < 0.01) while no such relationship was found in males.
Health statistics (1964) indicated that approximately 2% of the population of the United States has been diagnosed as having diabetes. This number represents primarily those under a physician's care for their disorder, and the criteria used for diagnosis is variable. The close association of diabetes mellitus and CHD has long been recognized and has been well documented. There is a high incidence of diabetes in persons with CHD and similarly, the incidence of CHD in patients with diabetes is very high. For instance, in one group of 314 patients with CHD, 12% also had diabetes (Lal and Bahl, 1967) and at the Joslin clinic, 46.5% of deaths from diabetes has been reported due to atherosclerosis heart disease (Marble, 1955). This relationship has been shown in the Framingham data; among those men, aged 30-59, initially free of CHD, diabetics have 1.4 times the incidence of CHD as non-diabetics. In women, the incidence is 2.5 times greater. The risk of death from CHD is 2.5 times higher in diabetic men and 5.7 times higher in diabetic women (Kannel et al., 1967). Animal experiments (Plenk et al., 1973) have demonstrated the occurrence and severity of the vascular lesions and showed a positive correlation to the elevation of the serum cholesterol levels in diabetic rats. This study suggested that the pathologic role of the diabetic state in atherogenesis seems to be primarily related to its serum cholesterol level. Thus, epidemiological and experimental data suggest a strong association between obesity, hypertension, diabetes, serum cholesterol level, and CHD.

The fact that CHD has familial clustering has been well established. In a study of parents of medical students, Thomas and Hirschhorn (1955) showed that the prevalence of CHD among siblings of individuals with CHD was four times higher than among siblings of individuals without
CHD. In the Western Collaborative Study, the risk of CHD was 2.4 times higher in those subjects with a positive family history of CHD compared to those with a negative family history (Rosenman et al., 1966). In a study of 191 survivors of myocardial infarction under 50 years of age in Finland, 80% (N = 413) of their first degree relatives were examined (Aro, 1973). Evidence of familial aggregation of hyperlipidemia was found in one-third of the families, although detailed analysis indicated that the elevated blood cholesterol and triglyceride concentrations observed had a multi-factorial etiology. The Framingham offspring study (Feinleib et al., 1975) also revealed that those children whose father did not have heart disease had a higher mean level of high-density lipoprotein (higher levels of high-density lipoprotein being protective against developing CHD (Enger, 1979) than those children of men who did have heart disease. Furthermore, there was a clear gradient in high-density lipoprotein level among the children according to the age at which the fathers suffered heart attacks. Also, animal breeding studies confirmed a strong genetic control of serum lipid concentrations (Hatch, 1974).

**Dietary Lipids and Blood**

**Cholesterol Concentration**

**Effect of Dietary Lipids on the Serum Cholesterol Concentration**

Atherosclerosis is the form of arteriosclerosis associated with coronary heart disease. It is primarily a disease of the intimal
lining of the blood vessels. It is indicated that atherosclerosis involves deposition of cholesterol in the walls of the arteries. This cholesterol is derived from the blood and the tendency for atherosclerosis to develop is greatly increased by a high level of cholesterol in the blood. According to Keys (1960) the diet enters the picture because of three sets of facts: 1) Dietary manipulation of animals can produce high blood cholesterol level and subsequent atherosclerosis; 2) Controlled experiments show that the cholesterol level in the blood of man is readily influenced by the diet; 3) Populations subsisting on different diets show differences in the frequency of coronary heart disease that are fully in accordance with the hypothesis that diet is, indeed, a major factor.

The type and quantity of the dietary fat eaten seems to influence the cholesterol concentration in the blood. Specifically, a diet high in saturated fats and cholesterol appears to be implicated. Studies on different kinds of animals show that in all species, elevated blood cholesterol levels promote atherosclerosis although there are differences between species in the way fats influence the cholesterol and associated lipids in the blood. Keys (1960) indicated that in man the effects of fats are reasonably clear. The saturated fatty acids in foods, either in natural fats or fats produced by hydrogenation of unsaturated oils, raises the cholesterol level. Those fatty acids with one point of unsaturation in the molecule have little or no cholesterol effect while the fatty acids with two or more points of unsaturation, or double bonds, in the molecule, tend to lower the blood cholesterol level when they are fed in the diet. Examples of oils made
up predominantly of unsaturated fatty acids are corn oil and safflower oil which are mainly linoleic acid. Olive oil is an example of an oil made up mainly of oleic acid, a mono-unsaturated fatty acid. Butter is an example of a fat in which the predominant fatty acids are saturated (Composition of Foods, 1963).

According to Roles and Hashim (1962) it was found that during the period when the subjects consumed a formular diet containing corn oil followed by ad libitum diet, a striking increase in daily fecal excretion of bile acids was observed, associated with a reduction of blood cholesterol and other lipids. When coconut oil was iso-calorically substituted for corn oil, during the next period, a reduction in the bile acid excretion and a rise in blood cholesterol occurred. They suggested that there would be at least two important mechanisms where the dietary fatty acids might influence blood cholesterol levels: 1) Different types of dietary fatty acids may influence the absorption of cholesterol from the gut and transport them through the organism; 2) Different types of fatty acids may increase or decrease the rate of cholesterol synthesis and catabolism. Other studies showed similar results that the reduction in serum cholesterol levels was accompanied by an increased excretion of neutral steroids and bile acids in the stools (Groen, 1973; Nichaman et al., 1967). Nichaman et al. (1967) suggested high linoleate feeding might contribute to the control of hyperlipidemia (elevated blood lipid concentration) by diverting more dietary fatty acids toward biochemical pathways leading to oxidation, leaving less for biosynthesis of low-density lipoprotein in which the major lipid is cholesterol.
This relationship has been seen in autopsy studies. They showed that the greatest atherosclerotic lesion involvement was associated with the person who used to have high intake of saturated fats, particularly myristic, palmitic, and lauric acid, during their lifetime (Moore et al., 1977). It also indicated that lesser lesion involvement with higher intake of linoleic and arachidonic acid.

The results of one of the most extensive studies by Keys and his associates (Keys et al., 1957, 1965), for almost 20 years with carefully controlled conditions have given comparable results and have consistently shown that the cholesterol raising effect of the saturated fatty acid is about twice the cholesterol-depressing effect of the polyunsaturated fatty acids. Keys and his associates expressed this relationship with the following equation.

$$\Delta \text{CHOL} = 2.7\Delta S - 1.3\Delta P$$

where \(\Delta \text{CHOL}\) represents the serum cholesterol change in mg/100 ml and \(\Delta S\) and \(\Delta P\) the changes in saturated and polyunsaturated fatty acid content of the diet expressed as a percentage of the total caloric intake. This formula applied to middle-aged eucaloric men with average serum cholesterol who ate a typical American diet. Ahrens et al. (1957) demonstrated a rough inverse relationship between the blood cholesterol and the iodine number (total degree of unsaturation) of various oils. This conclusion implies that mono-unsaturated acid is half as effective as linoleic acid. Gunning et al. (1964) suggested that the square root of the iodine number rather than the iodine itself was inversely related to the level of blood cholesterol.
Serum cholesterol concentration in men is also influenced by the dietary cholesterol content in the diet (Beveridge et al., 1960; Connor et al., 1964, 1978; Grande, 1974). Controlled experiments have shown a consistent elevation of serum cholesterol by adding cholesterol to diets of low cholesterol content. The results of metabolic studies designed to test the effect of dietary cholesterol showed that an average serum cholesterol decrement of 61 mg per 100 ml was achieved when given a cholesterol-free diet, while 30% increment was seen among men given 1650 to 4800 mg cholesterol in the diet (Connor, 1968). These changes were sustained for 11 weeks of study. When cholesterol was removed from the high cholesterol diet, the serum cholesterol fell 102 mg per 100 ml. Simultaneously, cholesterol was added to the cholesterol-free diets of other men, and the serum cholesterol rose 57 mg per 100 ml. Stare (1966) also reported an increase of 5 mg/dl serum cholesterol corresponding to a 100 mg increase in daily dietary cholesterol. Keys and his associates (1965) calculated and described the change in serum cholesterol produced by changing the cholesterol content of the diet over the range of 0 to 3441 mg per day as follows:

$$\Delta \text{CHOL} = 1.5 \left( z_2^{1/2} - z_1^{1/2} \right)$$

where $\Delta \text{CHOL}$ represents the change in serum cholesterol concentration in mg/100 ml, and $z_2$ and $z_1$ represent the mg of the cholesterol per 1000 calories in each of two diets (expressed as mg/100 KJ). More recently, Mattson et al. (1972) found a linear relationship between dietary cholesterol and serum cholesterol concentration. This
increase was linear over the entire range of sterol feeding among 70 males, 21 to 48 years, who were healthy inmates in a Philadelphia county prison. Their fatty acid composition approximated the diet normally consumed in the U.S., i.e., 40% saturated fatty acids and 12% polyunsaturated fatty acids. It was found that each 100 mg cholesterol in 1000 Kcal of diet resulted in approximately a 12 mg/100 ml increase in serum cholesterol level. Keys and Mattson's equation gave comparable results for a dietary cholesterol level on the order of 150 mg/1000 Kcal.

Similar results were observed in other studies (Anderson et al., 1973; Whyte and Havenstein 1976). When the diet of young men was changed from the standard diet to a moderate cholesterol-lowering diet, Anderson et al. (1973) found a 17% reduction in serum cholesterol level. There was an average 29% decrease when the standard diet was replaced by a strict cholesterol-lowering diet in which both butterfat and margarine (saturated fat) were excluded; corn oil was the only visible fat used, skim-milk liquid and skinless turkey replaced about half of the omitted meat, one egg per week was allowed in cooking, and fruits and vegetables and dried peas and beans were increased to compensate for the reduction in energy. In this same experiment, a change from the standard diet to the cholesterol-raising diet produced a 9% rise in serum cholesterol and a 25% rise in serum triglyceride.

Recently, the effect of dieting in order to lower the blood cholesterol level was studied by Whyte and Havenstein (1976) of Australian National University. They indicated that the major dietary contributors to the serum cholesterol level were both the fat and
cholesterol content of the diet, each adding more than 10 mg/100 ml to the blood cholesterol level when eaten regularly (100 gram serving of brains, 200 gram serving of meat, one egg per day, and 1 1/2 tbsp or 30 grams of butter per day). On the other hand, they found that polyunsaturated oils and margarines actively lower serum cholesterol while oysters, skim milk and nuts have practically no effect. While the regular consumption of one egg per day will, on the average, be responsible for 10-14 mg of blood cholesterol, the intake of half the quantity of egg would reduce the blood cholesterol level by half. An ounce of butter per day will promote cholesterol in the blood by 11.6 mg/100 ml, while the same amount of polyunsaturated margarine reduces it by 2.6 mg/100 ml. Thus, substituting polyunsaturated margarine for butter in these commonly consumed amounts should reduce the blood cholesterol level by 14.2.

This relationship has been convincingly demonstrated, not only by experimental studies in which individuals have been subjected to dietary changes under well controlled conditions, but by epidemiological studies comparing large population groups habitually subsisting on different diets. In a study of 14 groups of men (500 or more men in each) 40 through 59 years of age, living in seven different countries, Keys et al. (1970) demonstrated that 80% of the serum cholesterol variability among those groups could be explained by the different proportions of the saturated fat in the diet. Migration of populations to a different geographical area often involves changes in dietary habits. Among these studies, the observations of Japanese men living in Hawaii and California
(Nichaman et al., 1975) and Jews migrating to Israel (Grande, 1974) are widely quoted. In every age group the mean, median and percentiles for each of the biochemical variables are considerably lower for men in Japan than in California or Hawaii (Nichaman et al., 1975). The relative incidence of myocardial infarction among men recently migrated from Yemen was considerably lower than among earlier Yemenite immigrants and this difference has been related to the difference in fat content of the diets consumed by these two groups (Grande, 1974). Serum cholesterol levels, as well as the incidence and severity of atherosclerosis, were also lower in populations subsisting on vegetable diets than on those ingesting diets containing animal fat.

Studies of two groups of Seventh-day Adventists in California (Smith et al., 1970) and Washington, D.C. (West and Hayes, 1968) revealed that their serum cholesterol levels, as well as their coronary heart disease rate were lower than those of the general population (Wynder et al., 1959). This is attributed to the consumption of much less meat and fat of animal origin by Seventh-day Adventists (Walden et al., 1964). However, when compared with true vegetarians, their serum cholesterol levels were much higher (Sacks et al., 1975). A comparison between the serum cholesterol levels of average persons in the general population of the United States reported by Lewis et al. (1957) and those of Seventh-day Adventists was made. A serum cholesterol level of 220 mg/dl, a maximum safety level proposed by the Council on Food and Nutrition of the American Medical Association (1972), was attained at the age of 30 by average males in the United States, at the age of 40 by average females in the United States, and at the age of 50 by male and female Seventh-day Adventists.
A level of 240 mg/dl was attained at the age of 42, 48 and 63 by males (U.S.), females (U.S.) and Seventh-day Adventists, respectively. The average increase of serum cholesterol level per year of age in male Seventh-day Adventists was 1.7 mg/dl (Walden et al., 1964; West and Heyes, 1968) which was less than the value of 2.2 mg/dl obtained in the average U.S. male by Keys et al. (1950).

The study of unacculturated Tarahumaras Indians of Mexico found a positive correlation ($r = 0.874$) between total cholesterol in the blood and dietary cholesterol intake. This is the first time such a correlation has been found in men within a homogenous population (Connor et al., 1978). Particularly notable was the virtual absence of hypertension, obesity, and the usual age rise of the serum cholesterol level in adults.

Ancel Keys, who has studied the epidemiology of coronary heart disease extensively, made the following statement "...no population has yet been found who subsist on a low-fat diet and who have a high or even moderately high frequency of coronary heart disease. Moreover, no population known to subsist on a diet high in saturated fats has been found to have a low frequency of coronary heart disease. Lastly, every population so far investigated that is known to have a major change in the fats in the diet has also shown subsequent change in the frequency of coronary heart disease" (Keys, 1970).

**Dietary Role in the Prevention and Reduction of Coronary Heart Disease**

There is little evidence to suggest that a diet restricted in cholesterol and saturated fat would be unsafe, but there is considerable evidence to suggest that a diet high in cholesterol and
saturated fat may be unsafe. The reversibility of atherosclerosis has obvious significance for the prevention of CHD and other clinical consequences of atherosclerosis; however, evidence for reversibility of atherosclerotic lesions in humans is at best circumstantial. Experiments with animals have suggested that arterial lesions in rabbits showed regression (Bortz, 1968; Portman et al., 1967) or some types of lesions can be reversible (Armstrong et al., 1970) by dietary means. Tucker et al. (1971) found that aortic lesions can be predictably produced after 8 weeks of feeding a high cholesterol diet and that qualitative changes in the lesions occur 16 weeks after withdrawal from the diet.

Therefore, the basic concept in the prevention of atherosclerosis relates to the well established principle that the infiltration of lipoprotein cholesterol into the arterial intima is dependent upon its concentration in the plasma (Connor, 1972). Connor (1972) indicated that with low levels of the plasma cholesterol, the rate of entry into the arterial walls is balanced nicely by the rate of removal so that net accumulation does not occur. On the other hand, with high levels of lipoproteins carrying cholesterol, the rate of entry of cholesterol becomes greater than the rate of removal, cholesterol accumulation occurs; the atherosclerotic plaque is initiated and begins to grow. According to Connor (1972) the normal serum cholesterol levels imply lifetime serum cholesterol concentrations of 180 mg percent or less. These are the theoretical goals of prevention and treatment because atherosclerosis as a major disease entity and public health problem rarely occurs when blood cholesterol is below this level. It must be appreciated that these goals are not achievable in all instances but
nonetheless should be approached as basic objectives for a preventive measure. Thus, it appears that hypercholesterolemia is the first phase in the development of CHD. This initial stage is the appropriate and desirable point of attack for the prevention of CHD.

Deliberate efforts to control hypercholesterolemia have included diet, exercise, and drugs. For example, reducing the total calories derived from fat in the typical American male diet from 40 to 30%, altering the ratio of saturated to unsaturated fats from the typical 2:1 or 3:1 to 1:1, reducing daily cholesterol intake and reducing total calorie intake if the subject is overweight "generally have been successful in lowering serum cholesterol over sustained periods of time" (Simborg, 1970).

Therefore, several dietary prevention (primary and secondary) studies have been conducted and confirmed that the reduction or prevention of the incidence of coronary heart disease can be achieved through the reduction of serum cholesterol levels by means of adequately planned intervention methods. The occurrence of cholesterol in animal fat and the lower iodine value of fat of animal origin, together with various epidemiologic data, suggest that cholesterol-lowering diets should be rich in polyunsaturated fats. Generally, such lowering can be achieved most practically by partial replacement of the dietary sources of saturated fat, with sources of unsaturated fat, especially those rich in polyunsaturated fatty acids, and by a reduction in the consumption of foods rich in cholesterol.
The first primary prevention studies, involving members of the Anti-Coronary Club, were begun in New York in 1957. According to this study, the serum cholesterol fell an average of 30 mg per 100 ml in the first year of dieting by free-living, middle-aged men and a further decrease of 5 mg per 100 ml ensued over the next 4 years (Christakis et al., 1966). This persisted for more than 7 years in subjects maintaining the diet. This study, which initially comprised men aged 40-59 years, revealed the incidence of new coronary events of 0.98% among the controls, while 0.34% in the subjects on the diet (P < 0.02). Several other studies showed similar results. A 12-year study by Miettinen and Turpeinen (1972) and their associates in two mental hospitals in Helsinki revealed that in men, the use of the cholesterol-lowering diets was associated with considerably and significantly reduced mortality from coronary heart disease. It was found that the mean serum cholesterol level of the study group was greatly reduced while their linoleic and linolenic acid content of adipose tissue was increased (Miettinen, 1975; Turpeinen, 1968). In this study, the dietary intervention was limited to fat only; the diets were not modified in other respects. The Dayton study in Los Angeles (1969) achieved a significant reduction of fatal and non-fatal atherosclerosis events by dietary means in men due to the mean reduction of serum cholesterol of 29.5%. The National Diet Heart Study (Brown, 1968) is the largest, thoroughly documented intervention study dealing with healthy, free-living men in five urban centers and one institutional center, a mental hospital on a double blind experimental design. In the institutional group, adherence was excellent, while in the free-living centers, it was
less. Participants eating an average of no more than one restaurant meal a week had a serum cholesterol reduction of 15%, those eating six or meals out had only a 7% reduction. The overall reduction in blood cholesterol in free-living urban men was 11% even though the estimation of adherence to the diet was poor in about 20% of the cases. This study also revealed that a decrease in serum cholesterol was accompanied by a reduction in blood pressure and in weight.

The Oslo Diet Heart Study was conducted by Leren (1966, 1970) on 412 men below 68 years of age, who had survived a myocardial infarction for an average of 20 months before being admitted to the study. The men were randomly assigned to control and dietary treatment groups. The experimental diet was designed to reduce the intake of saturated fat and cholesterol and to increase the polyunsaturated fat. Participants were given oral instructions about their diet. During the 5 years, there were significantly fewer recurrences of infarctions (P < 0.02) and deaths from infarctions (P < 0.03) among the dieters as compared with the control group. A New Jersey study (Bierenbaum, 1973) during a 10 year experiment of modified fat diet on men, 30-50 years of age, with confirmed coronary artery disease and post myocardial infarction showed that there were significant reductions in serum lipids in the diet-managed group compared with the control group. The combined effects of weight control and dietary management produced a 17% improvement in the survival rate between the study and the control group (P < 0.05). This was especially true of the younger men who were under 45 years
of age when they entered the study. In this group, CHD incidence was
over twice as high in the control group as in the study group. Even
in the over 45 years of age group, the incidence in the control group
was one-third higher than in the study group. This study indicated that
most beneficial effects on mortality and morbidity, should be
started as early in life as possible in those susceptible to, or
already affected by, coronary disease. In London, 393 post-myocardial
infarction male patients were randomized into a control group and a
dieting group. It was found that serum cholesterol dropped 22% in
the dieting group and 6% in the experimental group.

It is worthy to note that in the majority of these studies,
the special diet, which may have been simply a low-fat, low-cholesterol,
or low-saturated diet with increased quantity of polyunsaturated fats,
appears to have had a favorable effect in preventing recurrence of
coronary disease events or reducing the risk of CHD by lowering
serum cholesterol level. Therefore, the restriction of lipid and
cholesterol in diets designed to prevent and treat hypercholesterolemia
and coronary heart disease in men has a sound logical and experimental
basis.

Although none of these studies provide incontrovertible evidence
of the value of the diet in preventing CHD, collectively, they support
the theory that dietary manipulation designed to decrease serum
cholesterol concentration is useful in reducing the risk of CHD.
It has been estimated from the statistical association of CHD and
serum cholesterol that a 15% average reduction in serum cholesterol
levels of a population would lead to a 35% reduction in CHD (Epstein,
1965).
The Proposed Model Construction

A number of bivariate correlations in the literature review in the preceding section are described among the variables of interest. Furthermore, on the basis of time sequence and theoretical assumptions, a causal ordering among the variables was postulated. Due to the difficulties inherent in a population study, a limited number of variables were thus formulated.

Figure 1 presents a hypothetical model of social and demographic characteristics, knowledge of coronary heart disease, and behavior variables on blood cholesterol level for a whole sample population. In the figure, the hypothetical causal paths between variables were indicated by the direction of arrows and the positive and negative signs represent positive and negative hypothetical relations between variables.

Specifically, the problem addressed is the explanation of blood cholesterol levels from personal characteristics of age, sex, coronary heart disease (CHD) heredity, the presence of certain disease(s), educational attainment, occupation, special diets, coronary heart disease knowledge, Type A/B behavior patterns, attitude toward less atherogenic diets, fat intake, energy expenditure, and relative weight.

Since it is not meaningful to consider each of these variables as exogenous with no causal relationship to or from the others, the multi-stage, multi-variate path model was constructed. For example, because of its priority in time (being determined at birth), sex was taken as an exogenous variable which generally has an asymmetrical causal effect on the level of education, occupational status, energy
Figure 1. Diagramatic Representation of the Relationship between Variables in the Proposed Model.

Note: HD = CHD heredity; DIS = Presence of certain disease(s); EDU = Educational attainment; DIET = Special dietary regimen; OCC = Occupation; KNOW = CHD knowledge; A/B = Type A/B behavior patterns; ATT = Attitude toward less atherogenic diets; STCAL = Saturated calorie intake; EE = Energy expenditures; RLWT = Relative weight; CHOL = Blood cholesterol concentration.

+= Direction of causality; + = a positive relationship, − = a negative relationship.
expenditure, and presence of certain disease(s) through different socio-occupational patterns of sex roles throughout life.

On the other hand, sex was postulated to have only a symmetric noncausal relationship to age which, in turn, is taken as an asymmetrical effect on education because of the different levels of educational experience of each age cohort. Age was further postulated to have an asymmetric positive effect on the presence of certain disease(s), on attitude toward less atherogenic diets, and on relative weight, and a negative effect on energy expenditure, through the physiological and psychological process of the aging phenomenon.

The presence of certain disease(s) of individuals was taken as the first of the dependent variables. In addition to its postulated dependency on coronary heart disease heredity, sex, and age, the presence of certain disease(s) was itself taken to have a direct effect on whether one is on a special diet which, in turn, will have a positive direct effect on coronary heart disease knowledge and attitude.

Education of the individual was taken as the second of the dependent variables. It is itself taken to have a direct effect on occupational status from the consideration of institutionalized patterns of hiring and employment in industrial societies, and the direct effect on coronary heart disease knowledge levels and on dietary compliance because the more one has of coronary heart disease knowledge, the better one can comply.

Again, on the basis of education-knowledge-attitude relationship, the CHD knowledge level was taken to be dependent on his/her
educational attainment and knowledge, and was expected to have a positive effect on physical energy expenditure and attitude.

By holding the same relationship of knowledge-attitude, the status of individual attitude toward less atherogenic diets was taken to be dependent on his age and CHD knowledge, while, in turn, the attitude was postulated to have an asymmetric negative effect on his relative weight.

Finally, dietary compliance and energy expenditure were expected to be dependent on the other variables and affect blood cholesterol levels.

In summary, the hypothetical model illustrated in Figure 1 depicts the relationships among age, sex, coronary heart disease heredity, presence of certain disease(s), special diets, educational attainment, occupation, coronary heart disease knowledge, Type A/B personality, attitude toward less atherogenic diets, fat intake, energy expenditure, relative weight, and blood cholesterol concentration. Age, sex, and coronary heart disease heredity were assumed to be exogenous variables, while the other variables were endogenous variables and interrelated with direct and indirect effects. Due to the many variables to be examined, this study will only concern the direct effect of independent variables on the dependent variables of relevance.

The effects of social and demographic characteristics, knowledge of coronary heart disease, and behavioral variables on overall blood cholesterol levels are examined, not only for the sample as a whole, but also for two subsamples differentiated on the basis of sex.
Hypotheses

Specific hypotheses are derived from the previously proposed model and literature review.

Presence of Certain Disease(s)

1. One with CHD heredity would have a higher number of certain disease(s) related to the risk of CHD incidence.
2. Males have a higher number of certain disease(s) related to the risk of CHD incidence than females.
3. As age increases, the number of certain disease(s) also increases.

Educational Attainment

4. Males have a higher level of educational attainment than females.
5. The older the age the lower the level of educational attainment.

Special Dietary Regimen

6. A person with CHD heredity has a higher probability of being on a special diet(s).
7. The higher the number of certain disease presence, the higher the probability of being on a special diet.
8. As age increases, the probability of a special diet(s) increases.

Occupational Status

9. Males have a higher physically active occupation.
10. The higher the educational attainment, the less physically active the occupation.

Knowledge of Coronary Heart Disease and its Risk Factors

11. The higher the number of certain disease(s) presence, the higher
12. The higher the educational level, the higher the CHD knowledge level.

13. One with special dietary regimen has higher CHD knowledge level.

Type A and Type B Behavior Patterns

14. Males are more prone to be Type A behavior pattern than females.

15. The higher educated person has a higher probability of being Type A behavior pattern.

Attitude toward Less Atherogenic Diet

16. One with CHD heredity will have a more favorable attitude toward less atherogenic diet.

17. The higher the CHD knowledge level, the more favorable will be its attitude toward less atherogenic diet.

18. As age increases, the attitude toward less atherogenic diet becomes more favorable.

Saturated Fat Intake

19. As the attitude toward less atherogenic diet becomes more favorable, the lower the saturated fat intake.

20. One with a special dietary regimen consumes less saturated fat.

21. The higher the level of educational attainment, the lower the saturated fat intake.

Physical Energy Expenditure

22. The higher the CHD knowledge level, the higher the physical energy expenditure.
23. Males have a higher physical energy expenditure than females.
24. The higher the physically active occupation, the higher the physical energy expenditure.
25. As age increases, physical energy expenditure decreases.

Relative Weight
26. The more favorable attitude toward less atherogenic diet, the less the relative weight.
27. The higher the saturated fat intake, the greater the relative weight.
28. Females have a higher relative weight than males.
29. The greater the physical energy expenditure, the lower the relative weight.
30. The older the age the higher the relative weight.

Blood Cholesterol Level
31. Males have a higher blood cholesterol level than females.
32. One with a Type A behavior pattern has a higher level of blood cholesterol.
33. One with CHD heredity has a higher blood cholesterol level.
34. One with a special dietary regimen has a lower blood cholesterol level.
35. As age increases, blood cholesterol level increases.
36. The higher the physically active occupation, the lower the blood cholesterol level.
37. The more the saturated fat consumed, the higher the blood cholesterol level.
38. The greater the physical energy expenditure, the lower the blood cholesterol level.

39. The higher the relative weight, the higher the blood cholesterol level.

The Role of Sex Difference on the Blood Cholesterol Level

40. The overall effects of selected social and demographic characteristics, CHD knowledge, and behavior variables on the blood cholesterol level among males would not be significantly different from those of females.
CHAPTER III

DATA AND METHODS

The data required for the study were obtained from 218 selected subjects of physicians in northern Utah communities who had pledged their support to this study. The data were acquired from the patients' medical charts and through a self-administered questionnaire and interview survey using a specially designed questionnaire.

Selection of Sample and Data Collection

Based on the information in the patients' medical charts, and through the cooperation of physicians in local clinics in northern Utah, those whose blood cholesterol levels were measured during the past year were selected for the study. Most of these subjects were free from clinical symptoms of coronary heart disease, although some of them had had such diseases as diabetes, gout, kidney problems, high blood pressure, rheumatic fever, and high blood cholesterol level.

The first step of the data collection process was to contact each subject selected for the sample. This was done by the physician's nurse. Following the initial contact, a specifically designed, self-administered questionnaire, three-day dietary record forms with proper instructions, and a consent form were mailed to those subjects who pledged their support to this study. These survey forms were sent out with a cover letter which indicated the importance of this study, the benefits to the patient and to the community, the assurance of anonymity, and their physician's support of the study. The cover
letter and the consent form, the dietary record form, and a copy of
the questionnaire are presented in Appendix A, B, and C, respectively.
The mailing was followed by a telephone call from a trained nutri-
tionist who answered any questions the participant might have had
regarding the study. At that time, an appointment was made with
each patient for an interview. The trained nutritionist spent from
20 minutes to an hour with each subject while checking the complete-
ness and accuracy of information on their completed questionnaires.
The completed data and patient consent form were collected at the
end of the interview.

Questionnaires were mailed out and 218 of 286 were returned. After
considering those who could not be located, those who had moved out
of town, those who had passed away or were hospitalized, and those
who were seriously ill or were not able to communicate due to ill-
ness, the respondent rate was about 84%. For the analysis in the
present study, all incomplete cases were eliminated. Out of the 218,
seven dietary records were incomplete; therefore, only 211 question-
naires were analyzed for the study. Among these, 12 of them were
interviewed over the telephone and their completed questionnaires
were mailed to the Department of Nutrition and Food Sciences, Utah
State University.

The blood cholesterol level of each individual was obtained
from each respondent's medical chart. If there was more than one
measurement taken during 1978, the average level of 1978 measurements
was used.
The questionnaire consisted of several tests designed to provide a measure of the level of coronary heart disease knowledge and attitude toward low cholesterol and low saturated fat intake. Information on the estimated saturated fat caloric intake, as expressed by a percentage of total caloric intake, was collected, as measured by three-day dietary records. Average daily energy expenditure on and off of the job during the period of 1978 was estimated from the survey questionnaire. The Type A/B behavioral patterns were measured by the use of the Jenkins Activity Survey (1978 edition). Socioeconomic, and demographic information was also obtained from the questionnaire. The questionnaire was pretested on a small sample before administration to the sample population.

**Operationalization of Variables**

**Coronary Heart Disease Heredity**

Question #21 was used for determination of familial coronary heart disease heredity of respondents.

21. Did either of your parents develop heart disease before the age of 60?

1. Yes 2. No 3. Don't know

The heredity of coronary heart disease is an important factor in the development of hyperlipidemia and/or premature coronary heart disease. Therefore, significant differences among respondents will be expected in the knowledge, attitude, and behavior process depending on the presence of coronary heart disease heredity of respondents.
The presence of coronary heart disease heredity was dichotomized as follows: Heredity presence (1) and Absence of heredity or "Don't know" (0). Those who didn't know about their parent's heart disease before the age of 60, are treated the same as absence of coronary heart disease heredity.

Sex

Information about the respondents' sex was obtained from question #26.

26. You are
   1. Male
   2. Female

Male is coded as (1) and female is coded as (0).

Age

Question #31 was used to obtain respondents' age.

3. Age at your last birthday? __________

Age is a continuous variable which ranges from 22 to 85 years.

Educational Attainment

The respondents' educational attainment was obtained with the following question:

51. How much schooling did you receive?
   1. 0-4 years
   2. 5-8 years
   3. Some high school
   4. Graduated from high school
   5. Trade school or business college
   6. Some college (including junior college)
7. Graduated from a four-year college

8. Post-graduate work at a college or university

The level of education of the years of schooling may not directly affect the blood cholesterol levels, but it is vitally important in formulating one's knowledge-attitude and behavior variables that could affect the level of blood cholesterol, and indirectly affect CHD.

To form a scale, the following years of education within the above categories was utilized: 0-4 years (2 years), 5-8 years (6 years), some high school (11 years), graduated from high school (12 years), trade school or business college (13 years), some college (14 years), graduated from a four-year college (16 years), and post-graduate work at a college or university (18 years).

Presence of Certain Disease(s)

In the knowledge information section of the questionnaire, question #14 asked information on the presence of certain disease(s).

14. Has your doctor ever told you that you have any of the condition(s) listed below?

a. Disease related to heart attacks or coronary Yes No

b. Rheumatic fever, rheumatic heart disease, or a heart murmur Yes No

c. Diabetes Yes No
d. High blood pressure Yes No
e. High blood cholesterol Yes No
f. Gout Yes No
g. Kidney trouble Yes No
The presence of certain disease(s) has an important role in the study of one's knowledge-attitude and behavior variables.

The presence of disease(s) was coded according to the number of disease(s) one has had or currently has. One point was given for each "Yes" answer except for high blood cholesterol. The total points were added for each respondent. This variable was recoded in number of disease(s) for each respondent.

**Special Dietary Regimen**

Whether one was on a special diet(s) or not, due to a health problem was obtained from question #15.

15. Are (were) you on a special diet because of a health problem?

1. Yes 2. No

Even though a person is on a special diet, it may not directly affect one's blood cholesterol level because of the many different types of diets available. However, if one is on a special diet because of a health problem, it would have a positive impact on his or her knowledge-attitude and compliance behavior.

This variable was dichotomized as Yes (1) and No (0).

**Occupation**

The respondents were asked about their employment, specific occupation, and title in questions #36 and 37 of the Physical Activity or Occupation section.

36. Which of the following was most applicable to you during the past year?
1. Employed
2. Housewife
3. Retired If you were retired or unemployed during last year:
4. Unemployed
5. None of the above

A. How long had you been retired? or unemployed?
   ________ months or ________ years

B. Did you have part-time work during the past year?
   1. Yes (Go to question #37)
   2. No

37. What was your specific occupation and title? __________________

Some previous research indicated that blood cholesterol level depends, to a certain degree, on the amount and intensity of physical activity when dietary factors are controlled. These effects occur, indirectly, through some other intervening variable such as energy expenditure, relative weight, and/or attitudinal variable.

The occupational category was classified as: (1) professional and technical; (2) managerial; (3) clerical and sales; (4) skilled and semi-skilled; (5) service and labor; (6) farmer; (7) full-time housewife; (8) housewife with part-time employment; and (9) retired. In order to be used in path analysis, the occupation was divided into two categories according to the physical activity of the respondent on the job. Professional, technical, managerial, clerical, sales, and retired are coded as (1), and skilled, semi-skilled, service, labor, farmer, full-time housewife, and housewife with part-time job, are coded as (0). It was assumed that the retired have less
physical activity and, on the other hand, housewives have relatively more physical activity on the job.

**Coronary Heart Disease Knowledge**

Questions 1-10 (Appendix C) were used to measure respondents' knowledge about coronary heart disease.

We now have evidence available that suggests that increasing dietary knowledge among population (Stern and Taylor, 1975), controlling physical energy-expenditure, body weight, stopping smoking, reducing blood pressure levels, and stress can, in fact, favorably affect the outcome of coronary heart disease (Stamler and Epstein, 1972). Knowledge, itself, may not be a direct cause of blood cholesterol levels, but it would be an influential factor through some other intervening variables, such as energy expenditure, saturated fat intake, and attitudinal variable.

The knowledge test consisted of sixty-one items to test the respondents' knowledge about coronary heart disease and its risk factors, including dietary factors, physical activity, Type A/B behavior patterns, and other risk factors related to blood cholesterol levels and coronary heart disease. The major part of the test was developed and validated in the previous research (Hall, 1978), and it was modified for our study. Twenty-two items assessed the knowledge of disease, twenty-six items measured the role of diet and food preparation, eleven with body weight and physical exercise, and two with behavior patterns. The scoring system was developed as follows: +1 point was given for the response of the "Right
Answer, 0 points for the "Not Sure" or "Undecided," and -1 points for the "Wrong Answer." The responses of "Strongly Agree" and "Agree" were treated as one category; "Disagree" and "Strongly Disagree" were also treated as one category.

This was a continuous variable expressed as a point score of knowledge from a minimum score of -61 to a maximum of +61.

Type A/B Behavior Patterns

The behavior patterns of the respondents were classified by means of a self-administered Jenkins Activity Survey (JAS) (1978). This test was developed by David Jenkins and was tested and validated in several previous studies (Jenkins et al., 1967). Special permission was given for use of this instrument. The JAS (1978 edition) consisted of a series of 52 items (Appendix C), and multiple choice questions precoded for ease and accuracy in keypunching. The score was rated for a behavior pattern involving urgency, excessive sense of time pressure, aggressiveness and competitiveness, explosiveness of speech, and preoccupation with obligation. Respondents were dichotomized into behavior Type A if they manifested high levels of these traits, and behavior Type B if they manifested low levels or an absence of behavior Type A characteristics.

The major study of personality and coronary heart disease relationships was performed by the Western Collaborative Groups (Rosenman et al., 1970, 1975). It was found that the behavior patterns bore a significant association with the incidence of coronary heart disease. It was also shown that behavior type and serum cholesterol are strongly and independently related to the risk of coronary heart disease.
The JAS provides a continuous distribution of A-B scores. The JAS test questionnaire is a valid means of measuring some of the ways in which behavior contributes to coronary risk and it can identify persons at higher risk of incurring an initial episode of clinical disease (Jenkins, et al., 1974).

**Attitude Toward Less Atherogenic Diets**

Attitude toward the intake of low cholesterol and low saturated fat was measured from question #11.

11. Of the following, which best describes your feeling about limiting your family's intake of cholesterol and saturated fat?

1. I am not interested at present.

2. I am interested but don't know enough nutrition to plan a low cholesterol, low saturated fat eating style.

3. I am interested but do not feel this eating style is practical for my family's food taste.

4. I presently make a modest effort to limit cholesterol and saturated fat intake.

5. I presently make a major effort to limit cholesterol and saturated fat intake.

This test was developed and used by Podell et al. (1975). The scoring system used in this study was developed as follows: 0 points were given for the responses of "Not Interested at Present," 1 point for "Interested but don't know enough nutrition to plan a low cholesterol, low saturated fat eating style," and "Interested but do not feel this eating style is practical for my family's food taste," 3 points were
given for "Presently making a modest effort," and 4 points were
given for "Presently making a major effort." This is a continuous
variable scoring from 0-4 points.

Saturated Fat Intake

To estimate dietary intake, each respondent was asked to record
all personal food and beverage consumption for 3 days, that is,
2 days during the week, and 1 day on the weekend, at least 1 day
apart. A three-day dietary record form is presented in Appendix B.
This pattern of dietary record collection was more representative
of the individual's food intake. Intake of total calories,
saturated fat, and 19 other nutrients were analyzed by the Index
of Nutritional Quality computer program developed at Utah State Uni-
versity (Sorenson and Hansen, 1975).

Many epidemiological and experimental studies indicated that
the dietary intakes of saturated fat and cholesterol and the
percentage of calories derived from fat were closely associated
with the blood cholesterol levels of men. The abnormally high
levels of lipid in the blood of men is believed to contribute to the
prevalence of coronary heart disease in many population groups (Hodges,
1968; Malhotra, 1967).

Caloric intake from saturated fat is expressed by the per-
centage of the total caloric intake. This is a continuous variable
in numbers of calories derived from saturated fat expressed as a
percentage of the total calories.

Physical Energy Expenditure

The physical activity was estimated from the subject's response
to the questions in the questionnaire that were designed for assessing physical activity for occupational and leisure time during the past year.

Question #41 was used for determining the average daily caloric expenditure of individuals on the job during the past year.

41. On the average during the past year, how many hours per day have you spent performing the following activities while on your job(s) and/or doing household tasks? (The number of hours that you spend at these activities should add up to the total number of hours you spend each day at your job(s) and/or in household tasks.)

Total hours per day at job(s) and/or in household tasks

1. Sitting, e.g., writing, sewing, talking, desk work, reading, watching television, knitting, etc.

2. Driving, e.g., trucks, bus, or other equipment

3. Standing, e.g., operating cash register, waiting for customers, etc.

4. Walking, e.g., walking to store, to work or at work, shopping, etc.

5. Light physical labor, e.g., working at lathe or other equipment, cooking, ironing, washing, dusting, laundry, typing, etc.

6. Moderate physical labor, e.g., using tools such as hammer, wrench, vacuuming, gardening, bowling, etc.

7. Heavy physical labor, e.g., lifting or carrying infants or heavy objects, digging, chopping wood, scrubbing floors, construction work, shoveling, jogging, active sports, etc.
Questions 45-80 were used for estimating the average daily energy expenditure of individuals off the job. The question stated that when off the job (or on lunch or tea break), on the average, how often during the past year have you performed the following activities. The details of the questions are presented in Appendix C.

A trained interviewer then spent an average of 8-10 minutes per individual for checking out detailed information for each activity filled out. The number of months in which the activity was performed, the average number of occasions in each month, and the average duration of activity on each occasion were all checked.

The major part of this questionnaire was designed by Stanford Heart Disease Prevention Program (1979) and slight modification was made for this study.

Energy expended in a specific activity was estimated as the product of the intensity code (the ratio of Work Metabolic Rate (WMR) to the Basal Metabolic Rate (BMR)) and the duration of activity. The formulation of WMR/BMR ratio, originally suggested by Dill (1936), was adopted by Reiff and Montoye and their colleagues (1967), and Taylor and his colleagues (1978). Intensity codes are based on experimentation in which rates of oxygen consumption (VO₂) were measured while people performed various specific activities (Consolzaio, 1971; Passmore and Durnin, 1955; Spector, 1956). For many activities VO₂ is a function of the rate of movement (walking, swimming) or the frequency of repetitions of an activity done at a constant rate (shoveling). Activities differed in customary lengths of pause and all these factors, depending on individual, vary. Empirical distribution
of many of these factors have been obtained in highly standardized, experimental situations, but are rarely available for the free-living situation.

The reliability of assessing physical activity by questionnaire and interview, using an objective method of calculating the average energy expenditure was compared with the subjective ranking of the two sets of 20 respondents by Reiff and his associates (1967). It indicated that the two methods gave approximately the same results. According to Taylor et al. (1978) the validity was also established against the reference of physical work capacity.

The first step in the preparation of the scoring system was the construction of a table of metabolic costs for various occupational and leisure tasks. These are given in Table 16 and 17 of Appendix D as a ratio of WMR/BMR. The average metabolic cost of occupational and/or leisure tasks were calculated from the table of metabolic cost of activities by Reiff and colleagues (1967) and Taylor et al. (1978).

The procedure using Table 16 and 17 was as follows. The work-to-basal ratio for a particular activity was multiplied by the number of minutes in which the subject engaged in that activity per day. This was repeated for all activities requiring appreciable energy expenditures. The products were summed and divided by 60 to obtain a work-to-basal ratio for occupation per day in hours. The same procedure was followed to estimate a work-to-basal ratio for leisure time. The number of each occasion during leisure time was coded as follows: "4-7 times per week" as 22 times per month, "2-3 times per week" as 10 times per month, "1-4 times per month" as 2.5 times
per month, "occasionally during year" as 0.5 times per month, and "never" as 0. The duration of each occasion was coded 15 minutes for less than 15 minutes, 22 minutes for 15-30 minutes, 45 minutes for 31-60 minutes, 75 minutes for 1-1 1/2 hours, and 90 minutes for more than 1 1/2 hours. The average work-to-basal ratio for leisure time per day was arrived at by dividing the work-to-basal ratio of the year by 365.

The caloric expenditure was next estimated from the objective scoring system. This was done by using each respondent's age, height, and weight to estimate the basal oxygen consumption with an assumed R.Q. of 0.85. The average daily work-to-basal ratio for occupation and leisure time was then multiplied by the basal oxygen consumption. This represented the average daily caloric expenditure for occupation and leisure time, respectively. Thus, the average total energy expenditure per day was expressed as the sum of average daily caloric expenditures for occupation and leisure time.

Physical activity, expressed as energy expenditure, is treated as a continuous variable in number of calories.

Relative Weight

Relative weight is a ratio, expressed in percent, of a person's weight to a desirable weight for his or her height. It was calculated from "desirable" weight by height published by the Metropolitan Life Insurance Company (1959). Therefore, the relative weight of 100 means that the individual has a desirable weight for his height and sex. This is a continuous variable in numbers.
Blood Cholesterol Level

Each respondent's blood cholesterol levels from the past year were actually obtained from medical charts during January and February of 1979. If there was more than one measurement taken, the average value was used in the analysis.

Blood cholesterol level is a continuous variable as expressed in mg/100 ml (mg%), or mg/dl, ranging from 110 to over 400 mg/100 ml.

Method of Data Analysis

For the analysis of the proposed model, the technique of path analysis was used. In addition to the assumptions in regression analysis, path analysis required the assumption of (1) a unidirectional causal order, and (2) a closed system. The proposed model was derived on the basis of extensive literature review and intensive consideration of validity. Therefore, it is believed that both assumptions mentioned are reasonable ones with respect to this research.

To estimate the parameters of the model (the path coefficients), the least square regression technique proved to be a convenient and appropriate tool. Since some of the variables in the model were measured in the dichotomous scale (heredity, special diets, and Type A/B behavior patterns etc.), the technique of dichotomous variables regression was also employed.

$u_1, u_2, u_3, u_4, u_5, u_6, u_7, u_8, u_9, u_{10},$ and $u_{11}$ were residuals of the corresponding regression equation in the model. The general form of a residual is $(\sqrt{1-R^2})$, where $R^2$ is the coefficient of determination, the square of the multiple correlation ($R$).
While the standardized regression coefficient (path coefficient) of an independent variable reveals the degree of association with the dependent variable, the unstandardized regression coefficient indicates the unit effect on the dependent variable with all the other variables being controlled. In the present research, both the standardized and the unstandardized coefficients were utilized for comparisons of different purposes. The standardized coefficients were used to compare the degree of association of independent variables within a regression equation. The unstandardized coefficients were used to examine the different effect of a certain independent variable in two populations, in this case, the male and female populations.

Specht and Warren's (1975) likelihood-ratio test was employed for the differences of coefficients between male and female models. Under the assumption that errors distribute normally, this hypothesis that coefficients are homogeneous within a given equation is an F-test applied separately to each equation.

The likelihood-ratio test statistic for an entire model is a function of the ratio of the unconstrained likelihood function (in this case, male and female sample) to the constrained likelihood function (in this case, whole sample). The distribution of the likelihood ratio's logarithm is approximately a Chi-square. Therefore,

$$X^2 = (N-d)M \quad (\alpha = 0.05)$$

where $N$ = sample size

$d$ = degree of freedom equal to the difference in number of parameters estimated by the two models
where $\hat{\sigma}_{cj}$ or $\hat{\sigma}_{uj} = \text{residual mean squares for equationing under the constrained or unconstrained models.}$

The residual mean squares are the residual sums of squares divided by the degree of freedom.

The likelihood-ratio test statistic for differences within an individual equation is the F-test of the general linear model. The test statistic is:

$$F = \frac{(RS_{ip} - RS_{iu})/dfc-dfu}{RS_{iu}/dfu}$$  \[(a = 0.05)\]

where $RS_{ip} = \text{residual sums of squares for equation i in the constrained model}$

$RS_{iu} = \text{residual sums of squares for equation i in the unconstrained model}$

$dfc = \text{degree of freedom in the constrained model}$

$dfu = \text{degree of freedom in the unconstrained model}$

The numerator is the difference between the constrained and unconstrained residual sums of squares divided by the degrees of freedom for this difference. The denominator is the residual sums of squares for the unconstrained model divided by the degrees of freedom. (For more detailed information, see Specht and Warren, 1975)

Discriminant function analysis is also used to find linear combinations of independent variables that best distinguish between cases in hyper- and normo-cholesterolemia among whole sample
populations and also between male and female sample populations. Default control procedure was used (S.P.S.S., 1975). According to this procedure, all independent variables are entered into the analysis concurrently. The discriminant functions are created directly from the entire set of independent variables, regardless of the discriminating power of each of the independent variables.

The standardized discriminant function coefficients represent the relative contribution of its associated variable to that function. The interpretation is analogous to the interpretation of beta weights in multiple regression. Thus, the technique of discriminant function analysis serves to identify the variables which contribute most to differentiation along the respective dimension (function).

By classifying the cases used to derive the functions in the first place and comparing predicted group membership with actual group membership, it can also empirically measure the success in discrimination by observing the proportion of correct classification (S.P.S.S., 1975). The purpose of classifying these cases is to see how effective the discriminating variables are.

In summary, the path analysis seems to yield a picture of the causal relationship of the proposed model. The estimation of the path coefficients was done by multiple regression analysis. While the dependent variable of path analysis is a continuous variable, the dependent variable of discriminant function analysis is a categorical or dichotomized variable. Therefore, these two techniques address themselves to two different questions; in path analysis in addition to the causality relationship, one can, in fact, assess the unit effect of independent variables and predicting the magnitude of
the dependent variable of relevance, while in discriminant function analysis, one can measure the discriminant power of the independent variables in the classification of the membership (membership refers to high- and normal cholesterol level).
CHAPTER IV
ANALYSIS OF DATA

This chapter contains two major sections. The first section describes characteristics of the sample population. The characteristics are examined to provide information on the selected sample interviewees. The second part contains the results and discussion. In this section, the results of multiple regression analysis and that of discriminant function analysis are discussed for the whole sample, as well as male and female samples.

The effects of these characteristics on three sample groups will be discussed.

1. The effect of social and demographic characteristics, CHD knowledge, and behavior variables on the level of blood cholesterol among the selected sample population in northern Utah communities.

2. The effect of social and demographic characteristics, CHD knowledge, and behavior variables on the level of blood cholesterol among a selected male population in northern Utah.

3. The effect of social and demographic characteristics, CHD knowledge, and behavior variables on the level of blood cholesterol among a selected female population in northern Utah.

Characteristics of Sample Population

The principle aim in this section is to provide a description
of the characteristics of the sample population. (See Table 1 and Table 2)

As described in the previous chapter, the sample used in this study was a selected population aged 22-88 years at the time of the survey (March-April, 1979), living in northern Utah communities, whose blood cholesterol level had been measured during the past year. As one of the aims was to evaluate the systematic relationship among causal factors of blood cholesterol level, normal subjects, as well as subjects with hypertension, diabetes, rheumatic fever, high blood cholesterol and others like gout and kidney problems were included in the sample, but no treatment was administered through this program.

As shown in Table 1, the distribution of sex between male and female was fairly close; 42.7% male and 57.3% female. Age distribution of the sample indicates that more than half of the sample population (54.6%) was between the ages of 40 and 64. Of these, 25.2% were male and 29.4% were female. Among those 65 and older, 27.1% were female and 17.1% male. Among those under 40 years of age, 11.2% were female and 7.1% were male.

As can be seen in Table 2, the mean age of the sample is 55.2 years, as compared with those of the Framingham Study (46.7), Albany Study (46.2), Chicago Gas Company Study (47.4), and Tecumseh Study (46.3) (McGee and Gordon, 1976). Thus, the mean age of the sample is slightly higher than those in four other U.S.-based cardiovascular disease studies. The mean relative weight of the respondents in this study, 117.7, is similar to those of Framingham (116.9), Albany (114.1), Chicago Gas Company (121.1), and Tecumseh (119.9) studies (McGee and Gordon, 1976).
Table 1. Distribution of Respondents by Socio-demographic Characteristics, Knowledge of Coronary Heart Disease, Dietary Practices, and Serum Cholesterol Level.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>93</td>
<td>42.7</td>
</tr>
<tr>
<td>Female</td>
<td>125</td>
<td>57.3</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>40</td>
<td>18.3</td>
</tr>
<tr>
<td>Female</td>
<td>(16)</td>
<td>(7.1)</td>
</tr>
<tr>
<td>40-64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>119</td>
<td>54.6</td>
</tr>
<tr>
<td>Female</td>
<td>(54)</td>
<td>(25.2)</td>
</tr>
<tr>
<td>65+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>59</td>
<td>27.1</td>
</tr>
<tr>
<td>Female</td>
<td>(22)</td>
<td>(10.0)</td>
</tr>
<tr>
<td><strong>CHD Heredity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have</td>
<td>63</td>
<td>28.9</td>
</tr>
<tr>
<td>Have Not</td>
<td>155</td>
<td>71.1</td>
</tr>
<tr>
<td><strong>Presence of Certain Disease(s)</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>78</td>
<td>35.8</td>
</tr>
<tr>
<td>One disease</td>
<td>73</td>
<td>33.5</td>
</tr>
<tr>
<td>Two diseases</td>
<td>29</td>
<td>13.3</td>
</tr>
<tr>
<td>Three diseases</td>
<td>25</td>
<td>11.5</td>
</tr>
<tr>
<td>Four diseases</td>
<td>6</td>
<td>2.8</td>
</tr>
<tr>
<td>Five diseases</td>
<td>4</td>
<td>1.8</td>
</tr>
<tr>
<td>Six diseases</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Educational Attainment (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-4</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>5-8</td>
<td>6</td>
<td>2.8</td>
</tr>
<tr>
<td>Some High school</td>
<td>21</td>
<td>9.6</td>
</tr>
<tr>
<td>Graduated from high school</td>
<td>52</td>
<td>23.9</td>
</tr>
<tr>
<td>Trade school or Business college</td>
<td>16</td>
<td>7.3</td>
</tr>
<tr>
<td>Some college (including junior college)</td>
<td>53</td>
<td>24.3</td>
</tr>
<tr>
<td>Graduated from a 4-year college</td>
<td>23</td>
<td>10.6</td>
</tr>
<tr>
<td>Post-graduate work at a college or university</td>
<td>46</td>
<td>21.1</td>
</tr>
<tr>
<td><strong>Special Dietary Regimen</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have</td>
<td>106</td>
<td>48.6</td>
</tr>
<tr>
<td>Have Not</td>
<td>112</td>
<td>51.4</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
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<td></td>
</tr>
<tr>
<td>Professional, Technical</td>
<td>40</td>
<td>18.3</td>
</tr>
<tr>
<td>Managerial</td>
<td>13</td>
<td>6.0</td>
</tr>
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</table>
Table 1. Continued

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clerical and Sales</td>
<td>12</td>
<td>5.5</td>
</tr>
<tr>
<td>Skilled and Semi-skilled</td>
<td>11</td>
<td>5.0</td>
</tr>
<tr>
<td>Service and labor</td>
<td>15</td>
<td>6.9</td>
</tr>
<tr>
<td>Farmer</td>
<td>7</td>
<td>3.2</td>
</tr>
<tr>
<td>Housewife, full-time</td>
<td>73</td>
<td>33.5</td>
</tr>
<tr>
<td>Housewife, partly employed</td>
<td>24</td>
<td>11.0</td>
</tr>
<tr>
<td>Retired</td>
<td>23</td>
<td>10.6</td>
</tr>
<tr>
<td>CHD Knowledge (points)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-24</td>
<td>12</td>
<td>5.5</td>
</tr>
<tr>
<td>25-44</td>
<td>131</td>
<td>60.1</td>
</tr>
<tr>
<td>45-60</td>
<td>75</td>
<td>34.4</td>
</tr>
<tr>
<td>Type A/B</td>
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<td></td>
</tr>
<tr>
<td>Type A (Positive standard score)</td>
<td>108</td>
<td>49.5</td>
</tr>
<tr>
<td>Type B (Negative or zero standard score)</td>
<td>107</td>
<td>49.1</td>
</tr>
<tr>
<td>Attitude toward Less Atherogenic Diets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Not Interested at present&quot;</td>
<td>10</td>
<td>4.6</td>
</tr>
<tr>
<td>&quot;Don't know enough nutrition to plan&quot;</td>
<td>25</td>
<td>11.5</td>
</tr>
<tr>
<td>&quot;Do not feel this eating style is practical&quot;</td>
<td>5</td>
<td>2.3</td>
</tr>
<tr>
<td>&quot;Modest effort&quot;</td>
<td>105</td>
<td>48.2</td>
</tr>
<tr>
<td>&quot;Major effort&quot;</td>
<td>73</td>
<td>33.5</td>
</tr>
<tr>
<td>Saturated Fat Intake (gram/day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-29</td>
<td>118</td>
<td>55.9</td>
</tr>
<tr>
<td>30-100</td>
<td>93</td>
<td>44.1</td>
</tr>
<tr>
<td>Energy Expenditure (kcal/day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 2290</td>
<td>124</td>
<td>58.8</td>
</tr>
<tr>
<td>Greater than 2300</td>
<td>87</td>
<td>41.2</td>
</tr>
<tr>
<td>Relative Weight* (&lt;) (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 100</td>
<td>36</td>
<td>16.5</td>
</tr>
<tr>
<td>100-104</td>
<td>16</td>
<td>7.3</td>
</tr>
<tr>
<td>105-109</td>
<td>34</td>
<td>15.6</td>
</tr>
<tr>
<td>110-114</td>
<td>23</td>
<td>10.6</td>
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<tr>
<td>115-119</td>
<td>24</td>
<td>11.0</td>
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<tr>
<td>120-124</td>
<td>17</td>
<td>7.8</td>
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<tr>
<td>125-129</td>
<td>25</td>
<td>11.5</td>
</tr>
<tr>
<td>130-134</td>
<td>15</td>
<td>6.9</td>
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<tr>
<td>135-139</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>140+</td>
<td>25</td>
<td>11.5</td>
</tr>
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Table 1. Continued.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Cholesterol Level (mg %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>110-249</td>
<td>114</td>
<td>52.3</td>
</tr>
<tr>
<td>250-400</td>
<td>104</td>
<td>47.7</td>
</tr>
</tbody>
</table>

Note: 
*a.* Diseases include high blood pressure, diabetes, gout, kidney trouble, rheumatic fever, and disease related to heart.

*b.* Special diets include low fat or low cholesterol, low salt or no salt, low sugar or low carbohydrate, low calorie, weight reduction, and high fiber.

*c.* Relative weight = \( \frac{\text{Respondents' Actual Weight}}{\text{Desired Weight for His/Her Height}} \times 100 \)

(Metropolitan Life Insurance Co., 1959)
Table 2. Means and Standard Deviations of Socio-demographic Characteristics, Knowledge of Coronary Heart Disease, Dietary Practices and Serum Cholesterol Level.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>55.2</td>
<td>14.7</td>
</tr>
<tr>
<td>Male</td>
<td>53.5</td>
<td>14.0</td>
</tr>
<tr>
<td>Female</td>
<td>56.4</td>
<td>15.1</td>
</tr>
<tr>
<td>Blood cholesterol &lt; 250 mg%</td>
<td>50.8</td>
<td>15.7</td>
</tr>
<tr>
<td>Blood cholesterol &gt; 250 mg%</td>
<td>56.7</td>
<td>11.1</td>
</tr>
<tr>
<td>Educational attainment (years)</td>
<td>13.9</td>
<td>2.8</td>
</tr>
<tr>
<td>CHD knowledge (points)</td>
<td>40.9</td>
<td>8.4</td>
</tr>
<tr>
<td>Saturated fat intake (gram/day)</td>
<td>29.3</td>
<td>12.8</td>
</tr>
<tr>
<td>Relative weight (%)</td>
<td>117.8</td>
<td>19.9</td>
</tr>
<tr>
<td>Energy Expenditure (Kcal/day)</td>
<td>2213.0</td>
<td>734.9</td>
</tr>
<tr>
<td>Blood cholesterol level (mg%)</td>
<td>242.5</td>
<td>52.4</td>
</tr>
<tr>
<td>Male</td>
<td>236.7</td>
<td>47.4</td>
</tr>
<tr>
<td>Female</td>
<td>246.8</td>
<td>55.5</td>
</tr>
</tbody>
</table>
Average schooling for the whole sample is 13.9 years, and 63.3% of the sample population have at least some college education. Of these half of them had graduated from a 4-year college or have had some post-graduate work. This may have contributed to the high mean CHD knowledge score, 40.7 points. Sixty points was the maximum possible score for CHD knowledge, and the range was from 4 to 60 points. As shown in Table 1, nearly one-third (29.8%) of the respondents were engaged in professional, technical, managerial, clerical, and sales work, while less than one-sixth (15.1%) were engaged in skilled, semi-skilled, service, labor, and farming work; 10.6% were retired and 43.5% were housewives, either full-time or with part-time employment.

The distribution of sample population between high and normal cholesterol level was fairly even; 52.3% for normo- and 47.7% for hyper-cholesterolemia. The mean blood cholesterol level of respondents was 242.5 mg % which was close to those of the Chicago Western Electric study (247.7 mg %) and the Chicago Gas Company study (237.5 mg %), while Framingham's (226.5), Albany's (229.1), and Tecumseh's (230.5) results were lower (McGee and Gordon, 1976). It was also observed that the mean age was lower among normo-cholesterolemia (50.8 years) than among hypercholesterolemia (56.7 years). The mean cholesterol level among males was 236.7 mg %, compared to 246.8 mg % for females. This finding was consistent with Fisher's findings in Southern Utah (1978).
Results and Discussion

Estimation of the Model for the Whole Sample Population

In the first part of the analysis, the model was evaluated for the whole sample population. Table 3 presents the zero-order correlation matrix, means, and standard deviations for all variables in the model. Table 4 contains standardized and unstandardized direct effects of independent variables on the dependent variable of relevance. All residuals which represent unspecified causes associated with each independent variable are also presented in Table 4. A path diagram of the whole sample model with standardized regression coefficients (path coefficients) illustrating results of empirical assessment of direct effects is given in Figure 2.

For each endogenous variable, the direct effects of each independent variable on the dependent variable of relevance are examined to test the main hypotheses of the study. Each effect coefficient is represented by standardized regression coefficients which allow for comparisons of the relative effect of the variables within the model. Thus, comparison of the relative levels of each of the independent variables is accomplished. Coronary heart disease heredity, sex, and age are treated as predetermined, or "exogenous" variables. Therefore, no attempt is made to analyze their antecedents. The results and discussions are organized about the successive endogenous variables.

Presence of certain disease(s). It was hypothesized that CHD heredity, sex, and age would have a positive influence on the
Table 3. Zero-Order Correlation Matrix, Means and Standard Deviations of All Variables in the Model.

<table>
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<tr>
<th></th>
<th>HD</th>
<th>SEX</th>
<th>AGE</th>
<th>DIS</th>
<th>EDU</th>
<th>DIET</th>
<th>OCC</th>
<th>KNOWL</th>
<th>A/B</th>
<th>ATT</th>
<th>STCAL</th>
<th>EE</th>
<th>RLWT</th>
<th>CHOL</th>
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<td>SEX</td>
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<tr>
<td>AGE</td>
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<td>-0.098</td>
<td>1.000</td>
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<tr>
<td>DIS</td>
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<td>0.094</td>
<td>0.329</td>
<td>1.000</td>
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<td>DIET</td>
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<td>-0.134</td>
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<tr>
<td>OCC</td>
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<td>-0.527</td>
<td>0.096</td>
<td>-0.112</td>
<td>-0.358</td>
<td>-0.006</td>
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<td>0.430</td>
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<td>A/B</td>
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<td>-0.050</td>
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<td>0.089</td>
<td>-0.024</td>
<td>0.105</td>
<td>0.072</td>
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<td>ATT</td>
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<td>0.253</td>
<td>0.092</td>
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<td>0.047</td>
<td>-0.026</td>
<td>0.023</td>
<td>-0.112</td>
<td>-0.123</td>
<td>0.006</td>
<td>-0.020</td>
<td>0.022</td>
<td>-0.058</td>
<td>1.000</td>
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<tr>
<td>EE</td>
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<td>0.088</td>
<td>-0.404</td>
<td>-0.126</td>
<td>0.080</td>
<td>-0.057</td>
<td>0.156</td>
<td>0.143</td>
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<td>-0.059</td>
<td>0.089</td>
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<td>RLWT</td>
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<td>0.074</td>
<td>0.111</td>
<td>-0.107</td>
<td>0.144</td>
<td>0.167</td>
<td>-0.072</td>
<td>0.134</td>
<td>0.092</td>
<td>0.118</td>
<td>0.189</td>
<td>1.000</td>
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<td>CHOL</td>
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<td>0.243</td>
<td>0.046</td>
<td>-0.083</td>
<td>0.243</td>
<td>-0.007</td>
<td>0.039</td>
<td>0.090</td>
<td>0.201</td>
<td>0.100</td>
<td>-0.191</td>
<td>0.110</td>
<td>1.000</td>
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</table>

Mean 0.30 0.42 5.52 1.27 13.9 0.50 0.62 40.9 1.50 3.08 14.0 223.0 117.8 242.5
S.D. 0.46 0.50 14.7 1.36 2.8 0.50 2.82 8.4 9.91 0.95 3.5 734.9 19.9 52.4

Note: HD = CHD heredity, DIS = Presence of certain disease(s), EDU = Educational attainment, DIET = Special dietary regimen, OCC = Occupation, KNOWL = CHD knowledge, A/B = Type A/B behavior patterns, ATT = Attitude toward less atherogenic diets, STCAL = saturated fat calorie intake, EE = energy expenditure, RLWT = Relative weight, CHOL = Blood cholesterol level.
Table 4. Regression Coefficients of Independent Variables on Dependent Variables in the Model

<table>
<thead>
<tr>
<th>Dependent Variable(s)</th>
<th>Independent Variable(s)</th>
<th>Regression Coefficients</th>
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<tr>
<td></td>
<td></td>
<td>Standardized (Unstandardized)</td>
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<tr>
<td>DIS†</td>
<td>HD</td>
<td>.066 (.198)</td>
</tr>
<tr>
<td></td>
<td>SEX</td>
<td>.132* (.364)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>.386*** (.324)</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>.271*** (.996)</td>
</tr>
<tr>
<td></td>
<td>Multiple R (.35934)</td>
<td></td>
</tr>
<tr>
<td>EDU</td>
<td>SEX</td>
<td>.174** (.994)</td>
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<tr>
<td></td>
<td>AGE</td>
<td>-.312*** (-.600)</td>
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<tr>
<td></td>
<td>EDU</td>
<td>.174** (.994)</td>
</tr>
<tr>
<td></td>
<td>Multiple R (.37218)</td>
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</tr>
<tr>
<td>DIET</td>
<td>HD</td>
<td>.084 (.913)</td>
</tr>
<tr>
<td></td>
<td>SEX</td>
<td>-.083 (-.838)</td>
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<tr>
<td></td>
<td>AGE</td>
<td>.134 (.439)</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>.271*** (.996)</td>
</tr>
<tr>
<td></td>
<td>U4</td>
<td>.934</td>
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<tr>
<td></td>
<td>Multiple R (.35678)</td>
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<tr>
<td>OCC</td>
<td>SEX</td>
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<td>EDU</td>
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<td></td>
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</tr>
<tr>
<td>KNOWL</td>
<td>DIS</td>
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</tr>
<tr>
<td></td>
<td>DIET</td>
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</tr>
<tr>
<td></td>
<td>EDU</td>
<td>.433*** (1.347)</td>
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<td>OCC</td>
<td>.091 (1.631)</td>
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<td>.910</td>
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<tr>
<td>A/B</td>
<td>SEX</td>
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<tr>
<td></td>
<td>AGE</td>
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<tr>
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<td>EDU</td>
<td>.027 (.936)</td>
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<tr>
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<td>U6</td>
<td>.992</td>
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<td></td>
<td>Multiple R (.41484)</td>
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<tr>
<td>ATT</td>
<td>HD</td>
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<tr>
<td></td>
<td>AGE</td>
<td>.293*** (.191)</td>
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<td></td>
<td>DIET</td>
<td>.111 (.212)</td>
</tr>
<tr>
<td></td>
<td>OCC</td>
<td>-.115 (-.223)</td>
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<tr>
<td></td>
<td>KNOWL</td>
<td>.453*** (.514)</td>
</tr>
<tr>
<td></td>
<td>U5</td>
<td>.826</td>
</tr>
<tr>
<td></td>
<td>Multiple R (.56305)</td>
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Table 4. Continued

<table>
<thead>
<tr>
<th>Dependent Variable(s)</th>
<th>Independent Variable(s)</th>
<th>Regression Coefficients</th>
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<tr>
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<td></td>
<td>Standardized (Unstandardized)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>STCAL</strong></td>
<td>SEX</td>
<td>0.049 (.348)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>-0.054 (-.128)</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>0.058 (.148)</td>
</tr>
<tr>
<td></td>
<td>DIET</td>
<td>-1.51* (-1.054)</td>
</tr>
<tr>
<td></td>
<td>EDU</td>
<td>-1.85* (-2.20)</td>
</tr>
<tr>
<td></td>
<td>KNOWL</td>
<td>0.069 (.288)</td>
</tr>
<tr>
<td></td>
<td>OCC</td>
<td>-0.020 (-.146)</td>
</tr>
<tr>
<td></td>
<td>A/B</td>
<td>0.042 (.149)</td>
</tr>
<tr>
<td></td>
<td>ATT</td>
<td>0.030 (-.112)</td>
</tr>
<tr>
<td></td>
<td>( u_8 )</td>
<td>0.977</td>
</tr>
<tr>
<td><strong>Multiple R</strong> (.21328)</td>
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<tr>
<td><strong>EE</strong></td>
<td>SEX</td>
<td>0.206** (306.140)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>-0.394*** (-19.725)</td>
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<td></td>
<td>OCC</td>
<td>0.324*** (487.968)</td>
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<tr>
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<td>KNOWL</td>
<td>-1.23* (-10.735)</td>
</tr>
<tr>
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<td>A/B</td>
<td>-0.059 (-4.386)</td>
</tr>
<tr>
<td></td>
<td>( u_9 )</td>
<td>0.865</td>
</tr>
<tr>
<td><strong>Multiple R</strong> (.50119)</td>
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<td></td>
</tr>
<tr>
<td><strong>RLWT</strong></td>
<td>HD</td>
<td>0.077 (3.357)</td>
</tr>
<tr>
<td></td>
<td>SEX</td>
<td>-1.125 (-5.030)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>0.170* (.231)</td>
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<td>DIS</td>
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<td>DIET</td>
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</tr>
<tr>
<td></td>
<td>A/B</td>
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</tr>
<tr>
<td></td>
<td>ATT</td>
<td>-1.205** (-4.280)</td>
</tr>
<tr>
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</tr>
<tr>
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<td>EE</td>
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<td>( u_{10} )</td>
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</tr>
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<td><strong>CHOL</strong></td>
<td>HD</td>
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<td>-0.045 (-4.790)</td>
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<td>AGE</td>
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<td>DIS</td>
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<tr>
<td></td>
<td>DIET</td>
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<tr>
<td></td>
<td>OCC</td>
<td>-0.062 (-6.698)</td>
</tr>
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<td></td>
<td>A/B</td>
<td>0.015 (.809)</td>
</tr>
<tr>
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<td>ATT</td>
<td>0.098 (5.382)</td>
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<td>STCAL</td>
<td>0.120 (1.798)</td>
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<td></td>
<td>EE</td>
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<tr>
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<td>RLWT</td>
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<td>( u_{11} )</td>
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</tr>
<tr>
<td><strong>Multiple R</strong> (.53084)</td>
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</table>

Note: \( u_1, u_2, u_3, u_4, u_5, u_6, u_7, u_8, u_9, u_{10}, u_{11} \) = Residual variables.  * * * \( p < 0.001 \), ** \( p < 0.01 \), *** \( p < 0.05 \)

*See Note on Table 3 for explanation of variables.
Figure 2. Path Diagram Illustrating Results of Empirical Assessment of Direct Effects in the Model

Note: *See Note on Figure 1 for explanation of variables.

= p < 0.001; = p < 0.01; = p < 0.05; = Not significant at 0.05 level.
presence of certain disease(s) related to the risk of CHD. Specifically, we assumed that males would have more of these diseases. All of the above hypotheses were supported. Each of the age and sex variables exhibited a significant positive effect on the presence of disease(s). The coefficients for sex and age were statistically significant at the 0.05 and 0.001 level of probability on the F-ratio test. Of the two variables, the effect of age (.384) was about two and one half times that found for sex (.132).

The effect of CHD heredity on the presence of certain disease(s) was not statistically significant at the 0.05 level of probability. This observation may be due partly to the fact that while the certain disease(s), such as diabetes and hypertension are most likely a heredity problem (Lal and Bahl, 1967; McDonough, 1965), others, such as kidney trouble and gout are not related to CHD heredity. The three variables combined explained about 13% of the variations in the presence of disease.

In summary, age, sex, and CHD heredity exert a positive direct influence on the presence of certain disease(s); however, age plays a more important role in the presence of disease than either sex or CHD heredity.

Educational attainment. It was hypothesized that males would have more educational attainment, while age would have a negative effect on education. The results indicated support for each of the hypotheses. Each of the sex and age variables exhibited a significant relationship to education attainment at the 0.01 and 0.001 level, respectively. Of the two variables, the direct effect of
age (-.312) is nearly twice that found for sex (.174) in a negative direction. As the Framingham study (1959) indicated, after correction of age, the significant lower incidence of CHD among the better educated subjects has disappeared, thus indicating there is a close relationship between age and educational level. These two variables explained about 14% of the variations in educational attainment.

In summary, being a male exerted a significant positive direct influence on educational attainment, while age exerted a significant negative effect on education; thus age and sex play an important role in educational attainment.

Special dietary regimen. It was hypothesized that age, CHD heredity, and the presence of certain disease(s) would have a positive influence on special dietary regimen. In other words, presence of certain disease(s) or CHD heredity may cause a person to be on a special diet. As age increases, the probability of a special diet increases also. Each of the above variables exhibited a positive effect on special diets. The coefficients of disease presence was statistically significant at the 0.001 level, while the effects of age and CHD heredity were not statistically significant at the 0.05 level. Of the two variables, the direct effect of disease presence (.271) on the special dietary regimen was more than double that found for age (.134).

In summary, it was observed that the presence of certain disease(s) exerts a significant influence on a person's special dietary regimen, while age and heredity play a role in a person's special diets.
Occupation. It was hypothesized that educational attainment would have a negative influence, while males are more likely to be engaged in more physically demanding occupations. In other words, the higher the educational level, the less physically active occupation a person would have. Men have more active occupations, such as labor, service, skilled, unskilled, and farming. The data supported the hypothesis of educational attainment on occupation.

Contrary to our expectations, males were observed to have less physically active occupations, such as professional, technical, managerial, sales, and clerical. Although many studies have observed the relationships between the occupational physical activity and CHD incidence among men (Cassel et al., 1971; Keys, A., 1975), women's housework has not been considered as an occupation. The consideration of this, as an occupation, is particularly important in this sample population. The majority of people (83%) belong to the Mormon religion, one that encourages women to stay home to rear children and take care of other domestic responsibilities, including household work. Also, these communities are centered by a major university, where many professionals and technical persons reside. It was found that 63.3% of the sample population have at least some college education, and more than half (57.3%) of the sample population were women. The above factors, undoubtedly contribute to the findings that contrasted our earlier hypotheses drawn from the theory. If housework had not been considered as an occupation, men would have a more physically active occupations.

The regression coefficients for sex and educational attainment were statistically significant at the 0.001 level of probability.
Of the two independent variables, the effect of sex (-.473) was more than one-half that found for educational attainment (-.261). The two variables combined explained about 34% of the variations in the occupational status.

In summary, it was found that the more educated the person, the less physically active the occupation would be. Males would have occupational categories of professional, managerial, sales, and clerical, which are sedentary occupations.

**CHD knowledge.** It was hypothesized that educational attainment, special dietary regimen, and the presence of certain disease would have a positive effect on CHD knowledge. Specifically, the greater the level of education, the higher the level of CHD knowledge. It was expected that a person with a special dietary regimen would have more knowledge about CHD. Presence of certain disease is expected to increase CHD knowledge. The above hypotheses are supported. On one hand, presence of certain disease and educational attainment exhibited a positive influence on CHD knowledge, as anticipated. As noted by other studies (Rosenberg, 1976), an observation was made that the presence of certain disease related to CHD risk, caused an increase in CHD knowledge. In this study, a significant positive relationship between educational attainment and CHD knowledge supported those of other studies (Casper, 1975; Morse et al., 1967; Sims, 1976; Young, 1956). Young (1956) found that nutritional knowledge was greatest in the younger, better educated, and higher income housewives. Similar results were obtained by Sims (1976) among mothers of preschool children.
Morse et al. (1967) and Cosper (1975) also showed that nutritional knowledge is highly correlated to educational attainment.

On the other hand, special dietary regimen had a negative influence on CHD knowledge, which was contrary to the expectation. In fact, it was found that some of the special dietary regimen may encourage the intake of high protein foods which is contraindicated for the prevention of CHD. This observation was consistent with our finding of a positive effect of special diets on blood cholesterol concentration. When the frequency table is closely examined, it is observed that only 28% of the sample population are supposedly on a low-fat or low-cholesterol diet, and the rest are on other types of special diets.

A CHD knowledge test was also composed of factors related to CHD and its risk factors, other than dietary knowledge. Therefore, there is a highly probable negative effect of special diets on CHD knowledge. If only dietary knowledge had been tested, instead of CHD knowledge, being on a special dietary regimen would have a positive influence on it. Of the three independent variables, the direct effect of education (.433) was absolutely the greatest among them.

In summary, the direct effect of educational attainment on CHD knowledge was statistically significant. A negative effect of special dietary regimen on CHD knowledge was counter to expectation; however, it was highly probable when the frequency table of special dietary regimen among the sample population was closely examined. Thus, educational attainment played an important part in increasing the CHD knowledge level.
Type A/B behavior patterns. It was hypothesized that males and educational attainment would have a positive influence on Type A/B behavior patterns. In other words, men are more prone to the Type A behavior pattern, while women are more of the Type B behavior pattern. There is a relationship between a higher educational level and more Type A behavior.

Educational attainment exhibited the anticipated positive influence on the Type A behavior pattern, while men's tendency to possess a Type A pattern was contrary to expectation. However, both relationships were very weak ones. Thus far, no study has made an attempt to compare the Type A/B behavior patterns between male and female subjects. Actually, the hypothesis was drawn from the purely theoretical basis that men are more educated, more prone to have stress (mentally and socially), and have more aggressive and ambitious characters than women. The finding that women tend to have Type A pattern was consistent with the observation of a higher blood cholesterol level among women of our sample population. Studies have indicated that men with Type A behavior patterns have an increased level of blood cholesterol (Friedman and Rosenman, 1970; Friedman et al., 1960; Glass, 1977), severe basic coronary atherosclerosis (Friedman, 1968) and an increased incidence of CHD (Friedman et al., 1959; Rosenman et al., 1970, 1975). Therefore, it was very interesting to find the different effects of male and female on the Type A/B behavior patterns. In the future it would be worthwhile to examine the sex difference on behavior patterns and serum cholesterol concentration among other populations as well.
In summary, there was a weak positive relationship between educational attainment and Type A behavior pattern. Although the observation that women tend to be Type A patterns was contrary to the expectation, it was consistent with the finding of a higher blood cholesterol level among women.

**Attitude toward less atherogenic diets.** It was hypothesized that CHD heredity, age, and CHD knowledge would have a positive effect on attitude toward a low cholesterol, low saturated fat diet.

All of the hypotheses were supported by the data. Both coefficients for age and CHD knowledge are significant at the 0.001 level of probability. CHD heredity had a weak positive influence on attitude.

Numerous animal experiments (Portman et al., 1967; Bortz, 1968; Tucker et al., 1967) and human clinical studies (Anderson et al., 1973; Connor et al., 1964, 1964, 1978; Keys et al., 1965, 1957; Mattson et al., 1972; Whyte and Havestein, 1976) indicate that there is an intimate relationship between fat intake and increased risk of CHD. During the past decade, studies have successfully demonstrated that the risk of CHD can be reduced by proper intervention programs. Hence, the study of behavior factors became an important task.

No matter how much information and evidence there is, if the general population is not aware of, or do not practice correctly through attitudinal change, information itself is not meaningful. Recently, Schwartz observed the direct strong positive relationship between nutritional knowledge and attitude among Canadian Public Health Nurses (1976) and among high school graduates (1975). Therefore,
our findings concerning the positive relationship of CHD knowledge to attitude support the results of other studies (Duyff et al., 1975; Schwartz, 1975, 1976)

No report has been found by the author demonstrating the effect of age on attitude toward less atherogenic diets. The hypothesis of a positive effect of age on attitude was drawn from the theory that, since the increased incidence of CHD increases with age, it was expected that the attitude toward less atherogenic diets would also increase with the increment in age.

Of the three independent variables, the direct effect of CHD knowledge (.453) was absolutely greatest among other variables; it was more than one-half that found for age (.293), more than four times that found for CHD heredity. These variables combined, explained about 32% of the variations in the attitude variable.

In summary, CHD knowledge had a direct effect in increasing the attitude toward less atherogenic diets and it acted as a prime intervening variable mediating between educational attainment and attitude. Age also had a direct effect on increasing attitude toward less atherogenic diets, which was also statistically significant. A weak relationship existed between CHD heredity and attitude.

**Saturated fat calorie intake.** It was hypothesized that the higher the educational level, the more the special dietary regimen, and the more the positive attitude toward less atherogenic diets, the less the fat intake would be.

All three of the above hypotheses were supported. The coefficient for educational attainment and special diet were statistically significant at the 0.05 level, while there was a weak association
between attitude and fat intake. Instead, attitude affects relative weight significantly. This will be discussed in detail later.

No direct relationship of educational attainment on fat intake has been found in the literature review; however, as discussed earlier, findings in this study suggest that a higher educational level increased knowledge level which, in turn, improved attitude. Maccoby et al. (1977) also reported that there was an orderly relationship among the knowledge of CHD risk, the changes in behavior compliance, and the physical variables in risk at the end of 2 years in an intervention program of cardiovascular disease. Puska (1978), Podell (1975), and Cerquerira et al. (1979) also observed similar positive changes in behavior and compliance, particularly in dietary practices after educational programs. Therefore, a more positive attitude toward less atherogenic diets may cause a person to consume less fat in the diet. This also suggests an inverse relationship of educational attainment on saturated fat intake.

Of the two significant variables, the direct negative effect of educational attainment (-.185) on saturated fat intake was slightly higher than that found for special diets (-.151).

In summary, the influence of educational attainment and special dietary regimen on saturated fat intake was direct and negative and they were statistically significant. There was a weak relationship between attitude and fat intake.

Energy expenditure. It was hypothesized that CHD knowledge, sex, and a physically active occupation would have a positive
influence on energy expenditure, while energy expenditure is decreased with age. In other words, the higher the CHD knowledge or the more physically active the occupation, the higher the energy expenditure would be. It was anticipated that men would spend more energy than women through strenuous work and active leisure activities.

All four of the above hypotheses were supported by the results of this study. The coefficients of age, occupational status, sex, and CHD knowledge were statistically significant at the 0.001, 0.001, 0.01, and 0.05 level of probability, respectively. Of the four significant variables, age (-.394) had the greatest effect on energy expenditure, negatively followed by the order of occupation (.324), sex (.206), and CHD knowledge (.123), which all were positively correlated. About 25% of the variations in the energy expenditure can be explained by these variables combined.

Although other studies have indicated a positive change in behavior and compliance after appropriate educational programs, no study has measured the effect of CHD knowledge on total energy expenditure. It is probably due to its difficulties in assessing total energy expenditure among the population. This study, however, attempted to measure the energy expenditure on and off the job. The method used for this study was explained in detail in Chapter III. The increased CHD knowledge would cause more physical energy to be expended was suggested by the data in this study. It was also found that the more physically active the occupation, the higher the total energy expended.

In summary, physically active occupations, males, and CHD knowledge had a direct positive effect on energy expenditure, while increasing age caused a decrease in total energy expenditure.
Relative weight. It was hypothesized that an increment in age and in saturated fat intake would increase the relative weight, while an increase in total energy expenditure and a positive attitude toward less atherogenic diets may decrease the relative weight. It was also hypothesized that males would have a lower relative weight.

All of the above hypotheses were supported, except the effect of energy expenditure on relative weight. The regression coefficients for attitude and age were significant at the 0.01 and 0.05 level respectively. The effect of sex difference was significant at the 0.066 level. There was a weak positive influence of saturated fat intake on relative weight. The positive effect of energy expenditure on relative weight was a rather interesting finding and it was contrary to the hypothesis. Theoretically, the increased energy expenditure will decrease the relative weight. Hickey (1975) noted in his study of 15,171 men that there is a negative association between leisure activity and relative weight. In this study we found a positive effect of total energy expenditure on relative weight. Total energy expenditure is the sum of energy expenditure on the job and during leisure time. This relationship may be explained as follows: the causal order between energy expenditure and relative weight may be reversed. In other words, for this population, body weight may not be the consequence of energy expenditure, but rather overweight may be the cause of more physical energy expenditure. It is highly probable that these respondents had experienced a problem of overweight and its related diseases, since the sample population was drawn from physician's lists.
The observation of a higher relative weight with age may be partly due to less physical energy expenditure among older people. As discussed in the literature review and in the previous section, dietary attitude mediates between CHD knowledge and compliance. Therefore, a higher relative weight is the outcome of a negative dietary attitude toward fat intake, since fat is a concentrated source of energy. This relationship has been observed in this study.

Of the two significant variables, attitude (−.205) exerted a larger effect than age (.170).

In summary, a positive attitude toward less fat intake would significantly decrease relative weight. Relative weight increased with age and a higher relative weight was found among women. The positive influence of energy expenditure on relative weight was contrary to the hypothesis.

Blood cholesterol level. It was hypothesized that CHD heredity, age, sex, Type A/B behavior patterns, saturated fat intake, and relative weight would have a positive influence on blood cholesterol level, while physically active occupation, energy expenditure, and special diets would have a negative effect on blood cholesterol level. Specifically, the greater the CHD heredity, the greater the fat intake, the higher the relative weight and the Type A pattern, the higher the blood cholesterol level. On the other hand, the more physically active the occupation and the higher the energy expenditure, the less the blood cholesterol level. Men are expected to have a higher blood cholesterol level, while special dietary regimen would cause the level to decrease.
The data indicated that, with the exception of sex and special diets, all relationships were in the expected direction. The direct effects of CHD heredity and age on blood cholesterol level are statistically significant. An animal breeding study (Hatch, 1974) and Framingham Offspring study (Feinleib et al., 1975) indicated a strong genetic control of serum lipid concentrations. Also, in a study of survivors of myocardial infarction under 50 years of age in Finland, Aro (1973) found a similar relationship of heredity and blood cholesterol concentration. Findings in this study strongly supported this relationship.

In the U.S., the average cholesterol level increases with age in both sexes until age 40. It then levels off in men older than 40 at approximately 230 mg/dl. In women, it continues to increase almost linearly until about age 60 and levels off at approximately 260 mg/dl (Health Statistic, 1967). By examining our sample population distribution (see Table 1) we found that a larger number of women are in the age group of 40 and over. Thus, the effect of age on blood cholesterol level supported the trend of the U.S. population statistics. This was also consistent with the findings of Seventh-day Adventist population studies (Walden et al., 1964; West and Hayes, 1968).

The positive effect of saturated fat intake and the negative effect of energy expenditure on blood cholesterol level were significant at the 0.059 and 0.070 level, respectively. This is not surprising that no strong statistical association can be demonstrated between fat intake and serum cholesterol concentration or between physical energy expenditure and serum cholesterol level of
populations eating a relatively uniform diet and working in a relatively uniform environment. The Framingham study observed no statistical relationship between dietary factors and blood cholesterol level (Kannel and Gordon, 1968).

It was observed that sex has little association to blood cholesterol values. This is consistent with the results of Seventh-day Adventist studies (Taylor, et al., 1976; West and Hayes et al., 1968).

Our finding of a weak relationship between relative weight and blood cholesterol level is in agreement with that of the Framingham study (Gordon et al., 1977).

The weak negative association of physically active occupations on cholesterol in the blood observed in our study, supports that of epidemiological studies in England (Keys, 1975).

We found little relationship between Type A/B behavior patterns and cholesterol level in the blood. Friedman and his associates (1959, 1960, 1970, 1975) indicated that the increased level of blood cholesterol, as well as CHD incidence among Type A persons, may be due to the particular environmental or stress factors which were given to them at the time of the study. This may suggest that Type A individuals are more susceptible to those kinds of stimuli that trigger physical and biochemical mechanisms in the body. This raises blood cholesterol level or a pathological consequence to cardiovascular function. Since our observation is not due to applying a particular stimulus to people, our finding of little association was consistent with the data of Western Collaboration study (Brand et al., 1976). It appears that Type A/B behavior patterns make an independent contribution to the prediction of CHD risk.
An unexpected positive influence on special diets on blood cholesterol level may be due to the fact that only 28% of the sample were on a low fat or low cholesterol diet, while 72% of them were on other dietary regimens which, in fact, may cause an increased blood cholesterol level.

Of the nine variables, the direct effect of CHD heredity (.347) is the greatest among them. It is more than one-half that found for age. The negative effect of energy expenditure (-.134) on blood cholesterol level is slightly greater than the positive effect of saturated fat intake (.120). About 28% of the variations in blood cholesterol level can be explained by the above variables.

In summary, CHD heredity, age, saturated fat intake, and relative weight played an important role in increasing blood cholesterol, while physical energy expenditure and physically active occupations played a role in decreasing blood cholesterol level.

In the last part of the analysis, the model was evaluated to identify which characteristics best distinguish between normo- (group 1 = blood cholesterol level less than 250 mg/100 ml) and hypercholesterolemia (group 2 = blood cholesterol level equal or greater than 250 mg/100 ml). The discriminant function technique was employed. The mean of the two groups for each characteristic are shown in Table 5. The results indicated that the means of CHD heredity, age, certain disease presence, Type A, saturated fat intake, and relative weight were higher among hypercholesterolemia than in normocholesterolemia, while the means of total energy expenditure, physically active occupation, and the educational attainment level were lower among the hypercholesterolemia, as expected. Although the higher mean of
Table 5. Means and Standard Deviations of Independent Variables Among Two Groups Having Different Blood Cholesterol Levels.

<table>
<thead>
<tr>
<th>Cholesterol Level (mg%)</th>
<th>HD*</th>
<th>SEX</th>
<th>AGE</th>
<th>DIS</th>
<th>EDU</th>
<th>DIET</th>
<th>OCC</th>
<th>KNOWL</th>
<th>A/B</th>
<th>ATT</th>
<th>STCAL</th>
<th>EE</th>
<th>RLWT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 250</td>
<td>.13</td>
<td>.46</td>
<td>52.1</td>
<td>1.11</td>
<td>14.0</td>
<td>.39</td>
<td>.65</td>
<td>40.7</td>
<td>.56</td>
<td>2.90</td>
<td>13.7</td>
<td>2358.4</td>
<td>116.2</td>
</tr>
<tr>
<td>≥ 250</td>
<td>.47</td>
<td>.39</td>
<td>58.4</td>
<td>1.44</td>
<td>13.8</td>
<td>.62</td>
<td>.58</td>
<td>41.2</td>
<td>2.45</td>
<td>3.25</td>
<td>14.3</td>
<td>2066.1</td>
<td>119.4</td>
</tr>
</tbody>
</table>

S.D.

| < 250                   | .34 | .41 | 16.6| 1.26| 3.0 | 1.04 | .48 | 8.9   | .50 | 1.04| 3.1   | 790.9| 19.0 |
| ≥ 250                   | .50 | .35 | 11.7| 1.45| 2.7 | 0.82 | .50 | 7.9   | 14.02| .82 | 3.8   | 644.8| 20.8 |

*See Note on Table 3 for explanation of variables.
special dietary regimen was contrary to our expectation it was con­
sistent with the finding of multiple regression analysis. This
relationship has been discussed in the previous section of regression
analysis.

Table 6 presents the standardized and unstandardized discri­
minant function coefficients of independent characteristics for
the whole sample. It was expected that CHD heredity, age, attitude,
fat intake, energy expenditure and Type A/B behavior patterns were
significant factors in discriminating hypercholesterolemia from
normocholesterolemia. Results of the F-ratio test indicated that
CHD heredity, age, special diets, attitude, and energy expenditure
were significant discriminators at the 0.001, 0.01, 0.001, 0.01,
and 0.01 level, respectively. Occupation and saturated fat intake
also showed the direct net influence. After controlling for the
effects of other variables, education became insignificant.

Table 7 shows the classification of results by means of the
derived function. As can be seen from this table, among hyper­
cholesterolemia, 65.0% were correctly classified, while 73.3% were
correctly classified among normocholesterolemia. As a whole,
almost 70% were correctly classified by this analysis.

When the coefficients of discriminant function analysis were
compared to that of multiple regression analysis, it was found that
the results of the discriminant function analysis supported those
of the regression analysis.
Table 6. Discriminant Function Coefficients for the Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standardized Coefficients</th>
<th>Unstandardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD†</td>
<td>-.701***</td>
<td>-1.527</td>
</tr>
<tr>
<td>SEX</td>
<td>.132</td>
<td>.266</td>
</tr>
<tr>
<td>AGE</td>
<td>-.292**</td>
<td>-.020</td>
</tr>
<tr>
<td>DIS†</td>
<td>.053</td>
<td>.039</td>
</tr>
<tr>
<td>EDU</td>
<td>.015</td>
<td>.005</td>
</tr>
<tr>
<td>DIET</td>
<td>-.290***</td>
<td>-.578</td>
</tr>
<tr>
<td>OCC</td>
<td>.250</td>
<td>.512</td>
</tr>
<tr>
<td>KNOWL</td>
<td>-.024</td>
<td>-.003</td>
</tr>
<tr>
<td>A/B</td>
<td>-.054</td>
<td>-.005</td>
</tr>
<tr>
<td>ATT</td>
<td>-.131**</td>
<td>-.138</td>
</tr>
<tr>
<td>STCAL</td>
<td>-.193</td>
<td>-.055</td>
</tr>
<tr>
<td>EE</td>
<td>.253**</td>
<td>.000</td>
</tr>
<tr>
<td>RLWT</td>
<td>-.100</td>
<td>-.005</td>
</tr>
</tbody>
</table>

Note: *** = P < 0.001, ** = P < 0.01, * = P < 0.05.
†See Note on Table 3 for explanation of variables.
Table 7. Classification Results of Blood Cholesterol Level Using the Discriminant Function Analysis for the Sample

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>No. of Cases</th>
<th>Predicted Group Membership</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Group 1</td>
</tr>
<tr>
<td>Group 1 (&lt;250 mg%)</td>
<td>101</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>73.3%</td>
</tr>
<tr>
<td>Group 2 (≥ 250 mg%)</td>
<td>100</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35.0%</td>
</tr>
</tbody>
</table>

Percent of "grouped" cases correctly classified: 69.15%
Differences in the Factors Affecting Cholesterol Levels between Males and Females

Differences in the factors affecting blood cholesterol level for males and females are generally not known. In this study, an attempt will be made to make an assessment of the differences between males and females.

Unstandardized coefficients are evaluated, since a comparison of standardized regression coefficients may be biased due to differences in standard deviation between male and female samples (S.P.S.S., 1975).

Table 8 contains Zero-Order correlations, means, and standard deviations of all variables in the model for each male and female sample.

The first step in the comparison study consists of checking the differences in means. The presence of certain disease(s), educational attainment, CHD knowledge, saturated fat intake, and energy expenditure were higher among men than women. On the other hand, the means for age, CHD heredity, special dietary regimen, physically active occupation, attitude toward less atherogenic diets, relative weight, and blood cholesterol level are higher among women.

For a more precise test on likelihoodness, Specht and Warren's (1975) likelihood-ratio test was employed. Likelihoodness was tested first with the total equations in the model, across male and female samples, since an overall test of a model is a stronger test procedure than examining only a single equation. For the data, the residual sums of squares and degrees of freedom
Table 8. Zero-Order Correlations, Means, and Standard Deviations of All Variables in the Model for Males and Females

<table>
<thead>
<tr>
<th></th>
<th>HD</th>
<th>AGE</th>
<th>DIS</th>
<th>EDU</th>
<th>DIET</th>
<th>OCC</th>
<th>KNOWL</th>
<th>A/B</th>
<th>ATT</th>
<th>STCAL</th>
<th>EE</th>
<th>RLWT</th>
<th>CHOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD*</td>
<td>--</td>
<td>-.116</td>
<td>.0227</td>
<td>.190</td>
<td>.077</td>
<td>.096</td>
<td>.113</td>
<td>.093</td>
<td>.118</td>
<td>-.005</td>
<td>.061</td>
<td>.179</td>
<td>.313</td>
</tr>
<tr>
<td>AGE</td>
<td>-.080</td>
<td>--</td>
<td>.429</td>
<td>-.385</td>
<td>.393</td>
<td>-.097</td>
<td>-.079</td>
<td>-.157</td>
<td>.363</td>
<td>.150</td>
<td>-.185</td>
<td>.154</td>
<td>.170</td>
</tr>
<tr>
<td>DIS</td>
<td>.043</td>
<td>.277</td>
<td>--</td>
<td>-.116</td>
<td>.410</td>
<td>-.128</td>
<td>.020</td>
<td>-.093</td>
<td>.254</td>
<td>.097</td>
<td>-.062</td>
<td>.106</td>
<td>.104</td>
</tr>
<tr>
<td>EDU</td>
<td>-.101</td>
<td>-.207</td>
<td>-.179</td>
<td>--</td>
<td>-.185</td>
<td>-.380</td>
<td>.434</td>
<td>.181</td>
<td>.120</td>
<td>-.214</td>
<td>-.142</td>
<td>-.044</td>
<td>-.057</td>
</tr>
<tr>
<td>DIET</td>
<td>.082</td>
<td>.100</td>
<td>.244</td>
<td>-.066</td>
<td>--</td>
<td>.031</td>
<td>.133</td>
<td>-.023</td>
<td>.368</td>
<td>-.084</td>
<td>.018</td>
<td>.167</td>
<td>.240</td>
</tr>
<tr>
<td>OCC</td>
<td>-.047</td>
<td>.181</td>
<td>-.016</td>
<td>-.210</td>
<td>-.133</td>
<td>--</td>
<td>.010</td>
<td>-.029</td>
<td>-.241</td>
<td>.084</td>
<td>.481</td>
<td>.280</td>
<td>-.054</td>
</tr>
<tr>
<td>KNOWL</td>
<td>.005</td>
<td>-.142</td>
<td>-.043</td>
<td>.421</td>
<td>-.001</td>
<td>-.131</td>
<td>--</td>
<td>.088</td>
<td>.454</td>
<td>-.159</td>
<td>.113</td>
<td>-.052</td>
<td>-.019</td>
</tr>
<tr>
<td>A/B</td>
<td>.055</td>
<td>.130</td>
<td>.141</td>
<td>-.017</td>
<td>.132</td>
<td>.053</td>
<td>-.017</td>
<td>--</td>
<td>-.019</td>
<td>.042</td>
<td>.034</td>
<td>.006</td>
<td>-.080</td>
</tr>
<tr>
<td>ATT</td>
<td>.061</td>
<td>.177</td>
<td>-.035</td>
<td>.109</td>
<td>.101</td>
<td>-.049</td>
<td>.429</td>
<td>.055</td>
<td>--</td>
<td>-.218</td>
<td>-.094</td>
<td>-.060</td>
<td>.232</td>
</tr>
<tr>
<td>STCAL</td>
<td>.116</td>
<td>-.171</td>
<td>-.065</td>
<td>-.020</td>
<td>-.155</td>
<td>-.021</td>
<td>.107</td>
<td>.037</td>
<td>.091</td>
<td>--</td>
<td>-.055</td>
<td>.315</td>
<td>.087</td>
</tr>
<tr>
<td>EE</td>
<td>.013</td>
<td>-.595</td>
<td>-.215</td>
<td>.301</td>
<td>-.116</td>
<td>-.044</td>
<td>.163</td>
<td>-.134</td>
<td>-.022</td>
<td>.253</td>
<td>--</td>
<td>.277</td>
<td>-.160</td>
</tr>
<tr>
<td>RLWT</td>
<td>.039</td>
<td>.027</td>
<td>.142</td>
<td>-.115</td>
<td>.128</td>
<td>.046</td>
<td>-.071</td>
<td>.141</td>
<td>-.179</td>
<td>.032</td>
<td>.182</td>
<td>--</td>
<td>-.019</td>
</tr>
</tbody>
</table>

Mean
- Male: .27 53.5 1.42 14.6 .50 .32 41.6 .58 3.04 14.2 2288.5 114.9 236.7
- Female: .32 56.4 1.16 13.4 .54 .84 40.4 2.17 3.10 13.9 2157.6 119.9 246.8

S.D
- Male: .45 14.0 1.48 3.1 .50 .47 8.5 .50 .94 4.0 415.1 13.9 47.4
- Female: .47 15.1 1.27 2.5 .50 .37 8.3 13.02 .96 3.1 652.3 23.2 55.5

Note: Males are above the diagonal, females are below the diagonal.
*See Note on Table 3 for explanation of variables.
for the unconstrained (male and female sample) and constrained (whole sample model) models are shown in Table 9. For the likelihood test statistic for an entire model, $M$ and $X^2$ are calculated as follows:


$$= \frac{(346.377)(2083.216)}{(347.757)(2110.416)} = 0.2122$$

$$X^2 = (N-d)M = (201-70) x 0.2122 = 27.7982$$

The chi-square was not statistically significant at the 0.05 level with 70 degrees of freedom. Therefore, the hypothesis of homogeneity of coefficients for the entire model was not rejected. In other words, the two groups were not significantly different from each other.

Next, the equation for blood cholesterol level was tested. For these data, the $F$-ratio for the blood cholesterol level equation is as follows:

$$F = \frac{(393727.907-369322.88)/189-175}{369322.88/175} = .82601$$

With 14 on the numerator and 175 degrees of freedom on the denominator, $P < 0.05$; therefore, we cannot reject the hypothesis that the coefficients are the same in both groups. In other words, the coefficients of the blood cholesterol level equation for the male and female groups were similar. The results of the significant test of difference for each regression equation across male and female samples are shown in Table 10. With the results ($F = 3.99615, 1.83825, 2.28375, \text{ and } 2.06632$, respectively) we can reject the hypotheses that the equations are the same in both groups for occupation, CHD knowledge, saturated fat intake, and energy expenditure. However,
Table 9. Residual Sums of Squares, Degree of Freedom and Residual Mean Squares for Unconstrained and Constrained Models.

<table>
<thead>
<tr>
<th>Equations</th>
<th>Residual Sums of Squares (Male and Female)</th>
<th>Degree of Freedom (Male &amp; Female)</th>
<th>Residual Mean Squares</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unconstrained Model</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIS*</td>
<td>148.205 + 170.811</td>
<td>195</td>
<td>1.636</td>
</tr>
<tr>
<td>EDU</td>
<td>684.077 + 670.474</td>
<td>197</td>
<td>6.876</td>
</tr>
<tr>
<td>DIET</td>
<td>16.109 + 26.951</td>
<td>193</td>
<td>2.231</td>
</tr>
<tr>
<td>OCC</td>
<td>14.484 + 14.923</td>
<td>195</td>
<td>1.508</td>
</tr>
<tr>
<td>KNOWL</td>
<td>4607.774 + 6488.218</td>
<td>185</td>
<td>59.978</td>
</tr>
<tr>
<td>A/B</td>
<td>19.889 + 19170.579</td>
<td>195</td>
<td>98.413</td>
</tr>
<tr>
<td>ATT</td>
<td>43.476 + 78.196</td>
<td>186</td>
<td>6.542</td>
</tr>
<tr>
<td>STCAL</td>
<td>1135.534 + 1012.6-5</td>
<td>184</td>
<td>11.675</td>
</tr>
<tr>
<td>EE</td>
<td>41556993.799 + 29677203.090</td>
<td>183</td>
<td>389257.9</td>
</tr>
<tr>
<td>RLWT</td>
<td>10838.345 + 50714.674</td>
<td>177</td>
<td>347.757</td>
</tr>
<tr>
<td>CHOL</td>
<td>142815.287 + 226507.606</td>
<td>175</td>
<td>2110.416</td>
</tr>
<tr>
<td><strong>Constrained Model</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIS</td>
<td>323.923</td>
<td>197</td>
<td>1.644</td>
</tr>
<tr>
<td>EDU</td>
<td>1371.127</td>
<td>198</td>
<td>6.925</td>
</tr>
<tr>
<td>DIET</td>
<td>43.853</td>
<td>196</td>
<td>0.224</td>
</tr>
<tr>
<td>OCC</td>
<td>31.215</td>
<td>198</td>
<td>0.158</td>
</tr>
<tr>
<td>KNOWL</td>
<td>13411.349</td>
<td>206</td>
<td>65.104</td>
</tr>
<tr>
<td>A/B</td>
<td>19324.989</td>
<td>197</td>
<td>98.096</td>
</tr>
<tr>
<td>ATT</td>
<td>124.221</td>
<td>194</td>
<td>0.640</td>
</tr>
<tr>
<td>STCAL</td>
<td>2334.783</td>
<td>191</td>
<td>12.224</td>
</tr>
<tr>
<td>EE</td>
<td>80886193.937</td>
<td>195</td>
<td>414800.995</td>
</tr>
<tr>
<td>RLWT</td>
<td>66158.017</td>
<td>191</td>
<td>346.377</td>
</tr>
<tr>
<td>CHOL</td>
<td>393727.907</td>
<td>189</td>
<td>2083.216</td>
</tr>
</tbody>
</table>

*See Note on Table 3 for explanation of variables.
Table 10. Test of Significance of the Difference for Each Regression Equation between Male and Female Samples

<table>
<thead>
<tr>
<th>Dependent Variable(s)</th>
<th>F</th>
<th>Significant Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIS*</td>
<td>$F_{2,197} = 1.49969$</td>
<td>NS</td>
</tr>
<tr>
<td>EDU</td>
<td>$F_{1,198} = 2.41070$</td>
<td>NS</td>
</tr>
<tr>
<td>DIET</td>
<td>$F_{3,196} = 1.18475$</td>
<td>NS</td>
</tr>
<tr>
<td>OCC</td>
<td>$F_{3,198} = 3.99615$</td>
<td>0.01</td>
</tr>
<tr>
<td>KNOWL</td>
<td>$F_{21,206} = 1.83825$</td>
<td>0.05</td>
</tr>
<tr>
<td>A/B</td>
<td>$F_{2,197} = 0.68345$</td>
<td>NS</td>
</tr>
<tr>
<td>ATT</td>
<td>$F_{8,194} = 0.48708$</td>
<td>NS</td>
</tr>
<tr>
<td>STCAL</td>
<td>$F_{7,191} = 2.28387$</td>
<td>0.05</td>
</tr>
<tr>
<td>EE</td>
<td>$F_{12,195} = 0.06632$</td>
<td>0.05</td>
</tr>
<tr>
<td>RLWT</td>
<td>$F_{14,191} = 0.94586$</td>
<td>NS</td>
</tr>
<tr>
<td>CHOL</td>
<td>$F_{14,175} = 0.83679$</td>
<td>NS</td>
</tr>
</tbody>
</table>

*See Note on Table 3 for explanation of variables.*
we cannot reject the hypotheses for certain disease presence, educational attainment, Type A/B behavior patterns, attitude, relative weight, special diets, and blood cholesterol level, because F statistics were not significant at the 0.05 level.

Next, we examined the differences of the effects of each independent variable on the dependent variable of relevance between men and women in the sample population. Table 11 lists unstandardized and standardized regression coefficients of independent variables on dependent variables of relevance for male and female samples. Figure 3 and Figure 4 represent the structural relationship with unstandardized regression coefficients among male and female samples. As can be seen from these figures, the direct effect of age on the presence of certain disease(s) for men was greater than for women. That is, the presence of certain disease(s) is increased by .460 unit for 1 unit increment in age for men compared to .238 unit increase for women. The direct effect of disease(s) on special diets between men and women was similar; with an increase of .975 for men and .900 for women. The positive influence of age on special diets among males was statistically significant at the 0.01 level, while that of females was not. The direct effect of age on educational attainment for men was greater than for women. Specifically, the educational attainment decreased by .848 unit for 1 unit decrement in age for men, while it decreased by .443 unit for women. Although the effect of education on CHD knowledge was similar between men and women, the positive effect of CHD knowledge on attitude for women was higher. About 43% of the variations in attitude for male and about 27% for female can be explained by the above variables.
Table 11. Regression Coefficients of Independent Variables on
Dependent Variables in Male and Female Samples

<table>
<thead>
<tr>
<th>Dependent Variable(s)</th>
<th>Independent Variable(s)</th>
<th>Male Coefficient Unstan. Std.</th>
<th>Female Coefficient Unstan. Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIS†</td>
<td>HD</td>
<td>.243 (.074)</td>
<td>.178 (.066)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>.460 (.437)***</td>
<td>.238 (.282)**</td>
</tr>
<tr>
<td></td>
<td>U₁</td>
<td>.901</td>
<td>.959</td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td>(.43479)</td>
<td>(.28479)</td>
</tr>
<tr>
<td>EDU</td>
<td>AGE</td>
<td>-.848 (-.385)***</td>
<td>-.443 (-.267)**</td>
</tr>
<tr>
<td></td>
<td>U₂</td>
<td>.923</td>
<td>.964</td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td>(.38469)</td>
<td>(.26656)</td>
</tr>
<tr>
<td>DIET</td>
<td>HD</td>
<td>.116 (.103)</td>
<td>.814 (.076)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>.101 (.282)**</td>
<td>.142 (.043)</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>.975 (.287)**</td>
<td>.900 (.229)*</td>
</tr>
<tr>
<td></td>
<td>U₃</td>
<td>.874</td>
<td>.966</td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td>(.48657)</td>
<td>(.25732)</td>
</tr>
<tr>
<td>OCC</td>
<td>AGE</td>
<td>-.952 (-.285)**</td>
<td>-.331 (.134)</td>
</tr>
<tr>
<td></td>
<td>EDU</td>
<td>-.742 (-.490)**</td>
<td>-.258 (-.174)</td>
</tr>
<tr>
<td></td>
<td>U₄</td>
<td>.887</td>
<td>.969</td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td>(.46240)</td>
<td>(.24649)</td>
</tr>
<tr>
<td>KNOWL</td>
<td>HD</td>
<td>-.142 (-.007)</td>
<td>.735 (.041)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>.362 (.060)</td>
<td>-.176 (-.032)</td>
</tr>
<tr>
<td></td>
<td>DIET</td>
<td>3.619 (.213)</td>
<td>.247 (.015)</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>-.104 (-.018)</td>
<td>.237 (.016)</td>
</tr>
<tr>
<td></td>
<td>EDU</td>
<td>1.466 (.532)***</td>
<td>1.385 (.417)***</td>
</tr>
<tr>
<td></td>
<td>OCC</td>
<td>1.824 (.100)</td>
<td>-.721 (-.032)</td>
</tr>
<tr>
<td></td>
<td>A/B</td>
<td>.137 (.008)</td>
<td>-.834 (.013)</td>
</tr>
<tr>
<td></td>
<td>U₅</td>
<td>.869</td>
<td>.904</td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td>(.49402)</td>
<td>(.43829)</td>
</tr>
<tr>
<td>A/B</td>
<td>AGE</td>
<td>-.364 (-.103)</td>
<td>.116 (.135)</td>
</tr>
<tr>
<td></td>
<td>EDU</td>
<td>.227 (.141)</td>
<td>.965 (.019)</td>
</tr>
<tr>
<td></td>
<td>U₆</td>
<td>.979</td>
<td>(.991)</td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td>(.20406)</td>
<td>(.13085)</td>
</tr>
<tr>
<td>ATT</td>
<td>HD</td>
<td>.255 (.111)</td>
<td>.148 (.072)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>.211 (.313)**</td>
<td>.172 (.269)**</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>.630 (.010)</td>
<td>-.946 (-.125)</td>
</tr>
<tr>
<td></td>
<td>DIET</td>
<td>.341 (.181)</td>
<td>.170 (.088)</td>
</tr>
<tr>
<td></td>
<td>EDU</td>
<td>.980 (.003)</td>
<td>-.130 (-.034)</td>
</tr>
<tr>
<td></td>
<td>OCC</td>
<td>-.368 (-.183)</td>
<td>-.824 (-.032)</td>
</tr>
<tr>
<td></td>
<td>KNOWL</td>
<td>-.470 (-.424)**</td>
<td>-.547 (.472)**</td>
</tr>
<tr>
<td></td>
<td>A/B</td>
<td>.337 (-.019)</td>
<td>.228 (.031)</td>
</tr>
<tr>
<td></td>
<td>U₇</td>
<td>.753</td>
<td>.856</td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td>(.65821)</td>
<td>(.51724)</td>
</tr>
</tbody>
</table>
Table 11. Continued

<table>
<thead>
<tr>
<th>Dependent Variable(s)</th>
<th>Independent Variable(s)</th>
<th>Male Coefficient</th>
<th>Female Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>STCAL</td>
<td>AGE</td>
<td>.625</td>
<td>(.220)</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>.349</td>
<td>(.129)</td>
</tr>
<tr>
<td></td>
<td>DIET</td>
<td>-1.229</td>
<td>(-.155)</td>
</tr>
<tr>
<td></td>
<td>EDU</td>
<td>-.194</td>
<td>(-.151)</td>
</tr>
<tr>
<td></td>
<td>OCC</td>
<td>.985</td>
<td>(.012)</td>
</tr>
<tr>
<td></td>
<td>KNOWL</td>
<td>.285</td>
<td>(.061)</td>
</tr>
<tr>
<td></td>
<td>A/B</td>
<td>.816</td>
<td>(.102)</td>
</tr>
<tr>
<td></td>
<td>ATT</td>
<td>-1.176</td>
<td>(-.279)*</td>
</tr>
<tr>
<td></td>
<td>U_9</td>
<td>.923</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td></td>
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<tr>
<td>EE</td>
<td>AGE</td>
<td>-11.954</td>
<td>(-.201)</td>
</tr>
<tr>
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<td>DIS</td>
<td>34.593</td>
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<td></td>
<td>DIET</td>
<td>18.722</td>
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</tr>
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<td>EDU</td>
<td>-36.054</td>
<td>(-.134)</td>
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<tr>
<td></td>
<td>OCC</td>
<td>775.926</td>
<td>(.436)***</td>
</tr>
<tr>
<td></td>
<td>KNOWL</td>
<td>19.333</td>
<td>(.198)</td>
</tr>
<tr>
<td></td>
<td>A/B</td>
<td>46.284</td>
<td>(.028)</td>
</tr>
<tr>
<td></td>
<td>ATT</td>
<td>-8.121</td>
<td>(-.009)</td>
</tr>
<tr>
<td></td>
<td>U_9</td>
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<td></td>
<td>Multiple R</td>
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</tr>
<tr>
<td>RLWT</td>
<td>HD</td>
<td>3.690</td>
<td>(.119)</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>.259</td>
<td>(.261)*</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>-.138</td>
<td>(-.015)</td>
</tr>
<tr>
<td></td>
<td>DIET</td>
<td>4.874</td>
<td>(.176)</td>
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<tr>
<td></td>
<td>EDU</td>
<td>1.498</td>
<td>(.334)</td>
</tr>
<tr>
<td></td>
<td>OCC</td>
<td>6.548</td>
<td>(.221)*</td>
</tr>
<tr>
<td></td>
<td>KNOWL</td>
<td>-.236</td>
<td>(-.145)</td>
</tr>
<tr>
<td></td>
<td>A/B</td>
<td>-.730</td>
<td>(-.026)</td>
</tr>
<tr>
<td></td>
<td>ATT</td>
<td>-.767</td>
<td>(-.052)</td>
</tr>
<tr>
<td></td>
<td>EE</td>
<td>.476</td>
<td>(.286)*</td>
</tr>
<tr>
<td></td>
<td>STCAL</td>
<td>1.141</td>
<td>(.327)**</td>
</tr>
<tr>
<td></td>
<td>U_9</td>
<td>.819</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHOL</td>
<td>HD</td>
<td>35.417</td>
<td>(.234)**</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>-.101</td>
<td>(.030)</td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>-2.217</td>
<td>(-.069)</td>
</tr>
<tr>
<td></td>
<td>DIET</td>
<td>19.502</td>
<td>(.206)</td>
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<tr>
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<td>EDU</td>
<td>-.259</td>
<td>(.017)</td>
</tr>
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<td>OCC</td>
<td>-.180</td>
<td>(-.000)</td>
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<td>KNOWL</td>
<td>-.683</td>
<td>(-.123)</td>
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<td>A/B</td>
<td>-8.900</td>
<td>(-.093)</td>
</tr>
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<td>ATT</td>
<td>9.931</td>
<td>(.198)</td>
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<td>(-.105)</td>
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<td>STCAL</td>
<td>1.985</td>
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<td></td>
<td>RLWT</td>
<td>-.439</td>
<td>(-.128)</td>
</tr>
<tr>
<td></td>
<td>U_9</td>
<td>.870</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*See Note on Tables 3 and 4 for explanation of variables.
Figure 3. Diagrammatic Representation of the Relationship Between Variables Among Males.

Note: *See Note on Figure 1 for explanation of variables.

- - - - = $p < 0.001$; - - - = $p < 0.01$; - - - = $p < 0.05$; · · · = Not significant at 0.05 level.
Figure 4. Diagrammatic Representation of the Relationship Between Variables Among Females.

Note: *See Note on Figure 1 for explanation of variables.

= p < 0.001; = p < 0.01; = p < 0.05; = Not significant at 0.05 level.
Thus, CHD knowledge is an intervening variable mediating between the education and the attitude for both sexes. That the more educated engage in less physically active occupations was indicated in this study. This was consistent with the finding that less energy expenditure was observed among those whose occupation is less physically active. These trends were noted in both sexes, however, its association was stronger in males than in females. It was also found that energy expenditure decreased significantly with age in females; its magnitude is nearly double that found for males. The above variables explained 39% of the variations in energy expenditure for women, compared with 29% for men. Among women there was a consistent negative relationship between age and saturated fat intake, and between age and physical energy expenditure. Women with a positive attitude toward less atherogenic diets had a significantly less relative weight. On the other hand, men with a positive attitude toward less atherogenic diets consume less saturated fat in the diet. It is interesting to note that the relative weight of men increased with age, but this was not so in women.

The findings of a positive effect of total energy expenditure on relative weight on both sexes were contrary to the expectation. These have been discussed in the previous section.

The effect of CHD heredity on blood cholesterol level was greater for women; it increased by 44.0 mg % for women compared to 35.5 mg % for men.

The positive effect of special diets on blood cholesterol is counter to what was anticipated. When we examine the statistical significance by sexes, the positive effect of special diets has disappeared
in the male sample model. This suggests that the positive relationship among the whole sample model was due to the fact that more females are on the special diets that may be contradicted to lowering blood cholesterol level. This has been discussed earlier.

In summary, the better educated males and females were younger, and more knowledgeable about CHD. The more CHD knowledge they have, the higher the attitude toward less atherogenic diets. For males, attitude directly affected saturated fat consumption which, in turn, had a direct relationship to relative weight. Among females, there was a direct attitudinal effect on relative weight. We observed statistically significant positive effects of CHD heredity, age, and saturated fat intake on blood cholesterol concentration among females and of CHD heredity among males. Twenty-three percent of the variation in blood cholesterol levels among males can be explained by the above 12 variables, compared to 36% for females. The likelihood-ratio test indicated that, in general, the effects of social and demographic, CHD knowledge, and behavior variables on blood cholesterol level were not significantly different across the male and female sample population.

In the last section of this chapter, the discriminant function analysis will be discussed. Table 12 presents the means and standard deviations of hyper- and normo-cholesterolemia for each known characteristic by sex. For both sexes, the means of CHD heredity, age, the presence of certain disease(s), and saturated fat intake were higher among hypercholesterolemia, while the means of total energy expenditure and physically active occupation were lower among hypercholesterolemia as anticipated. Here it is interesting
Table 12. Means and Standard Deviations of Independent Variables among Two Groups having Different Blood Cholesterol Levels for Males and Females

<table>
<thead>
<tr>
<th>Cholesterol Level (mg%)</th>
<th>HD*</th>
<th>AGE</th>
<th>DIS</th>
<th>EDU</th>
<th>DIET</th>
<th>OCC</th>
<th>KNOWL</th>
<th>A/B</th>
<th>ATT</th>
<th>STCAL</th>
<th>EE</th>
<th>RLWT</th>
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<td>.66</td>
<td>.79</td>
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<tr>
<td>&lt; 250</td>
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<td>17.4</td>
<td>1.24</td>
<td>2.9</td>
<td>.49</td>
<td>.32</td>
<td>9.8</td>
<td>.50</td>
<td>1.05</td>
<td>2.8</td>
<td>660.8</td>
<td>22.6</td>
</tr>
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<td>1.30</td>
<td>2.1</td>
<td>.48</td>
<td>.41</td>
<td>6.7</td>
<td>17.9</td>
<td>.84</td>
<td>3.4</td>
<td>622.9</td>
<td>23.6</td>
</tr>
</tbody>
</table>

*See Note on Table 3 for explanation of variables.
to point out that the influence of education was different between men and women. While men have a higher educational level among normo-cholesterol group, women have a lower educational level among the same group. This was consistent with the result of a higher CHD knowledge score among this group of men than among women.

Table 13 shows the coefficients of discriminant function by sex. It was anticipated that CHD heredity, saturated fat intake, energy expenditure, and Type A/B patterns are significant factors in discriminating two groups of blood cholesterolemia among males. As indicated in this table, CHD heredity ($P < 0.001$), and Type A/B behavior patterns ($P < 0.05$) are statistically significant discriminators of two groups of cholesterolemia in males. For females, it was anticipated that CHD heredity, saturated fat intake, energy expenditure, and age, are significant discriminators between two groups. Data revealed that the hypotheses of CHD heredity ($P < 0.001$), age ($P < 0.05$), and energy expenditure ($P < 0.05$) were supported.

We found that special diets and attitude also exerted a statistically significant role in this analysis. As can be seen from Table 14, the classification results indicated that the discriminant function predicted better normo-cholesterol groups for both sexes (73.9% for males and 78.2% for females. Almost three out of four respondents for males (72.94%) and females (75.86%) were correctly classified by this analysis.

When the coefficients of regression were compared to those of discriminant function analysis, the discriminant function analysis supported the conclusion drawn from coefficients of regression.
Table 13. Discriminant Function Coefficients for Males and Females

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male Coefficients</th>
<th>Female Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD†</td>
<td>-1.725 *</td>
<td>(-.771)***</td>
</tr>
<tr>
<td>AGE</td>
<td>-.012 *</td>
<td>(-.175)</td>
</tr>
<tr>
<td>DIS</td>
<td>-.034 *</td>
<td>(-.050)</td>
</tr>
<tr>
<td>EDU</td>
<td>.053</td>
<td>(.165)</td>
</tr>
<tr>
<td>DIET</td>
<td>-.476 *</td>
<td>(-.239)</td>
</tr>
<tr>
<td>OCC</td>
<td>.495</td>
<td>(.232)</td>
</tr>
<tr>
<td>KNOWL</td>
<td>.004</td>
<td>(.038)</td>
</tr>
<tr>
<td>A/B</td>
<td>.806</td>
<td>(.401)*</td>
</tr>
<tr>
<td>ATT</td>
<td>.001</td>
<td>(.001)</td>
</tr>
<tr>
<td>STCAL</td>
<td>-.061</td>
<td>(-.242)</td>
</tr>
<tr>
<td>EE</td>
<td>.000</td>
<td>(.174)</td>
</tr>
<tr>
<td>RLWT</td>
<td>.016</td>
<td>(.221)</td>
</tr>
</tbody>
</table>

†See Note on Table 3 for explanation of variables.

*** = P < 0.001, ** = P < 0.01, * = P < 0.05.
Table 14. Classification Results of Blood Cholesterol Level Using Discriminant Function Analysis for Male and Female Samples.

<table>
<thead>
<tr>
<th>Actual Group</th>
<th>No. of Cases</th>
<th>Predicted Group Membership</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Group 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group 1 (&lt; 250 mg%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group 2 (≥ 250 mg%)</td>
</tr>
</tbody>
</table>

Percent of "grouped" cases correctly classified: 72.94%

|                      |              | Male     | Female  |
|                      |              | Group 1 (< 250 mg%) | 55 | 43 | 12 | 78.2% | 26.2% |
|                      |              | Group 2 (≥ 250 mg%) | 61 | 16 | 45 | 26.2% | 73.8% |

Percent of "grouped" cases correctly classified: 75.86%
CHAPTER V
SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to measure the relationships between social and demographic characteristics, coronary heart disease knowledge, and behavior variables and blood cholesterol level. Furthermore, the analysis was carried out separately for males and females to examine if male and female blood cholesterol levels were influenced differently by those variables.

The data were based on the specially designed survey conducted for this study in northern Utah communities. The basic model was evaluated for the sample as a whole and for males and females. The multiple regression analysis technique was employed including path analysis. The likelihood test was used for evaluation of difference in coefficients between male and female samples. Also, a discriminant function technique was used to identify the characteristics that best distinguish between hyper- and normo-cholesterolemia among the whole sample, and among males and females.

The first part of the analysis investigated whether the direct effect of each independent variable on the relevant dependent variable was statistically significant and in the same direction as anticipated. A comparison of the relative levels of each of the independent variables was also conducted. Table 15 contains a summary of the relationships between each of the independent and dependent variables in the whole sample model.
Table 15. Summary Table.

<table>
<thead>
<tr>
<th>Dependent Variable(s)</th>
<th>Independent Variable(s)</th>
<th>Characteristic of Effect</th>
<th>Hypotheses</th>
<th>Finding</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIS*</td>
<td>HD</td>
<td>+</td>
<td>+</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SEX</td>
<td>+</td>
<td>+</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>+</td>
<td>+</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>EDU</td>
<td>SEX</td>
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<td>+</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>-</td>
<td>-</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>DIET</td>
<td>HD</td>
<td>+</td>
<td>+</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DIS</td>
<td>+</td>
<td>+</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>+</td>
<td>+</td>
<td>NS</td>
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</tr>
<tr>
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<td>-</td>
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<td></td>
</tr>
<tr>
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<tr>
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<td>+</td>
<td>NS</td>
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<tr>
<td></td>
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<td>-</td>
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<td>-</td>
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<tr>
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<td>AGE</td>
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<td>+</td>
<td>NS</td>
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<tr>
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<td>HD</td>
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<td>+</td>
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<tr>
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Table 15. Continued.

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<tr>
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<td>A/B</td>
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<tr>
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<tr>
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<td>RLWT</td>
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<td>NS</td>
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</table>

NS = Not significant

* DIS = Presence of certain disease(s), EDU = Educational attainment, OCC = Occupation, KNOW = CHD knowledge, A/B = Type A/B behavior patterns, ATT = Attitude toward less atherogenic diets, STCAL = saturated fat calorie intake, EE = energy expenditure, RLWT = Relative weight, CHOL = Blood cholesterol level.
In the second part of the analysis, the influence of sex difference on the effects of independent variables upon blood cholesterol level was assessed. Specifically, the sample was classified into two groups; male and female. Special attention was given to a comparison of structural parameters across these two strata. Figure 3 and Figure 4 present a summary of the effects of independent variables on blood cholesterol level, with unstandardized regression coefficients among males and females, respectively.

In the last part of the analysis, the discriminant function technique was applied to find linear combinations of independent variables that best distinguish between cases in hyper- and normocholesterolemia among the whole sample population, and also between male and female samples.

Blood cholesterol level can be influenced by three categories of process. The three categories are social and demographic variables, CHD knowledge, and behavioral variables. The socio-demographic variables selected to test this model are age, sex, body weight, the presence of certain diseases, educational attainment, and occupation. The behavioral variables selected to test are Type A/B behavior patterns, saturated fat calorie intake, attitude toward less atherogenic diets, fat intake, physical energy expenditure, and Type A/B patterns. Table 15 contains the summary of hypotheses, findings, and the level of significance.

The major results of this analysis are as follows:

1) Age, sex and CHD heredity exerted a positive direct influence on the presence of certain disease; however, age played the most
important role in the disease presence, followed by sex and CHD heredity.

2) Special dietary regimen was influenced by the presence of certain disease(s) and it reduced the saturated fat calorie intake.

3) Educational attainment was directly affected by age and sex factors. About 14\% of the variations in educational attainment were explained by the above two variables. It was found that men have a significantly higher education level than do women. A significant negative influence of age on educational attainment was also observed. On the other hand, educational attainment played an important direct role affecting occupational status, CHD knowledge, and dietary compliance, especially saturated fat intake. Thus, education acted as an intervening variable mediating between age, sex, and behavior variables.

4) The positive effects of educational attainment on CHD knowledge and that of CHD knowledge on attitude were highly statistically significant, thus CHD knowledge mediated between the educational level and the attitude toward less atherogenic diets. The same relationship existed between education and CHD knowledge, and CHD knowledge and energy expenditure, indicating the intermediary role of CHD knowledge between educational level and energy expenditure.

5) The educational attainment and sex difference played a significant role in occupational status; the more educated, the less physically active occupation a person would have, such as professional, technical, managerial, sales, and clerical. More males engage in the professional categories of occupation than do females. Therefore, sex, age, and occupation had a significant direct effect
on energy expenditure. Specifically, the more physically active the occupation, the higher the total energy expenditure. While an increase in age decreased the total energy expenditure, males expended more total energy than did females. These variables explained about 25% of the variations in energy expenditure.

6) Not only CHD knowledge affected attitude, but age had a positive effect on attitude toward less atherogenic diets. Data indicated that the more positive attitude, the less would be the relative weight. Thus, attitude mediated between CHD knowledge and relative weight and it, in turn, affected blood cholesterol level.

7) A weak positive influence of relative weight and saturated fat calorie intake on blood cholesterol concentration was observed. The influence of energy expenditure and a physically active occupation had a negative effect on blood cholesterol level. The effects of CHD heredity on blood cholesterol level were the strongest among other variables, followed by special diets, age, energy expenditure, and saturated fat intake. All these variables combined explained about 28% of the variations in the cholesterol level in the blood. Among the male sample, 23% of the variations in the blood cholesterol level could be explained by the above variables, compared to 36% for the female sample.

8) In order to study the differences in coefficients across male and female samples, the likelihood-ratio test was employed. This analysis indicated that the hypotheses of homogeneity of coefficients for the entire model were not rejected; in other words, the influence of social and demographic characteristics, CHD knowledge,
and behavior variables on blood cholesterol level was not significantly different between the male and the female sample.

9) The discriminant function analysis found that CHD heredity, age, special dietary regimen, attitude toward less atherogenic diets, and energy expenditure were the statistically significant discriminators between hyper- and normo-cholesterolemia in the whole sample population, as well as in the female sample, while CHD heredity and Type A/B behavior patterns were the significant discriminators among the male sample. It was found that the results of discriminant function analysis were consistent with those of the regression analysis.

10) When the coefficients of regression analysis were compared to those of discriminant function analysis, the results of discriminant function supported that of multiple regression.

Conclusions

This study has provided further evidence that there is a direct strong association between the level of education and knowledge about coronary heart disease (CHD), and between this knowledge and attitude toward low-fat, low-cholesterol diets. Furthermore, a more positive attitude toward low-fat, low-cholesterol diets served directly to decrease the relative body weight. On the other hand, increased expenditure of energy was due to increased CHD knowledge and physically active occupations.

This relationship may be viewed as one in which CHD knowledge is mediated between educational level and attitude or between educational level and compliance.
Although the effect of saturated fat intake on blood cholesterol level was not strong ($P < 0.07$), it was still worth it to find such a relationship among this homogenous population. The Framingham study found no relationship between food intake and blood cholesterol level. Another important finding of this study was a negative association of total energy expenditure on blood cholesterol concentration.

From these findings, it is strongly suggested the importance of an increased level of education and CHD knowledge and the change of attitude toward low-fat, low-cholesterol diets. Accordingly, it is anticipated that the reduction in saturated fat intake and an increment in physical energy expenditure might cause a lower cholesterol level in the blood.

While the positive effect of the presence of CHD in a parent and age on blood cholesterol level cannot be modified, the CHD knowledge, attitude, intake of saturated fat, and energy expenditure can be easily improved if one perceives the threat of illness or the potential benefits of the recommended health action. A cue to action that triggers the appropriate behavior can be internal (for example, sickness) or external (for example, education through mass media campaigns and interpersonal interactions). Thus, CHD compliance behavior is the result of the interaction of a variety of social and demographic factors, CHD knowledge and attitude, and/or medical factors.

Therefore, the CHD preventive studies cannot be formulated in isolation. Since the major risk factor of CHD is considered to be elevated blood cholesterol level, this study dealt with the
determinant factors that influence blood cholesterol. It appears that preventive measures for coronary heart disease depend greatly upon the selected variables within this framework. In other words, the findings from this model could be applied to the macro-social level. That is, the major influencing factors on blood cholesterol level, such as age, sex, education, occupation, knowledge of coronary heart disease, and behavior variables could be applied to CHD preventive programs.

From these findings, a CHD preventive program should emphasize the importance of:

1) increasing CHD knowledge through different educational media.
2) changes in attitude and practice toward low-fat, low-cholesterol diets.
3) increasing physical energy expenditure.

Through the above programs, people would increase their knowledge about CHD, change their attitude and practice toward low-fat, low-cholesterol diets, and expend more physical energy that would help to reduce the cholesterol level in the blood and so reduce the risk of CHD.

In conclusion, this study strongly supports the potential value of educational programs for coronary heart disease prevention.

Suggestions for Further Study

This study analyzed the selected determinants of blood cholesterol level among the selected sample population in northern Utah. As a further step, this study can be improved by following three major directions:
First, since the sample of this study is limited to a special group of the population, i.e. persons on the physicians' lists, further research is required to supplement the limitations; particularly, random samples from the general population need to be examined.

Second, since this study observed only the direct effects of independent variables on dependent variables on relevance, the indirect effects of independent variables are to be examined. There are too many variables to study the indirect effects in this model. Therefore, the number of variables should be reduced before examining the indirect effects.

Third, a couple of important findings of this study, such as no effect of Type A/B behavior patterns on blood cholesterol level and a positive effect of estimated energy expenditure on relative weight need to be tested in populations similar to these environmental conditions.


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in a West Indian Community (St. Kitts, Wisconsin); with observations 

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Appendix A

Cover Letter and Consent Form
This is the follow-up of our earlier contact about your participation in our study, "Cardiovascular Health in Cache Valley". We do appreciate very much your willingness to assist in this study.

Prevention and treatment of heart disease has been singled out as one of the most serious problems facing Americans today. Studies in other states have shown that many people do not have enough knowledge about heart disease that would help them to avoid heart attacks and other premature heart diseases.

As an effort to assess the level of knowledge of heart disease risk factors, and how well people comply with known health measures, we, Dr. John L. Sorenson, M.D., Dr. Hugh D. Hammond, M.D., and researchers at the Department of Nutrition and Food Sciences at Utah State University are undertaking this collaborative study.

We need your cooperation by filling out the enclosed questionnaire which consists of three parts (Knowledge Information, Physical Activity Pattern and Behavior Patterns) and three day food intake record sheets. Your answers will be kept absolutely confidential and will be used for statistical purposes only, no individual identification will be revealed. It is important for us to obtain complete answers to all questions so that this information can be used for planning an educational program aimed at reducing the incidence and recurrence of heart disease in our community.

We will call you within the next ten days to answer any questions that you might have and make an appointment with you for collection of the questionnaire. For your participation we will make certain that you receive the results of the study. We thank you in advance for your cooperation.

Sincerely yours,

John L. Sorenson, M.D.
Deloy G. Hendricks, Ph.D.
Hugh D. Hammond, M.D.
Wendy W. Kim, M.S.
Informed Consent For Participation

In The Study:

"Cardiovascular Health Study In Cache Valley Community"

I understand that my name will not be used in any way with this study and that all data will be published using means and ranges of data by groups with no reference to individuals. I understand that I may withdraw my consent for participation in this study at any time.

Name

Date
Appendix B

Dietary Record Forms
### Example of Better Recorded Dietary

<table>
<thead>
<tr>
<th>Time</th>
<th>Food Name</th>
<th>Amount</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td>grape juice</td>
<td>8 fl. oz.</td>
<td>canned</td>
</tr>
<tr>
<td></td>
<td>cheerios</td>
<td>1-1/2 c</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with sugar &amp; milk</td>
<td>1 tsp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>coffee</td>
<td>3/4 c</td>
<td>2% milk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 coffee cups</td>
<td></td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
<td>peanut butter sand.</td>
<td>2-1/2 T peanut butter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 T jelly</td>
<td>3/4 oz.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 slice cheese bread</td>
<td>2 slices (16 sl. per lb.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>carrots</td>
<td>1 oz.</td>
<td>raw</td>
</tr>
<tr>
<td></td>
<td>apple</td>
<td>1:3 in. dia.</td>
<td>apple peelings</td>
</tr>
<tr>
<td></td>
<td>milk</td>
<td>2:10 oz. glasses</td>
<td>skin milk</td>
</tr>
<tr>
<td><strong>Dinner</strong></td>
<td>roast beef-rump</td>
<td>4 oz.</td>
<td>lean only</td>
</tr>
<tr>
<td></td>
<td>potato with butter</td>
<td>2 in dia x 3-1/2 in. baked</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with sour cream</td>
<td>1 pat (88/lg.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>broccoli spears</td>
<td>3 spears: 4-1/2 in. fresh, cooked, steamed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>lettuce salad:</td>
<td>1 C</td>
<td>shredded</td>
</tr>
<tr>
<td></td>
<td>iceberg lettuce</td>
<td>1/8 in. sl. of 2-1/2” dia.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tomato</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>dressing</td>
<td>1-1/2 tbl.</td>
<td>thousand island</td>
</tr>
<tr>
<td></td>
<td>olive</td>
<td>1 small</td>
<td>black</td>
</tr>
<tr>
<td></td>
<td>cake</td>
<td>1/16 of 10 in tube</td>
<td>angel food</td>
</tr>
<tr>
<td></td>
<td>starwberries</td>
<td>1/3 c</td>
<td>frozen w/sugar</td>
</tr>
<tr>
<td></td>
<td>cream</td>
<td>4 T whipped</td>
<td>heavy shipping w/sugar (2 tsp.)</td>
</tr>
<tr>
<td></td>
<td>milk</td>
<td>8 oz.</td>
<td>whole milk</td>
</tr>
<tr>
<td><strong>Snacks</strong></td>
<td>fudge</td>
<td>1 cubic in.</td>
<td>homemade-no nuts</td>
</tr>
<tr>
<td></td>
<td>orange</td>
<td>3-1/2 in. dia.</td>
<td>navel</td>
</tr>
<tr>
<td></td>
<td>peanuts</td>
<td>about 1-1/2 tbls.</td>
<td>salted, roasted</td>
</tr>
</tbody>
</table>
## DIETARY INTAKE RECORD—DAY ONE

PLEASE LIST ALL FOODS AND BEVERAGES YOU CONSUME DURING THREE DAYS. (TWO DAYS DURING THE WEEK AND ONE DAY ON THE WEEK-END, AT LEAST ONE DAY APART).

<table>
<thead>
<tr>
<th>Date:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Time you ate the food</th>
<th>What kind of food did you eat? Be specific. For instance, what kind of fruit or cereal did you eat? Indicate extras like sugar, butter, jelly eaten or put on food, etc.</th>
<th>How much of each food did you eat? Use a house measure to describe the quantity eaten, i.e., ½ cup peas, 1 tablespoon of raisins, 6 potato chips, etc.</th>
<th>How was the food prepared? Boiled, fried, raw, roasted, etc. Indicate kind of cooking oil used, i.e., lard, corn oil, olive oil, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dinner:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PLEASE LIST ALL FOODS AND BEVERAGES YOU CONSUME DURING DAY TWO

<table>
<thead>
<tr>
<th>DATE:</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Show the approximate TIME you ate the food</th>
<th>WHAT KIND OF FOOD DID YOU EAT? Be specific. For instance, what kind of fruit or cereal did you eat? Indicate extras like sugar, butter, jelly eaten or put on food, etc.</th>
<th>HOW MUCH OF EACH FOOD DID YOU EAT? Use a house measure to describe the quantity eaten, i.e. 4/3 cup peas, 3 tablespoons of raisins, 6 potato chips, etc.</th>
<th>HOW WAS THE FOOD PREPARED? Boiled, fried, raw, roasted, etc. Indicate kind of cooking oil used, i.e., lard, corn oil, olive oil, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dinner:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PLEASE LIST ALL FOODS AND BEVERAGES YOU CONSUME DURING DAY THREE

<table>
<thead>
<tr>
<th></th>
<th>WHAT KIND OF FOOD DID YOU EAT? Be specific. For instance, what kind of fruit or cereal did you eat? Indicate extras like sugar, butter, jelly eaten or put on food, etc.</th>
<th>HOW MUCH OF EACH FOOD DID YOU EAT? Use a household measure to describe the quantity eaten, i.e., ½ cup peas, 3 tablespoons of raisins, 6 potato chips, etc.</th>
<th>HOW WAS THE FOOD PREPARED? Boiled, fried, raw, roasted, etc. Indicate kind of cooking oil used, i.e., lard, corn oil, olive oil, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Snack:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lunch:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Snack:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dinner:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Snack:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C

Questionnaire
CARDIOVASCULAR HEALTH STUDY IN CACHE VALLEY COMMUNITY

John L. Sorenson M.D.,
Hugh D. Hammond M.D., and
The Department of Nutrition and Food Science
Utah State University
How do people in Cache Valley feel about the nutrition-health information they are getting, particularly that information related to coronary heart disease risk factors? To what extent do people in this community practice nutrition-health measures? What degree of progress is being made toward reducing the incidence of cardiovascular disease in this community? Answers to these and other questions related to heart disease are the focus of this study which will help physicians and scientists in their efforts for treating and reducing heart diseases in this community.

Please answer all the questions and the three day food intake should be recorded in such a way that 2 days during the week and 1 day on the week-end, at least one day apart. If you wish to comment on any questions or explain your answers, please use the margins or the back of this questionnaire.

"Cardiovascular Health Study for Cache Valley" is a cooperative effort of Dr. John L. Sorenson, M.D., Dr. Hugh D. Hammond, M.D. and the Department of Nutrition and Food Science at Utah State University.

Please completely fill out the questionnaire and retain it. The interviewer will contact you within the next 10 days for the collection of this questionnaire.

CONFIDENTIAL: The information recorded is for Cardiovascular Health Study purposes only. It will be coded and analyzed anonymously. The results will be disclosed only in the form of statistical tables which will carry no individual identification.
KNOWLEDGE INFORMATION

Please read instructions and answer every question unless the instructions indicate that it is not applicable to you. Please check (✓) or circle number or write answer in the space provided.

1. Bill went to his doctor for a check up. He wanted to know his risk of getting heart disease. Which of the following should the doctor include in his examination?

   a. Blood pressure
   b. Blood cholesterol
   c. Smoking information
   d. Diabetes
   e. Family history
   f. Electrocardiogram
   g. Body weight

2. Atherosclerosis is the heart disease that usually causes heart attacks. Which one of the following definitions BEST describes atherosclerosis? (Circle the number.)

   a. Blood pressure
   b. Blood cholesterol
   c. Smoking information
   d. Diabetes
   e. Family history
   f. Electrocardiogram
   g. Body weight

3. The following are some risk factors believed to be involved in coronary heart disease. Please circle whether you strongly agree (SA), agree (A), undecided (U), disagree (D) or strongly disagree (SD) with the statements.

   (CIRCLE YOUR CHOICE)

   a. High blood cholesterol -----------------
   b. Vitamin deficiency ------------------
   c. Overweight ------------------------
   d. Cigarette smoking ------------------
   e. Too many alcoholic beverages ------

   YES NO NOT SURE
### 4. Which one of the following is most likely to result from eating a diet with a lot of animal fat and cholesterol? (Circle the number.)

- a. Stomach ulcer
- b. Clogging the arteries
- c. Damage to the valves
- d. Not sure

### 5. For each of the comparisons of food below, please check the one which best fits the Heart Saver Eating Style. Please indicate "NOT SURE" if you are uncertain about it.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>OR</th>
<th></th>
<th></th>
<th>NOT SURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>□</td>
<td>Pork</td>
<td>□</td>
<td>Veal</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>□</td>
<td>Turkey</td>
<td>□</td>
<td>Steak</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>□</td>
<td>Whole milk</td>
<td>□</td>
<td>Skim milk</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>□</td>
<td>Olive oil</td>
<td>□</td>
<td>Corn oil</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>□</td>
<td>Tuna fish</td>
<td>□</td>
<td>Salami</td>
<td></td>
</tr>
<tr>
<td>f.</td>
<td>□</td>
<td>Halibut</td>
<td>□</td>
<td>Corned beef</td>
<td></td>
</tr>
<tr>
<td>g.</td>
<td>□</td>
<td>Rice</td>
<td>□</td>
<td>Hot dog</td>
<td></td>
</tr>
<tr>
<td>h.</td>
<td>□</td>
<td>Egg yolk</td>
<td>□</td>
<td>Egg white</td>
<td></td>
</tr>
<tr>
<td>i.</td>
<td>□</td>
<td>Oyster</td>
<td>□</td>
<td>Chicken</td>
<td></td>
</tr>
<tr>
<td>j.</td>
<td>□</td>
<td>Cheddar cheese</td>
<td>□</td>
<td>Cottage cheese</td>
<td></td>
</tr>
</tbody>
</table>
6. In your opinion, which of the following are acceptable for the Heart Saver Eating Style? Please indicate "NOT SURE" if your are uncertain about it.
   
   a. Ice cream
   b. Sherbet
   c. Angel food cake
   d. Pound cake
   e. Fruit compote
   f. Strawberry shortcake
   g. Pumpkin pie
   h. Fresh strawberries

7. In your opinion, are the following statements about the Heart Saver Eating Style True, False or Not Sure?

   a. Eat veal, poultry, and fish often: limit total meat, fish and poultry to 6-8 ounces per day.
   b. Trim fats from meat and use them in cooking.
   c. Substitute low-fat items such as liver often from high-fat items.
   d. Eat pan-fried meat rather than roasted or broiled meat.

8. The statements below are about fats and their relationship to blood cholesterol. Check whether the statement is True, False or Not Sure.

   a. Saturated fats tend to increase blood cholesterol.
   b. Polyunsaturated fats tend to lower blood cholesterol.
   c. Hydrogenated fats will lower blood cholesterol.
   d. Monounsaturated fats have little effect on blood cholesterol.
9. In your opinion, are the following statements about weight, True, False or are you Not Sure?

a. Successful weight loss results from burning more calories than you eat.  
   [ ] TRUE [ ] FALSE [ ] NOT SURE

b. If your physical activity stays the same but you eat less, you will burn up stored fat and lose weight.  
   [ ] TRUE [ ] FALSE [ ] NOT SURE

c. Fasting is a safe way to reduce weight because more weight is lost in a shorter period of time.  
   [ ] TRUE [ ] FALSE [ ] NOT SURE

d. If you continue to eat the same, increased exercise will increase calories used and result in weight loss.  
   [ ] TRUE [ ] FALSE [ ] NOT SURE

e. Skipping meals is justifiable if you need to lose weight quickly.  
   [ ] TRUE [ ] FALSE [ ] NOT SURE

f. Increased physical activity plus eating less food is the best way to lose weight rapidly.  
   [ ] TRUE [ ] FALSE [ ] NOT SURE

g. What a person eats is only important if one is trying to gain or lose weight.  
   [ ] TRUE [ ] FALSE [ ] NOT SURE

h. It is perfectly healthy to gain weight as one gets older.  
   [ ] TRUE [ ] FALSE [ ] NOT SURE

10. The following statements are about physical activity and stress and their relationship to premature heart disease. Please circle whether you strongly agree (SA), agree (A), undecided (U), disagree (D) or strongly disagree (SD) with each statement.

   (CIRCLE YOUR CHOICE)

   a. Exercise does not seem to be an important factor for prevention of heart disease  
      --------------------------  SA A U D SD

   b. Exercise is not necessary for those adults over 60 years old  
      --------------------------  SA A U D SD

   c. The lower blood cholesterol levels are often found in the physically active population  
      --------------------------  SA A U D SD

   d. Psychological stress, if it is repetitive, can often raise blood cholesterol level  
      --------------------------  SA A U D SD
e. Persons whose characteristics show intense aggressiveness and the sense of time urgency are not likely to develop premature heart disease _______ SA A U D SD

11. Of the following, which best describes your feeling about limiting your family's intake of cholesterol and saturated fat? (Please circle only ONE.)

1. I am not interested at present.
2. I am interested but don't know enough nutrition to plan a low cholesterol and low saturated fat eating style.
3. I am interested but do not feel this eating style is practical for my family's food taste.
4. I presently make a modest effort to limit cholesterol and saturated fat intake.
5. I presently make a major effort to limit cholesterol and saturated fat intake.

12. My feeling about low cholesterol and low saturated fat food: (Choose ONE of each pair.)

a. □ Difficult to prepare OR □ Easy to prepare □
   b. □ Inferior taste OR □ Tastes all right □
   c. □ Too expensive OR □ Reasonably priced □

13. Would you participate if our community develops physical exercise programs to reasonably suit your needs?

1. Yes (Go to Question 14)
2. No --------------------------------
3. Undecided (Go to Question 14)

If your answer is NO, please circle the reasons stated below:

a. Too busy to participate.
   b. Transportation is problem.
   c. Physical condition makes unable to participate.
   d. Already have personal exercise program.
   e. Other, please specify.
14. Has your doctor ever told you that you have any of the conditions listed below and/or are you taking medicine(s) prescribed by a doctor for any of the following conditions?

(PLEASE CIRCLE ALL THAT APPLY)

<table>
<thead>
<tr>
<th>Condition</th>
<th>I have had or do have this condition</th>
<th>I have or do now take medicine for this condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Diseases related to heart attacks or coronary</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td>b. Rheumatic fever, rheumatic heart disease or a heart murmur</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td>c. Diabetes</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td>d. High blood pressure</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td>e. High blood cholesterol</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td>f. Gout</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
<tr>
<td>g. Kidney trouble</td>
<td>YES NO</td>
<td>YES NO</td>
</tr>
</tbody>
</table>

15. Are (were) you on a special diet because of a health problem? 1. YES 2. NO (Go to Question 16)

IF YES:
A. Did your doctor give you this diet? 1. YES 2. NO

B. What kind of a diet are (were) you following?
   1. Low fat or low cholesterol
   2. Low salt or no salt
   3. Low sugar or low carbohydrate
   4. Low calorie
   5. Weight reduction
   6. High fiber

C. How long are (were) you on this diet? ____________________________

D. Where do (did) you get your information about this diet? ____________________________
E. Has your health status improved since you have been on this diet? 

1. YES 2. NO 3. NOT SURE

IF YES: Please circle the ones that apply.

1. Lowered blood cholesterol level
2. Lowered blood pressure
3. Reduced weight
4. Improved diabetic conditions
5. Others, please specify

16. Which of the following medical advice has been given to you by your physician?

a. Stop smoking
b. Relax from emotional stress
c. Exercise on a regular basis
d. Reduce body weight

YES NO NOT SURE

17. If you answered YES ON ANY OF QUESTIONS 14, 15 or 16 do (did) you comply with this advice and/or dietary or medical treatment?

a. YES, always (Go to Question 18)
b. NO, not always
c. NOT APPLICABLE (Go to Question 18)

IF YOU DO NOT ALWAYS COMPLY, please check each of the following reasons that apply to you.

a. Because I often forget to take medicine.
b. I believe there is little relationship between diet and coronary heart disease.
c. I am not convinced that smoking cigarettes can cause coronary heart disease.
d. Because I don't know enough about nutrition to modify my diet.
e. There is probably little relationship between exercise and heart disease. 

f. Because I consider myself "healthy".

g. Because I enjoy good food.

h. Others, please specify

18. Some foods are not recommended for the prevention of heart disease. Would you change your food habits under the following circumstances?

a. When physician recommends.

b. When recommended by family members, relatives or friends.

c. When I learn that the wise selection of food is important for the prevention of many diseases.

d. When I realize that I have high blood cholesterol or other heart disease risk factors.

e. When one close to me has had heart disease or a heart attack.

19. Please rank 5 of the following with respect to the amount of nutrition-health related knowledge you have received from each source. One (1) would indicate the most, 2 next to the most, etc. and please write zero (0) if you did not receive any information from that source.

a. Physicians.

b. Dietitians, nurses or nutritionists.

c. Family members, relatives or friends.

d. Education received while in schools.

e. Television, radio or newspaper.

f. Magazines or cookbooks.

g. Nutrition and health text books.

h. Health agencies or government publications.

i. Health store.
20. In many places, community health programs have been effective in reduction of heart disease. Please rank the following according to how important you feel they would be to a program introduced in this community. Rank from 1 through 6 again with 1 being most important.

- a. Through the local physicians.
- b. Through the dietitians or nurses.
- c. Through the extension personnel.
- d. Television, radio, newspaper.
- e. Local community church basis.
- f. Through community nutrition-health seminars given by physicians and other health professionals.

21. Did either of your parents develop heart disease before the age of 60?

- 1. YES
- 2. NO
- 3. DON'T KNOW

22. Do you take vitamin and/or mineral supplements?

- 1. YES
- 2. NO

23. What was your blood cholesterol level the last time it was measured?

- 1. Never measured
- 2. Don't know
- 3. ______ mg/100 ml blood

24. Your blood pressure?

- 1. Never measured
- 2. Don't know
- 3. ______

25. What is your smoking habit?

- 1. Never smoked. (Go to Question 26)
- 2. Smoked, but stopped smoking. (Go to Question 25-D)
- 3. Smoking. → IF YOU SMOKE: A. How long have you been smoking?
  
  B. Do you smoke:

- 1. Pipe (Go to Question 26)
- 2. Cigar (Go to Question 26)
- 3. Cigarette
C. How many cigarettes a day do you smoke?
   1. 1 to 10
   2. 11 to 20
   3. 21 to 30
   4. Over 30

D. IF YOU STOPPED SMOKING, what were your reasons?
   a. Physician's suggestion
   b. Suggestions from family members, relatives or friends
   c. Religion
   d. Smoking is related to the increased incidence of many diseases
   e. Other __________

26. You are:
   1. Male
   2. Female ----- A. Would you say that you are:

   1. Before menopause
   2. In menopause (Hot flashes, irregular periods and quick sweats)
   3. After menopause
   4. Without ovaries (Hysterectomy with removal of both ovaries)

B. Are you now using hormone supplement (Estrogen) or birth control pills?
   1. YES  2. NO
27. Present marital status?  
1. Never married  
2. Married and living together  
3. Separated or divorced  
4. Widowed  
5. Other  

28. Your religious preference?  
1. LDS  
2. Protestant  
3. Catholic  
4. Other  
5. None  

29. Which best describes your total family income for the past year?  
1. 4,199 or less  
2. 4,200 to 7,299  
3. 7,300 to 9,999  
4. 10,000 to 19,999  
5. 20,000 to 29,999  
6. 30,000 or over  

30. Your racial or ethnic background?  
1. Caucasian (White)  
2. Black  
3. Oriental  
4. Other, specify  
5. None  

31. Age at your last birthday?  

32. How many members in your family shared total family income for the past year?  

33. Which state were you born in?  
If you were born in a foreign country, please state name.  

34. Your weight?  

35. Your height?  

The next questions deal with your activities. Please read instructions carefully and answer as accurately as possible.

(I) PHYSICAL ACTIVITY ON OCCUPATION  

36. Which of the following was most applicable to you during the past year?  
1. Employed (Go to Question 37)  
2. Housewife (Go to Question 41)  
3. Retired  
4. Unemployed  
5. None of above (Go to Question 41)  

IF YOU WERE RETIRED OR UNEMPLOYED DURING LAST YEAR:  

A. How long had you been retired or unemployed?  

_____ months OR _____ years
### B. Did you have part time work during the past year?

1. **YES** (Go to Question 37)
2. **NO** (Go to Question 41)

**DURING THE PAST YEAR:**

37. What was your specific occupation and title? __________________________

38. About how many hours per **Week** did you work at your job?  
   __________________________ hours/week

39. How many months of the **Year** did you spend at this job?  
   __________________________ months/year

40. How long had you done that kind of work? _____ months OR _____ years

41. On the average during the **PAST YEAR**, how many **HOURS** per **DAY** have you spent performing the following activities while **ON YOUR JOB(S)** and/or in doing **HOUSINGLE TASKS**? The number of hours you spend at these activities should add up to the total number of hours you spend each day at your job(s) and/or in household tasks.

#### HOURS PER DAY

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting, e.g., writing, sewing, talking, desk work, reading, watching television, knitting, etc.</td>
<td></td>
</tr>
<tr>
<td>Driving, auto, trucks, bus or other equipment</td>
<td></td>
</tr>
<tr>
<td>Standing, e.g., operating cash register, waiting for customers, etc.</td>
<td></td>
</tr>
<tr>
<td>Walking, e.g., walking to stores, to work or at work, shopping, etc.</td>
<td></td>
</tr>
<tr>
<td>Light physical labor, e.g., working at lathe, or other equipment, cooking, ironing, washing, dusting, laundry, typing, etc.</td>
<td></td>
</tr>
<tr>
<td>Moderate physical labor, e.g., using tools such as hammer, wrench, vacuuming, gardening, bowling, etc.</td>
<td></td>
</tr>
<tr>
<td>Heavy physical labor, e.g., lifting or carrying infants or heavy objects, digging, chopping wood, scrubbing floors, construction work, shoveling, jogging, active sports, etc.</td>
<td></td>
</tr>
</tbody>
</table>

(Interviewer: Be sure the hours for the different types of activities add up to the total hours spent at job and household tasks.)
42. How would you rate the amount of physical activity you performed while at work and/or in household tasks during the past year? If you are retired or unemployed, please answer about the kind of work you have usually done during the past year.

1. Very little activity
2. Little activity
3. Moderate activity
4. Active
5. Very active (Much physical exertion)

(II) PHYSICAL ACTIVITY ON LEISURE TIME

43. On the average during the past year, how would you rate the amount of physical activity on your leisure time on an average working day and on non-working day -- at home or recreation?

(PLEASE CIRCLE ONE NUMBER FROM EACH COLUMN)

<table>
<thead>
<tr>
<th>WORKING DAY</th>
<th>NON-WORKING DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Very little</td>
<td>1</td>
</tr>
<tr>
<td>2. Little</td>
<td>2</td>
</tr>
<tr>
<td>3. Moderate activity</td>
<td>3</td>
</tr>
<tr>
<td>4. Active</td>
<td>4</td>
</tr>
<tr>
<td>5. Very active (Much physical exertion)</td>
<td>5</td>
</tr>
</tbody>
</table>

44. Is your physical activity restricted for any health reason?

1. YES  --> IF YES, What are the reasons?
2. NO

__________________________
When off the job (or on lunch or tea breaks), on the average, how often during the past year have you performed the following activities? (Please check your BEST estimate.)

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>HOW OFTEN</th>
<th>HOW LONG EACH TIME</th>
<th>HOW MANY MONTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please circle the ones you most enjoyed doing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light physical labor, e.g., cooking, ironing, dusting,</td>
<td>45</td>
<td>46</td>
<td>47</td>
</tr>
<tr>
<td>work bench, washing, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate physical labor, e.g., hammering, vacuuming,</td>
<td>48</td>
<td>49</td>
<td>50</td>
</tr>
<tr>
<td>inside paint, power lawn mowing, trimming bushes, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy work or farming, e.g., hand lawn mowing,</td>
<td>51</td>
<td>52</td>
<td>53</td>
</tr>
<tr>
<td>digging, shoveling, outside paint, construction work,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>carrying heavy objects, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>54</td>
<td>55</td>
<td>56</td>
</tr>
<tr>
<td>Jogging, running, bicycling, horseback riding, etc.</td>
<td>57</td>
<td>58</td>
<td>59</td>
</tr>
<tr>
<td>Bowling, dancing, etc.</td>
<td>60</td>
<td>61</td>
<td>62</td>
</tr>
<tr>
<td>Swimming, skiing, skating, etc.</td>
<td>63</td>
<td>64</td>
<td>65</td>
</tr>
<tr>
<td>Fishing boating, sailing, etc.</td>
<td>66</td>
<td>67</td>
<td>68</td>
</tr>
<tr>
<td>Hunting, hiking, golfing, etc.</td>
<td>69</td>
<td>70</td>
<td>71</td>
</tr>
<tr>
<td>Baseball, softball, tennis, etc.</td>
<td>72</td>
<td>73</td>
<td>74</td>
</tr>
<tr>
<td>Calisthenics or weight training</td>
<td>75</td>
<td>76</td>
<td>77</td>
</tr>
<tr>
<td>Reading, movies, radio, TV, handicraft, crochet, etc.</td>
<td>78</td>
<td>79</td>
<td>80</td>
</tr>
</tbody>
</table>
BEHAVIOR PATTERNS

The interplay of the "Type A coronary-prone" behavior pattern and pathophysiologic mechanisms have been implicated in the development of coronary heart disease or heart attacks. Please circle only one best answer for each of the following questions.

1. Do you ever have trouble finding time to get your hair cut or styled?
   1. Never
   2. Occasionally
   3. Almost always

2. How often does your job "stir you into action"?
   1. Less often than most people's jobs
   2. About average
   3. More often than most people's jobs

3. Is your everyday life filled mostly by:
   1. Problems needing solutions
   2. Challenges needing to be met
   3. A rather predictable routine of events
   4. Not enough things to keep me interested or busy

4. Some people live a calm, predictable life. Others often find themselves facing unexpected changes, frequent interruptions, inconveniences, or "things going wrong". How often are you faced with these minor (or major) annoyances or frustrations?
   1. Several times a day
   2. About once a day
   3. A few times a week
   4. Once a week
   5. Once a month or less

5. When you are under pressure or stress, what do you usually do?
   1. Do something about it immediately
   2. Plan carefully before taking any action

6. Ordinarily, how rapidly do you eat?
   1. I'm usually the first one finished
   2. I eat a little faster than average
   3. I eat at about the same speed as most people
   4. I eat more slowly than most people

7. Has your spouse or friend ever told you that you eat too fast?
   1. Yes, often
   2. Yes, once or twice
   3. No, never
8. How often do you find yourself doing more than one thing at a time, such as working while eating, reading while dressing, or figuring out problems while driving?

   1. I do two things at once whenever practical
   2. I do this only when I'm short of time
   3. I rarely or never do more than one thing at a time

9. When you listen to someone talking, and this person takes too long to come to the point, how often do you feel like hurrying the person along?

   1. Frequently
   2. Occasionally
   3. Almost never

10. How often do you actually "put words in the person's mouth" in order to speed things up?

    1. Frequently
    2. Occasionally
    3. Almost never

11. If you tell your spouse or a friend that you will meet somewhere at a definite time, how often do you arrive late?

    1. Once in a while
    2. Rarely
    3. I am never late

12. How often do you find yourself hurrying to get to places even when there is plenty of time?

    1. Frequently
    2. Occasionally
    3. Almost never

13. Suppose you are to meet someone at a public place (street corner, building lobby, restaurant) and the other person is already 10 minutes late. What will you do?

    1. Sit and wait
    2. Walk about while waiting
    3. Usually carry some reading matter or writing paper so I can get something done while waiting

14. When you have to "wait in line" at a restaurant, a store, or the post office, what do you do?

    1. Accept it calmly
    2. Feel impatient but not show it
    3. Feel so impatient that someone watching can tell I am restless
    4. Refuse to wait in line, and find ways to avoid such delays
15. When you play games with young children about 10 years old (or when you did so in past years), how often do you purposely let them win?

1. Most of the time
2. Half of the time
3. Only occasionally
4. Never

16. When you were younger, did most people consider you to be:

1. Definitely hard-driving and competitive
2. Probably hard-driving and competitive
3. Probably more relaxed and easy going
4. Definitely more relaxed and easy going

17. Nowadays, do you consider yourself to be:

1. Definitely hard-driving and competitive
2. Probably hard-driving and competitive
3. Probably relaxed and easy going
4. Definitely relaxed and easy going

18. Would your spouse (or closest friend) rate you as:

1. Definitely hard-driving and competitive
2. Probably hard-driving and competitive
3. Probably relaxed and easy going
4. Definitely relaxed and easy going

19. Would your spouse (or closest friend) rate your general level of activity as:

1. Too slow – should be more active
2. About average – busy much of the time
3. Too active – should slow down

20. Would people who know you well agree that you take your work too seriously?

1. Definitely yes
2. Probably yes
3. Probably no
4. Definitely no

21. Would people who know you well agree that you have less energy than most people?

1. Definitely yes
2. Probably yes
3. Probably no
4. Definitely no
22. Would people who know you well agree that you tend to get irritated easily?

1. Definitely yes
2. Probably yes
3. Probably no
4. Definitely no

23. Would people who know you well agree that you tend to do most things in a hurry?

1. Definitely yes
2. Probably yes
3. Probably no
4. Definitely no

24. Would people who know you well agree that you enjoy a "contest" (competition) and try hard to win?

1. Definitely yes
2. Probably yes
3. Probably no
4. Definitely no

25. How was your temper when you were younger?

1. Fiery and hard to control
2. Strong but controllable
3. No problem
4. I almost never got angry

26. How is your temper nowadays?

1. Fiery and hard to control
2. Strong but controllable
3. No problem
4. I almost never get angry

27. When you are in the midst of doing a job and someone (not your boss) interrupts you, how do you usually feel inside?

1. I feel O.K. because I work better after an occasional break
2. I feel only mildly annoyed
3. I really feel irritated because most such interruptions are unnecessary

28. How often are there deadlines on your job?

1. Daily or more often
2. Weekly
3. Monthly or less often
4. Never
29. These deadlines usually carry:
   1. Minor pressure because of their routine nature
   2. Considerable pressure, since delay would upset my entire work group
   3. Deadlines never occur on my job

30. Do you ever set deadlines or quotas for yourself at work or at home?
   1. No
   2. Yes, but only occasionally
   3. Yes, once a week or more

31. When you have to work against a deadline, what is the quality of your work?
   1. Better
   2. Worse
   3. The same. (Pressure makes no difference.)

32. At work, do you ever keep jobs moving forward at the same time by shifting back and forth rapidly from one to the other?
   1. No, never
   2. Yes, but only in emergencies
   3. Yes, regularly

33. Are you content to remain at your present job level for the next five years?
   1. Yes
   2. No, I want to advance
   3. Definitely no; I strive to advance and would be dissatisfied if not promoted in that length of time

34. If you had your choice, which would you rather get?
   1. A small increase in pay without a promotion to a higher level job
   2. A promotion to a higher level job without an increase in pay

35. In the past three years, have you ever taken less than your allotted number of vacation days?
   1. Yes
   2. No
   3. My type of job does not provide regular vacations

36. In the last three years, has your personal yearly income changed?
   1. It has remained the same or gone down
   2. It has gone up slightly (as the result of cost-of-living increases or automatic raises based on years of service)
   3. It has gone up considerably
37. How often do you bring your work home with you at night, or study materials related to your job?
   1. Rarely or never
   2. Once a week or less
   3. More than once a week

38. How often do you go to your place of work when you are not expected to be there (such as nights or weekends)?
   1. It is not possibly on my job
   2. Rarely or never
   3. Occasionally (less than once a week)
   4. Once a week or more

39. When you find yourself getting tired on the job, what do you usually do?
   1. Slow down for a while until my strength comes back
   2. Keep pushing myself at the same pace in spite of the tiredness

40. When you are in a group, how often do the other people look to you for leadership?
   1. Rarely
   2. About as often as they look to others
   3. More often than they look to others

41. How often do you make yourself written lists to help you remember what needs to be done?
   1. Never
   2. Occasionally
   3. Frequently

For questions 42-46, compare yourself with the average worker in your present occupation, and mark the most accurate description.

42. In amount of effort put forth, I give:
   1. Much more effort
   2. A little more effort
   3. A little less effort
   4. Much less effort

43. In sense of responsibility, I am:
   1. Much more responsible
   2. A little more responsible
   3. A little less responsible
   4. Much less responsible
44. I find it necessary to hurry:
   1. Much more of the time
   2. A little more of the time
   3. A little less of the time
   4. Much less of the time

45. In being precise (careful about detail), I am:
   1. Much more precise
   2. A little more precise
   3. A little less precise
   4. Much less precise

46. I approach life in general:
   1. Much more seriously
   2. A little more seriously
   3. A little less seriously
   4. Much less seriously

For questions 47-49, compare your present work with your work setting of 5 years ago. If you have not been working for 5 years, compare your present job with your first job.

47. I worked more hours per week:
   1. At my present job
   2. 5 years ago
   3. Cannot decide

48. I carried more responsibility:
   1. At my present job
   2. 5 years ago
   3. Cannot decide

49. I was considered to be at a higher level (in prestige or social position):
   1. At my present job
   2. 5 years ago
   3. Cannot decide

50. How many different job titles have you held in the last 10 years? (Be sure to count shifts in kinds of work, shifts to new employers, and shifts up and down within a firm.)
   1. 0-1
   2. 2
   3. 3
   4. 4
   5. 5 or more
51. How much schooling did you receive?

1. 0-4 years
2. 5-8 years
3. Some high school
4. Graduated from high school
5. Trade school or business college
6. Some college (including junior college)
7. Graduated from a four-year college
8. Post-graduate work at a college or university

52. When you were in school, were you an officer of any group, such as a student council, glee club, 4-H Club, sorority or fraternity, or captain of an athletic team?

1. No
2. Yes, I held one such position
3. Yes, I held two or more such positions

THANK YOU

If there are any comments you wish to make, please use this space for that purpose.
Appendix D

Metabolic Costs for Various

Occupational and Leisure Tasks
Table 16. Metabolic Cost of Occupational Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Work Metabolic Rate</th>
<th>Basal Metabolic Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting, e.g., writing, sewing, talking, desk work, reading, watching television, knitting, etc.</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Driving, auto, trucks, bus, or other equipment</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Standing, e.g., operating cash register, waiting on customers, etc.</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Walking, e.g., walking to stores, to work or at work, shopping, etc.</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Light physical labor, e.g., working at lathe or other equipment, cooking, ironing, washing, dusting, laundry, typing, etc.</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Moderate physical labor, e.g., using tools as hammer, wrency, vacuuming, gardening, bowling, etc.</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>Heavy physical labor, e.g., lifting or carrying infants or heavy objects, digging, chopping wood, scrubbing floors, construction work, shoveling, jogging, active sports, etc.</td>
<td>6.3</td>
<td></td>
</tr>
</tbody>
</table>
Table 17. Metabolic Cost of Leisure Time Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Work Metabolic Rate</th>
<th>Basal Metabolic Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light physical activity, e.g., cooking, ironing, dusting, work bench, washing, etc.</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Moderate physical activity, e.g., hammering, vacuuming, inside housepainting, power lawn mowing, trimming bushes, etc.</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>Heavy work or farming, e.g., hard lawn mowing, digging, shoveling, outside painting, construction work, carrying heavy objects, etc.</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Jogging, running, bicycling, horseback riding, etc.</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>Bowling, dancing, etc.</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Swimming, skiing, skating, etc.</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>Fishing, boating, sailing</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Hunting, hiking, golfing, etc.</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Baseball, softball, tennis etc.</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Calesthenics or weight training</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Reading, movies, radio, watching T.V., handcraft, crochet, etc.</td>
<td>1.8</td>
<td></td>
</tr>
</tbody>
</table>
VITA
Wendy Whanghea Kim
Candidate for the Degree of
Doctor of Philosophy

Dissertation: Effects of Social and Demographic Characteristics, Knowledge of Coronary Heart Disease and Dietary Practices on the Level of Serum Cholesterol

Major Field: Nutrition and Food Sciences

Biographical Information:

Personal Data: Born in Seoul, Korea, September 14, 1938, daughter of Dong Sik and Mil Ja Yea; married Yun Kim February 16, 1963; two sons--Harold Young (15 years old), Donald Young (13 years old), and a daughter--Gloria Young (11 years old).

Education: Graduated from Kyunggi Girls High School in 1957; received Bachelor of Science degree from Ewha Womans' University, Seoul, Korea, with a major in Pharmacy in 1961; graduate work at College of Pharmacy, the University of Michigan, Ann Arbor, Michigan (1962-1963) and the Philadelphia College of Pharmacy and Science, Philadelphia, Pennsylvania (1963); received Master of Science degree from Utah State University, Logan, Utah, with a major in Food and Nutrition in 1969; completed requirements for Doctor of Philosophy with a major in Nutrition and Food Sciences at Utah State University in 1979.

Honors and Fellowships: Received the highest academic honor scholarship, Ewha Womans' University, 1960; University president's gold medal awarded for the highest scholastic achievement, Ewha Women's University, 1961; Summa Cum Laude graduate, Ewha Women's University, 1961; Hospital pharmacy intern fellowship, University of Michigan, Ann Arbor, Michigan, 1962-63.