AN ABSTRACT OF THE THESIS OF

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This study examined lifestyle changes as related to the risk of coronary heart disease (CHD) in Chinese students at Oregon State University (OSU). The study population included male students or scholars from the People's Republic of China who were attending OSU during spring term 1992. Fifty subjects were interviewed using a structured questionnaire.

The questionnaire included eight categories of information: (1) bodyweight and blood pressure, (2) diet, (3) alcohol consumption, (4) cigarette smoking, (5) physical activity, (6) psychological stress, (7) acculturation factors, and (8) demographic factors.

Results indicated that for this group of Chinese students, bodyweight, consumption of dietary fat, dairy products, soft drinks, and psychological stress had increased significantly during their stay in the US. Meanwhile, the level of physical activity had decreased. These changes, especially if continued, may have the potential to increase their risk of developing CHD.

On the other hand, there were no significant changes in blood pressure and alcohol consumption. For cigarette smokers, smoking had decreased.

In their responses to the open-ended questions, the reasons given for bodyweight changes included diet, decreased physical activity, and increasing age. Diet

changes were attributed to food availability, relative price, and convenience. For decreased cigarette smoking, lack of smoking environment was considered to be the most important factor. Automobile use, limited spare time, and no friend to play with were the reasons for decreased physical activity. Finally, pressure in school, financial difficulty, and worrying about future were considered to be the reasons for increased psychological stress.

Multiple regression analysis indicated that the length of US stay and decreased physical activity were significant predictors for bodyweight gain. The length of US stay was also a significant predictor for changes in total dietary fat. Having financial aid from school was associated with decreased physical activity. Living as single was significantly associated with increased psychological stress. This study failed to identify any significant associations between acculturation factors and changes in the CHD risk factors.

LIFESTYLE CHANGES AS RELATED TO THE RISK OF CORONARY HEART DISEASE IN CHINESE STUDENTS AT OREGON STATE UNIVERSITY

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CHAPTER I

INTRODUCTION

Coronary heart disease (CHD) is the leading cause of premature death in developed countries (WHO, 1986). Although CHD is generally considered a western disease, its prevalence has been increasing in many developing countries. As noted by Dodu (1988), CHD in many developing countries is moving from a relatively rare disease to an epidemic disease. It is projected by the World Health Organization that by the year 2000, cardiovascular disease (in which CHD accounts for a large proportion) will become a substantial health problem in virtually every country in the world (WHO, 1990).

"Affluent" diet, high blood cholesterol, high blood pressure, obesity, cigarette smoking, physical inactivity, and psychological stress are some of the lifestyle risk factors of coronary heart disease (WHO, 1982). Populations with higher levels of these factors tend to experience higher CHD morbidity and mortality. In China, for example, the diet is low in fat, especially low in saturated fat, and CHD mortality in China is also low. In 1984, the crude CHD death rate in China was estimated to be only one-tenth of that in the United States (Tao et al., 1989).

CHD risk factors can be reduced through changes in lifestyle, such as reducing consumption of cholesterol in diet. If such changes can be made throughout life, the onset of coronary heart disease can be postponed or even be prevented (Fries and Crapo, 1981).

On the other hand, the level of CHD risk factors may increase with negative changes in lifestyle. For example, following economic growth, people in many developing countries tend to adopt a lifestyle of "affluence" which is characterized by high-fat and low-fiber food. As a result, their levels of CHD risk factors increase (McMurry et al., 1991). Studies among immigrant populations also show that their levels of CHD risk factors and prevalence of CHD tend to be closer to that of their adopted country. In a study of first generation Asian Americans, Klatsky and Armstrong (1991) find that blood cholesterol level in the study sample is not only similar to their US-born counterparts but also similar to American blacks and whites.

Jenkins (1983) summarizes that CHD risk is mainly attributed to changes in lifestyle:

> Differences in risk for cardiovascular disease among populations and individuals are largely social and behavioral. The great rise in incidence of and mortality from coronary heart disease and hypertension over the course of this century in the United States and in Europe is not due to genetics, since the population gene pool has not changed noticeably. The twentieth century epidemic seems due to the changes in the ways in which people eat and sleep, work and play, relate to one another, and react emotionally as well as to the sociocultural circumstances under which they live. Similarly, the decline in CHD mortality in the United States, now more than 30 per cent less than the 1968 level, is attributed to changes in life styles and behaviors.

Statement of the Problem

An enormous body of scientific research has been conducted on the risk factors of coronary heart disease, including many cross-cultural studies on immigrants. However, few researchers have studied the effect of sojourn on the changes of CHD risk factors. A representative population of sojourners is Asian students studying in western countries (Weissman and Furnham, 1987). Do these students increase their level of CHD risk factors after they have lived in a western country for a certain period of time? If they do, which of the risk factors are mostly affected; how much change has occurred; how long does it take for the changes to occur; and what elements underlie these changes?

In recent years, increased numbers of Asian students have come to study in the United States. A number of differences between these students and immigrants have been identified: (1) most of the Asian students are within the same age cohort and thus have a similar degree of cultural upbringing; (2) their cultural values and lifestyle preferences have been well cultivated at the time of their arrival in the US; (3) their time of stay in the United States is relatively short; and (4) their country identity did not change during their stay. These characteristics make them an ideal population for studying dramatic environmental and sociocultural changes. Such studies can provide a better understanding of the impact of environmental and sociocultural changes on CHD risk factors. In addition, such studies can provide information for developing primary prevention strategies for CHD and other lifestyle related diseases in developing countries. At present, no such study has been conducted in Chinese students.

Objectives of the Study

The primary purpose of this study is to examine if there are any changes in a number of lifestyle CHD risk factors in Chinese students at Oregon State University (OSU). Further, demographic, environmental, and cultural factors associated with the possible changes are examined. CHD risk factors that are examined in this study include bodyweight, diet, alcohol consumption, cigarette smoking, physical activity, and psychological stress. The objectives of this study were to:

1. Identify a present profile of CHD risk factors, demographic factors, and acculturation factors in Chinese students at OSU using an interviewer administered questionnaire. The CHD risk factors covered in this study include diet, body mass index, alcohol consumption, cigarette smoking, physical activity, and psychological stress.

2. Identify a previous profile (the profile of subjects while in China) of CHD risk factors in Chinese students at OSU based on their diet, body mass index, alcohol consumption, cigarette smoking, physical activity, and psychological stress using the same questionnaire.

3. Examine if there are any differences on the CHD risk factors between the two profiles.

4. Examine the relationship between selected demographic factors and CHD risk factor changes (if there is any).

5. Examine the relationship between acculturation and CHD risk factor changes (if there is any).

Research Questions

The study is constructed utilizing the following research questions:

1. Are there any changes in diet, body weight, alcohol consumption, cigarette smoking, physical activity, and psychological stress in Chinese students at OSU during their stay in the US?

2. If there are changes on the above factors, what is the direction and the magnitude of these changes?

3. Is there any association between demographic factors and changes in the CHD risk factors?

4. Is there any association between acculturation factors and changes in the CHD risk factors?

Hypotheses

The hypotheses of the study include:

1. **Ho**: For the Chinese students at OSU, there is no significant difference between the present profile and the previous profile on the following CHD risk factors:
   a. bodyweight
   b. diet
   c. alcohol consumption
   d. cigarette smoking
   e. physical activity
   f. psychological stress

   Ha: For the Chinese students at OSU, there is a significant difference between the present profile and the previous profile on the above CHD risk factors.

2. **Ho**: There is no significant association between the demographic factors (such as marital status, time of stay in the US) and changes (if there is any) of the CHD risk factors.

   Ha: There is a significant association between the demographic factors and changes (if there is any) of the CHD risk factors.

3. **Ho**: There is no significant association between acculturation and changes (if there is any) of the CHD risk factors.

   Ha: There is a significant association between acculturation and changes (if there is any) of the CHD risk factors.

Definition of Terms

The following terms are defined to clarify their use in this study:

Acculturation: is cultural change, usually at the individual level, induced by culture contact (Ovando, 1988). For the study population, acculturation is further defined as lifestyle changes incurred by studying in the United States.

Chinese students at OSU: male students or scholars from the People's Republic of China (mainland China) who were attending Oregon State University during spring term 1992.

Coronary heart disease (CHD): is narrowing of the coronary arteries, usually due to atherosclerosis, which reduces or blocks the blood flow to the heart muscle (AHA, 1988).

CHD risk factors: are factors that increase the risk of CHD. These factors are identified based on extensive clinical and epidemiological research. The most significant CHD risk factors include heredity, male sex, increasing age, smoking, high blood pressure, and high blood cholesterol. Other well established CHD risk factors include diabetes, obesity, physical inactivity, and psychological stress. Diet is associated with some of these factors, such as high blood cholesterol and obesity. Alcohol is also found to be associated with the risk of CHD. At the individual level, the more risk factors present, the greater the chance that a person will develop CHD (AHA, 1988). The CHD risk factors that are examined in this study include diet, alcohol drinking, smoking, physical activity, and psychological stress.

Limitations of The Study

The following limitations have been acknowledged:

1. The study population is limited only to male students or visiting scholars from the People's Republic of China studying at Oregon State University.

2. The sample size is limited and the sample is not randomly selected. As a result, selection bias could be introduced.

3. Information obtained for this study is solely based on self-report and therefore subject to recall and measurement bias. In particular, participants had to recall their life habits many years back. Bodyweight and blood pressure are not measured with identical scientific criteria.

4. Some of the important CHD risk factors, such as blood cholesterol and diabetes, are not evaluated in this study.

5. Complete quantitative dietary evaluation is not performed.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The purpose of this study is to examine the effect of acculturation, as a result of studying in the United States, on lifestyle changes that are related to the risk of coronary heart disease in Chinese students. The relationship can be depicted as:

$$\text{lifestyle in China} \xrightarrow{\text{acculturation}} \text{lifestyle in the US}$$

This chapter will review literature concerning CHD, CHD risk factors, and acculturation. Differences in the prevalences of CHD and CHD risk factors between China and the United States will also be discussed. In addition, due to the complexity in dietary assessment and measurement of acculturation, a review on related measurement issues is included in this chapter.

Definition of Coronary Heart Disease

Coronary heart disease is also called coronary artery disease, or ischemic heart disease. It is "impairment of heart function due to inadequate blood flow to the heart compared to its needs, caused by obstructive changes in the coronary circulation to the heart" (International Society and Federation of Cardiology/World Health Organization, 1979). The clinical manifestations of CHD include sudden death, myocardial infarction, angina pectoris, congestive heart failure, and other disturbances of cardiac function. The underlying pathological change of CHD is atherosclerosis (WHO, 1990).

Atherosclerosis is the thickening and hardening of the arteries characterized by formation of plaques in the inner lining of the artery. Plaques are deposits of fatty substances, cholesterol, cellular waste products, calcium and fibrin (AHA, 1988).

One of the popular hypotheses developed to explain the etiology and pathogenesis of atherosclerosis is the response-to-injury hypothesis (Hurt, 1990). This hypothesis states that some factors (such as hypercholesterolemia, high blood pressure, immunologic factors, toxins, and viruses) can damage the endothelium of the artery. Over time, platelet accumulate and blood clot forms in the artery wall. Eventually, the accumulated blood clot may block the artery. Also, platelet growth factor released by platelet stimulates the proliferation of smooth muscle cells. The interaction of platelet, smooth muscle cells, and other substances from the blood leads to the formation of plaques (AHA, 1988). Overall, the etiology of coronary heart disease is multifactorial. It is the interaction of genetic factors and a variety of environmental factors (Leaf and Ryan, 1990).

Epidemiology of Coronary Heart Disease

CHD is the major cause of death in western countries. International data on the incidences of CHD has been lacking. The following comparisons are based on mortality rates. Among men, USSR and Eastern European countries have the highest death rates (486.2 per 100,000 for USSR). The rates are substantially lower in New Zealand (349.5), the United Kingdom (340.0), and the United States (275.0). The lowest mortality in developed countries is found in Japan (52.5) where dietary fat consumption is also lower. Nevertheless, differences on diagnosis, coding, and treatment technology should be considered when examining

country differences in CHD mortality rates (Lopez, 1990).

In the United States, it was estimated by the National Interview Survey (Hurt, 1990) that 2.9 percent of Americans (6.9 million) had coronary heart disease. For men, the prevalence was 84.5 per 1000 population at age 45 to 64, 167.2 at age of 65 to 74, and 179.5 at age 75 and over. For women, the corresponding estimates by age were 36.0, 84.4, and 139.9 respectively.

Each year, coronary heart disease causes about 800,000 new heart attacks and an additional 450,000 recurrences in the United States (Hurt, 1990). In 1987, heart attack caused 513,700 deaths in the US About 60% of the deaths occurred before the victim reached a hospital (Leaf and Ryan, 1990).

In developing countries, the prevalence of CHD has been lower. In Beijing, China, for example, the age-standardized CHD death rate for the population aged 35-64 during 1984-1986 was 49 per year per 100,000. The corresponding rate was 197 for the United States and 294 for the USSR (WHO, 1989).

Due to lifestyle changes, especially dietary changes, following economic growth and urbanization, the rate of CHD has also been increasing in developing countries (WHO, 1990). In China, the prevalence and incidence of coronary heart disease has experienced an increase in the past four decades (Tao et al., 1989). Also, studies on immigrants have indicated that CHD rates in immigrants are between that of their native country and that of their adopted country (Marmot et al., 1975; Marmot and Syme, 1976).

Risk Factors of Coronary Heart Disease

The etiology of coronary heart disease is multifactorial. A number of factors have been identified as risk factors of coronary heart disease based on clinical and

epidemiological studies. Among them, heredity, male sex, and age are factors that cannot be changed. On the other hand, diet, high blood cholesterol, high blood pressure, cigarette smoking, diabetes, obesity, physical inactivity, and psychological stress are factors that are changeable by modification in lifestyle and by medical treatment (AHA, 1988; WHO, 1982). Other CHD risk factors that have been identified include heavy alcohol consumption, oral contraceptive use, and many psychosocial factors (Kaplan and Stamler, 1983).

Volumes could be written on CHD risk factors. It is not the purpose of this thesis to fully discuss all of the CHD risk factors. This section summarizes those risk factors that are included in this study. Later, discussions on acculturation and changes in risk factors will be made where the association between CHD and risk factors will be further elaborated.

1. Diet and cholesterol

The relationship between habitual diet, blood cholesterol, and CHD has been well established by a large body of scientific research (WHO, 1982). Stamler (1978) states: "it is further reasonable and sound to designate 'rich diet' as a primary, essential, necessary cause of the current epidemic of premature atherosclerotic disease raging in the western industrialized countries." The effect of habitual diet on the development of CHD is mainly due to its direct association with blood cholesterol.

Population studies have shown a strong association between total cholesterol (TC) level and CHD incidence. In the United States, the Pooling Project Study (Pooling Project Research Group, 1978) showed that a serum cholesterol of 240 mg/dl or greater increased the risk of CHD significantly. Internationally, the Seven Countries Study showed that CHD incidence and mortality were strongly

associated with the level of serum cholesterol among populations (Keys, 1980).

In adults, blood total cholesterol level exhibits the level of low-density lipoprotein (LDL) cholesterol which makes up 60% to 80% of the TC. LDL is identified as the major component of cholesterol deposited in atherosclerotic plaques and CHD risk is positively associated with increased level of LDL (WHO, 1982).

High density lipoprotein (HDL) cholesterol, on the other hand, was shown to have an inverse relationship to the risk of CHD. HDL usually accounts for 20% to 30% of the TC (WHO, 1982). It was found that a low level of HDL consistently predicts the incidence of CHD and the association is independent to TC and other CHD risk factors. TC-HDL and LDL-HDL ratios are also strong determinants of CHD risk. Moreover, a low level of serum HDL cholesterol was found to be associated with other CHD risk factors such as cigarette smoking, obesity, physical inactivity, and family history (Gordon and Rifkind, 1989).

Although it remains controversial, the role of elevated serum triglycerides has been shown to be associated with the risk of coronary heart disease. The level of triglycerides is affected by increased bodyweight and uncontrolled diabetes (Gotto and Wittels, 1983).

For individuals within populations, the relationship between diet, blood cholesterol, and the risk of CHD has been difficult to quantify because of wide individual variation in nondietary factors (such as differences in cholesterol absorption and metabolism due to genetics) and because of difficulty in accurately measuring nutrient intake (Gotto and Wittels, 1983). The Multiple Risk Factor Intervention Trial (MRFIT) (Neaton and Wentworth, 1992), however, showed a strong graded association between serum cholesterol level above 180 mg/dl and CHD mortality after an average of a 12 year follow-up.

Increased consumption of dietary cholesterol results in increased absorption of cholesterol into the blood. The effect of dietary cholesterol on blood cholesterol is especially significant when the baseline level of dietary cholesterol is low. McMurry et al. (1991) conducted a study among Tarahumara Indians of Mexico whose usual diet is low in cholesterol and saturated fats. After given a typical diet of the affluent society to the study subjects for five weeks, their levels of blood cholesterol, triglyceride, and body weight increased dramatically. The mean of TC increased from 121 to 159 mg/dl, LDL from 72 to 100 mg/dl, HDL from 32 to 42 mg/dl, and triglyceride from 81 to 108 mg/dl. The mean increase in bodyweight was 3.8 kg. In the Seven Country Study, saturated fat intake of total energy, mean TC level, and a 15-year CHD incidence were 3%, 165 mg/dl, and 144 per 10,000 for Japan and 22%, 270 mg/dl, and 1,202 per 10,000 for eastern Finland. It was observed that for populations with a mean saturated fat intake between 3% to 10%, the mean TC level was consistently below 200 mg/dl and CHD mortality was also low. When saturated fat intake became more than 10% of the total energy intake, there was a striking increase in CHD mortality (Keys, 1980, Keys et al., 1984).

Dietary saturated fats are very influential in raising blood cholesterol. Major sources of saturated fatty acids (SFA) and cholesterol include meat fats, dairy fats (such as in whole milk, butter, cheese, and ice cream), and other visible fats used for cooking, spread, and salads (e.g. lard, "hard" margarine, and cheese based salad dressings). Cholesterol is also high in egg yolk. Poultry contains less saturated fats than red meats. Fish, in general, is especially low in saturated and relatively high in unsaturated fatty acids (Gotto and Wittels, 1983).

It was noted that fat consumption is high among populations in Mediterranean countries and among Eskimos,

but the incidence of CHD in these populations are relatively low. Studies indicate that not all saturated fatty acids will induce hyper-cholesterolaemia and consequently atherosclerosis. Only SFAs containing 12 to 16 carbon atoms are atherogenic. These medium chain fatty acids are high in red meats and in dairy products. Polyunsaturated fatty acids and monounsaturated fatty acids, on the other hand, reduce serum cholesterol and are protective against thrombosis. For Mediterranean countries and Eskimos, although their total fat intake is high, the fats eaten are mainly mono-unsaturated fatty acids (olive oil) or polyunsaturated fatty acids (derived from marine foods). Based on this evidence, Ulbricht and Southgate (1991) developed a formula for calculating indices of atherogenicity (IA) and thrombogencity (IT) for food items based on fatty acid composition of the foods. They proposed that future clinical trials should be aimed not at reducing total fat intake, but rather, at reducing both IA and IT in diet.

Dietary intervention studies, in turn, support the association between diet, blood, cholesterol, and coronary heart disease. In the Oslo Study among a group of 16,202 men aged 40-49 years, Hjermann et al. (1981) showed a 13% reduction in mean serum cholesterol concentration parallelled with a 47% lower incidence of myocardial infarction in the intervention group than in the control group. Overall, dietary modification is a very useful strategy for primary prevention of CHD.

2. Cigarette smoking

Cigarette smoking causes more deaths due to coronary heart disease than does lung cancer. However, the association between smoking and CHD, compared to the association with lung cancer, is less widely understood by the public. Cigarette smoking is a good example that a

personal choice/behavior becomes a CHD risk factor.

The etiology of cigarette smoking on CHD is suggested to be the effect of nicotine, carbon monoxide, and many other substances. These agents aggravate the development of atherosclerosis and contribute to the onset of myocardial infarction and sudden death by causing a rise in free fatty acids and an increase in platelet. In addition, these agents interfere with myocardial oxygen delivery, increase heart rate and blood pressure at rest, and reduce the threshold for ventricular fibrillation (Aronow and Kaplan, 1983).

The Surgeon General stated that cigarette smoking is "the most important of the known modifiable risk factors for coronary heart disease in the United States" (USDHHS, 1983). Not only is there a dose-response relationship between cigarette smoking and CHD risk, cigarette smoking also acts synergistically with other CHD risk factors (Holbrook et al., 1984).

For example, the CHD death rate for moderate smokers is found to be in between that of nonsmokers and heavy smokers (USDHHS, 1983). In a population study in the United States, Friedman (1967) found that in states with higher sales of cigarettes, CHD death rates are also higher. In the Multiple Risk Factor Intervention Trial (MRFIT), Neaton and Wentworth (1992) identified a risk gradient in CHD mortality with increased levels of cigarette smoking. A synergistic effect between smoking, serum cholesterol level, and blood pressure also was detected.

Another interesting phenomenon between smoking and CHD is that CHD mortality in ex-smokers is found to be significantly lower than in current smokers. Smoking cessation reduces CHD mortality substantially. For those who have smoked less than 20 years, 10 years after quitting smoking, CHD risk is about the same as nonsmokers (Holbrook et al., 1984).

3. High blood pressure

Along with high blood cholesterol and cigarette smoking, high blood pressure is another major risk factor for coronary heart disease. High blood pressure contributes significantly to the incidence of CHD (WHO, 1982).

In the Pooling Project Study (Pooling Project Group, 1978), it was found that the higher the diastolic blood pressure (DBP), the higher the risk of CHD. For individuals with DBP 90 mmHg or higher, the relative risk is about twice of those with DBP < 80 mmHg. The relationship between CHD risk and systolic blood pressure (SBP) shares the same pattern because DBP and SBP are highly correlated. In the Multiple Risk Factor Intervention Trial (Neaton and Wentworth, 1992), among 316,099 men, both SBP and DBP were significant predictors for CHD death.

In addition, high blood pressure is associated with other CHD risk factors, such as high blood cholesterol, cigarette smoking, obesity, physical inactivity, as well as age, sex, and heredity (Stamler, Stamler, and Liu, 1985).

4. Obesity

Overweight is often used to describe a body weight that is above certain arbitrary standards in relation to height. It could be caused either by an excess of body fat or by highly developed muscles such as exhibited in some athletes.

Obesity, on the other hand, is exclusively used for an abnormal excess in body fat based on certain standards. The most commonly used standards for evaluating the prevalence of obesity include (1) the "desirable" weight range associated with the greatest longevity; (2) one standard deviation within the estimated mean weight of college-aged males and females; and (3) the estimated median weights of the general population characterized by sex, age, and height (Van Itallie, 1979).

The relative weight of body fat is usually difficult to

quantify. Although hydrostatic measurement can provide the most accurate estimate of body fat, it requires certain laboratory equipment, a trained technician, and submerging the subject in water. Body mass indices (BMI) are derived for more convenient measurement of body adiposity. The most widely used and also the most valid BMI is the Quetelet index (kg/m^2) (Revicki and Israel, 1986). Bray (1983) defines overweight as BMI (kg/m^2) greater than 25 for males, 27 for females and obesity as body fat makes up 25% or more of the bodyweight for males and 30% or more for females. Obesity is the result of an imbalance in energy intake and output. Factors such as high fat and high sugar diet, heredity, and sedentary lifestyle are believed to be responsible for obesity.

Studies have shown that obesity is associated with an increased risk of coronary heart disease. It is also related to other risk factors of CHD such as high blood pressure, high blood cholesterol, and diabetes mellitus. Weight control in populations might reduce the incidence of these risk factors (WHO, 1982).

In a study of Japanese-American men in Hawaii, body fat, as measured in body mass index, was closely associated with an increased risk of CHD even in this relatively lean population (Curb and Marcus, 1991).

In the Framingham study, it was found that for every 10% increase in relative weight, there is a 6.5 mmHg rise in systolic blood pressure, a 12 mg/dl rise in plasma cholesterol, and a 2 mg/dl rise in fasting blood sugar. Likewise, these measurements decrease with declines in body weight (Kannel and Gordon, 1979).

Another phenomenon between obesity and CHD is that people acquired obesity between the ages of 20 and 40 tend to have a much greater risk in the development of subsequent coronary heart disease than individuals who become obese in older age (Rabkin et al., 1977).

5. Alcohol consumption

Previous studies have described a "protective" effect against CHD with light and moderate alcohol drinking. Compared to light drinkers, higher CHD incidence was found for nondrinkers and heavy drinkers (WHO, 1982). Such a J-shaped or U-shaped relationship between alcohol and CHD has been found in many studies as summarized by Hennekens (1983).

It was suggested that alcohol consumption increases the level of high density lipoprotein cholesterol and that alcohol has an antithrombotic effect (Lazarus et al., 1991). Another plausible explanation for the preventive effect of moderate drinking is that there may be a confounding relationship between drinking and personality type or diet. One study (Jones et al., 1982) found that men who drank moderate amounts of alcohol (25-49 g per day) ingested significantly less of the major nutrients, including cholesterol, than nondrinkers, light drinkers, or heavy drinkers (Hennekens, 1983).

On the other hand, alcohol is associated with several CHD risk factors such as hypertension and obesity. Considering the other physiological and social complications of alcohol consumption, the use of alcohol as a preventive measure for CHD is not recommended (WHO, 1982).

6. Physical inactivity

People with sedentary life-style have lower energy expenditure which may lead to weight gain and obesity is an important CHD risk factor. Direct evidence between physical inactivity and CHD has been lacking. However, evidence from epidemiological studies on occupational and leisure time activities have shown that higher levels of physical activity reduce the risk of CHD through reduction of bodyweight, blood cholesterol, blood pressure, and insulin activity (WHO, 1982).

In a study of about 17,000 male Harvard University alumni, Paffenbarger (1978) found that 2000 kcal a week of moderately intense activities, such as walking, cycling, gardening, and stair climbing, was the most effective activity level to reduce the risk of CHD; above this level, there was little further improvement. The risk associated with physical inactivity appear to be independent of associations with age, cigarette smoking, blood pressure, body mass index, or history of parental heart attack.

In a study among 7,615 subjects in Australia (Bauman and Owen, 1991), higher levels of physical activity were also found to reduce total blood cholesterol and blood pressure.

7. Psychological and social factors

Two types of psychological factors are believed to be related to the risk of CHD, namely, type A personality and psychological stress. However, study results on these factors are mixed and remain controversial. The physiological mechanisms of these factors on the development of CHD have not been well established (Jenkins, 1983; Glass, 1983; Ruberman, 1992).

Type A behavior is characterized by competitiveness, ambitiousness, hostility, a sense of urgency about doing things, and impatience. In the Western Collaborative Group Study (Rosenman et al., 1976), 3,154 healthy men were followed for 8.5 years. After adjusting for other risk factors, type A individuals had about twice the risk of developing CHD than type B individuals.

A number of stress factors, as related to sociocultural factors, have been suggested to be associated with the incidence of sudden cardiac death and myocardial infarction. These factors include multiple life event changes, life dissatisfaction, depression, residential moves, loss of prestige, sociocultural class change between childhood and

adulthood, loss of employment, excessive workload and responsibility, and death of close relatives (Syme and Seeman, 1983; Weidner and Chesney, 1985).

In a study in Brazil, using a multiple regression model, Dressler et al. (1991) found that the level of serum lipids was not only associated with dietary fat intake, but was also independently related to psychosocial factors as measured by socioeconomic class, coping style, and social support.

Interrupted or lack of social ties has been proposed to be a risk factor for CHD. It could be the underlying factor between social changes and CHD because individuals who experience residential or occupational changes tend to experience more interrupted relationships. Type A individuals may also be less interested in investing the energy needed to obtain and maintain close ties with other people. In a nine year follow-up study of mortality, after adjusting for baseline health status and other risk factors, Berkman and Syme (1979) found that individuals who were initially identified as having few friends and few contacts with others, had an increased mortality rate. In a study of occupational stress and health, House et al. (1979) found that social support from family, friends, and co-workers seemed to function as a buffer between stress on the job and the risk of CHD which is independent from the level of smoking, blood pressure, and serum cholesterol.

Overall, the etiology of CHD is multifactorial. Although the associations between CHD and its risk factors have been demonstrated, using a single factor or combination of the well understood factors can only partially predict the CHD morbidity and mortality for either individuals or populations. It is suggested that much of the variance in CHD etiology remains to be explained (Weidner and Chesney, 1985). Urbanization, overpopulation, and industrialization have also been linked to the incidence of CHD. As a result,

the association between CHD and the well studied risk factors "are strongly mediated by the ambient situations in which individuals live and work, as well as by other psychosocial factors that distinguish one individual from another" (Rosenman, 1990).

Factors That Influence Lifestyle Changes

As indicated by Jenkins (1983), differences in CHD risk among populations and individuals are largely social and behavioral. The earlier significant increase, as well as the recent decline in CHD mortality during the course of this century in the United States and in many western countries, indicates that the changes are not due to genetics because there was little change in the population gene pool. As Jenkins described: "The twentieth century epidemic seems due to changes in the ways in which people eat and sleep, work and play, relate to one another, and react emotionally as well as to the sociocultural circumstances under which they live".

For the human species, significant dietary changes have only occurred over the past several hundred years, especially during the 20th century, as a result of agricultural revolution and technological advancement. The diet of the modern society contains much more fat, especially saturated fat, refined sugar, foods of high caloric density, and alcohol than the hunter-gatherers and the peasant agriculturalists in the previous much longer course of the human history. In fact, the human body has had no time to adapt biologically to this "disturbances of human culture" (WHO, 1990).

Substantial dietary changes first occurred in western countries which became affluent during the past 100 years. Table 2.1 shows the dietary trend from 1860 to 1975 in the United States (Brewster and Jacobesen, 1978).

Table 2.1 Dietary Trends in the United States, 1860-1975

Nutrients	Percentages of energy			
	1860	1910	1925	1975
Protein	12	12	12	12-15
Fat	25	32	35	40-45
Carbohydrates				
Complex(starch)	53	43	37	22
Simple(sugars)	10	13	16	24
Total	63	56	53	46

In the mean time, along with other social and lifestyle changes, CHD incidence has also increased. In 1900, heart disease accounted for 9.4% of all deaths in the United States (USDHHS, 1985). In 1963, CHD alone represented 30% of all deaths (Thom and Maurer, 1988).

CHD mortality has begun to decline in the past 20 years in many developed countries. In the United States, CHD mortality has reduced 40 to 45 percent since 1968. This reduction has been attributed to improved medical intervention and positive lifestyle changes (Sytkowski, Kannel, and D'Agostino, 1990).

In contrast, CHD incidence has been increasing in many developing countries following economic growth and adaptation of a lifestyle of an affluent society, such as increased consumption of animal products and free sugar, reduced physical activity, and more stress. Other interrelated factors contributing to the increase in CHD incidence include demographic aging of the population and urbanization (WHO, 1990).

In China, for example, food intake from animal sources has gradually increased during the past twenty years, especially in urban areas. In Shanghai County, cancer, cerebrovascular disease, and heart disease were the sixth,

seventh, and eighth most common causes of mortality during 1960-1962. By 1978-1980, these diseases had become the leading causes of death (Gu and Chen, 1982). In Singapore (where the population is largely Chinese), the age standardized CHD mortality rate had doubled from 1957 to 1979 and had become the leading cause of death (Dodu, 1984).

Another example has occurred in Crete, the largest island of Greece. Over the past 30 years, the Cretans have become more prosperous and more concerned with business, rather than traditional farming. Most importantly, their diet has been "westernized". From 1960 to 1988 for Cretans, bread consumption has decreased by 70%, potatoes by 53%, fruits by 31%, and eggs by 48%; meat consumption has increased by 160%, fish by 88%, and cheese by 366%. These changes have brought about an increase in saturated fatty acid intake of 27.5% and a decrease in monounsaturated fatty acid intake of 34%. Meanwhile, the total serum cholesterol concentration for Cretan men aged 40-60 years has increased from 4.7 mmol/L to 6.4 mmol/L and CHD mortality in Greek men has increased 24% (Kafatos et al., 1991).

Diet patterns have long been observed as a risk factor for CHD. Diet serves as a good example for illustrating the effect of cultural and social factors on lifestyle changes. Paige (1983) summarizes that food intake is influenced by environmental, cultural, and social factors as well as by personal preferences and needs (Figure 2.1) (Paige, 1983).

The environmental factors that influence diet patterns include availability, cost, the amount of time spent in purchasing and preparing, cooking skill, and media advertising. Cultural factors define which food items are considered edible or non-edible. In each culture certain food items are also conceptually related to wealth, power, status, and cultural identity. Socially, foods are associated with interpersonal relationship. Foods can represent security, comfort, love, and friendship that come

with social interaction. Finally, people prefer particular food because they like the taste which in turn is formed and influenced by environmental, cultural and social factors (Paige, 1983).

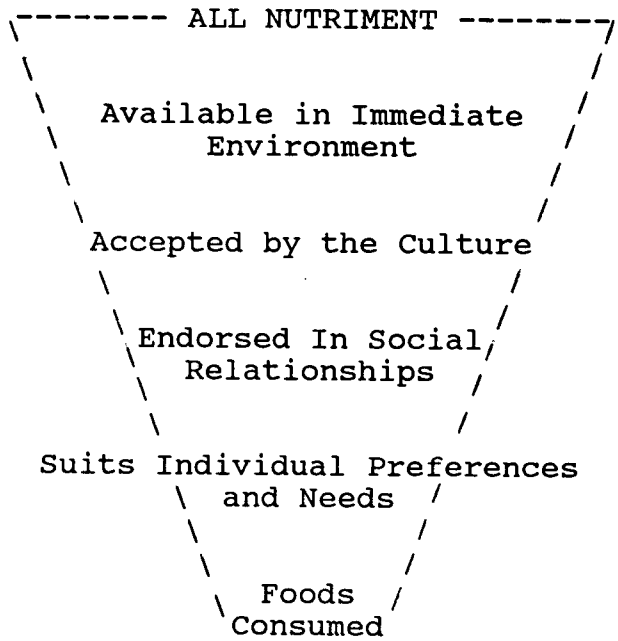

Figure 2.1 Factors That Influence Individual Food Choices.

Pelto (1981) developed a lifestyle model of dietary habits (Figure 2.2). In this model, a variety of lifestyle factors such as occupation, education, income, ethnic identity, and nutrition knowledge are all contributing factors for dietary behavior.

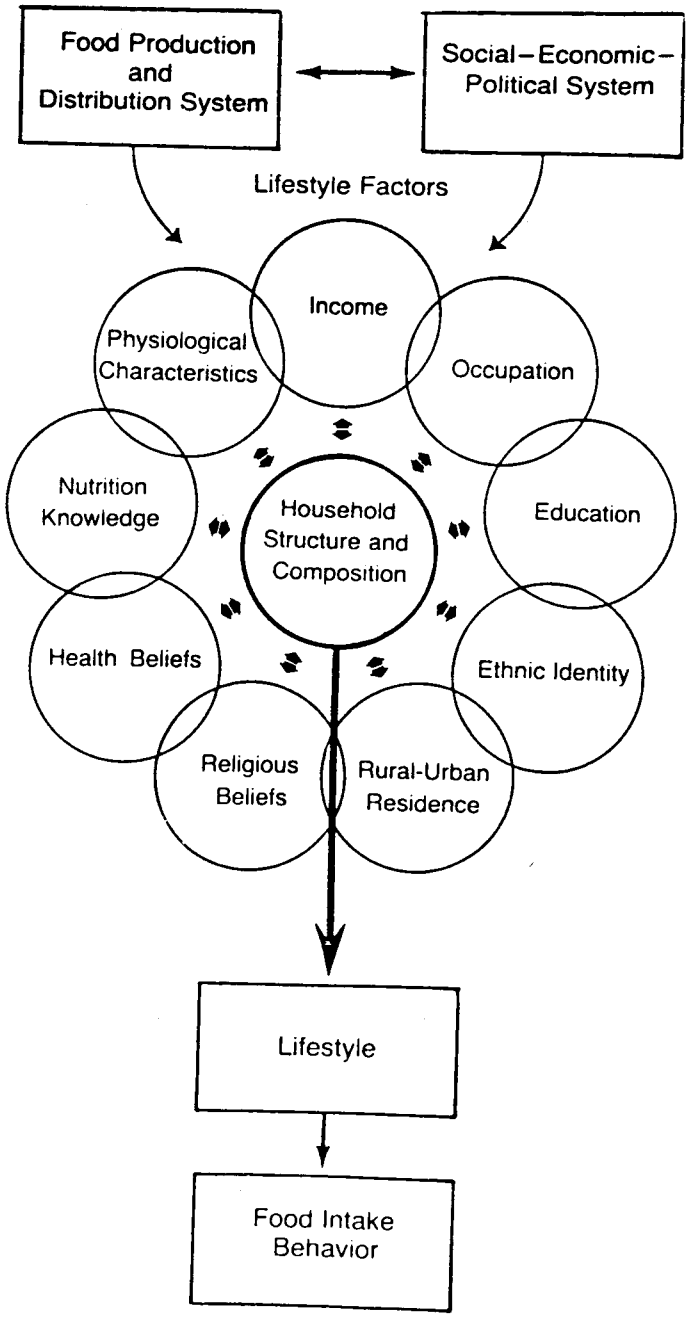

Figure 2.2 Lifestyle Model of Dietary Behavior

Acculturation and Changes of the CHD Risk Factors

In a broad sense, the term acculturation encompasses all aspects of cultural and social changes (Marmot and Syme, 1976). More exclusively, Redfield et al. (1936) define acculturation as:

> Acculturation comprehends those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original culture patterns of either or both groups. Under this definition acculturation is to be distinguished from culture change, of which it is but one aspect, and assimilation, which is at times a phase of acculturation.

Ovando (1988), using the broader definition of acculturation, defines assimilation as that aspect of acculturation, in culture contact situations, where the direction of culture change is primarily from one group to the other as a result of an unequal status and power relationship.

Upon culture contacts, especially when individuals in one culture group move physically into another culture, such as in the case of immigration, their physical, cultural, and social environments all change dramatically. Many cross-cultural studies on CHD risk factors have been conducted among immigrants. These studies attempt to determine the relative importance of environmental, cultural, and genetic factors on the risk of coronary heart disease (Yu, 1991). The effect of acculturation has been noted by many of these studies.

In a study of Japanese men living in California, Hawaii, and Japan, Marmot et al. (1975) found a Japan-Hawaii-California gradient of increasing level of blood cholesterol in addition to the higher prevalence of coronary heart disease in California Japanese compared to Hawaiian

and native Japanese. When blood cholesterol, blood pressure, and smoking were controlled, the California Japanese remained to have the highest CHD prevalence. Also, the results indicate that conventional risk factors can only account for part of the CHD prevalence. The authors suggest that the CHD prevalence gradient is most likely to be the result of environment differences. Compared to Japanese in the home country, Japanese Americans differ in many aspects of lifestyle such as diet and occupation, as well as social and cultural milieu.

In another study among Japanese-Americans in California (Marmot and Syme, 1976), 3809 subjects were categorized based on their degree of retained traditional Japanese culture. Individuals in the study were given an acculturation score on a scale from "traditional Japanese" to "western" based on a questionnaire evaluation. Three acculturation indices used in the study included cultural upbringing, cultural assimilation, and social assimilation. The study results indicated that the most traditional group had a CHD prevalence similar to that observed in Japan. The group that was most acculturated to western culture had a CHD prevalence three to five times higher.

Reed et al. (1982) found that among 4,653 Japanese American men in Hawaii, acculturation was independently associated with CHD prevalence, but not incidence. Individuals with higher scores of western lifestyle had higher serum cholesterol, were more obese, smoked more cigarettes, had less complex carbohydrate in diet, and were less physically active compared to their counterparts with the more traditional Japanese lifestyle.

Curb and Marcus (1991) compared body mass index and skinfold thicknesses between Japanese 45-69 years old men living in Japan, Hawaii, and California. They found that BMI and central obesity, as measured by subscapular skinfold thickness, were substantially higher in Japanese men in

Hawaii and California than their counterparts in Japan. Also, the mean BMI in Japan was relatively stable across the age groups. In Hawaii and California Japanese, however, BMI was lower in the older age groups in which acculturation to western lifestyle was the least. Meanwhile, the Japan group consumed fewer calories per day and the percent of caloric intake from dietary fat was also lower in the Japan group than the Hawaii group. The authors suggested that adoption of a more western lifestyle, especially diet, by the Japanese in the United States had contributed to the deleterious effects on the increased risk of coronary heart disease.

Klatsky and Armstrong (1991) conducted a cross-sectional study on CHD risk factors among 13,031 Asian Americans living in Northern California. The study did not find any differences on total serum cholesterol level between the US-born Asian Americans and those born in their home countries. Also, the cholesterol levels for these Asian Americans were similar to that of the US blacks and whites. The authors suggested that this similarity in cholesterol level could be attributed to the rapid adoption of a high-fat diet among these Asian Americans. Nevertheless, US-born Asian Americans had a higher risk of obesity and hypertension compared to their Asian born counterparts. Among both men and women, age and married status were positively associated with obesity. Education and alcohol consumption were not related to obesity in men but were inversely related to obesity in women. The study also found that the US-born Asian American men were less likely to smoke than their Asian-born counterparts. This lower prevalence of smoking in US-born Asian American men was suggested to be the result of the antismoking campaigns in the United States.

Two models regarding acculturation and alcohol consumption were reviewed by Markides et al. (1988) in their

three-generation study of Mexican Americans. The "acculturative stress" model implies that higher levels of drinking are due to stresses associated with acculturation in a larger society. The "acculturation" model, on the other hand, suggests that patterns of alcohol consumption reflect the extent to which individuals adopted norms and practices of the mainstream society. In this study, acculturation, as measured by English language use, was negatively related to alcohol consumption in the middle generation (less acculturated drink more) and was positively related to drinking in women of the younger generation.

In a study of the prevalence of CHD risk factors among elderly Chinese Americans in Boston Chinatown, Choi et al. (1990) found that the risk factor profile in the study population, in terms of diet, blood cholesterol, and obesity, was similar to that in China. Dietary intake of carbohydrates and fats in this group of Chinese Americans were remarkably different from that in American whites. Because most of the subjects in the study were non-English-speaking and preserved their traditional lifestyle, the authors concluded that these traditional Chinese characteristics may be protective against coronary heart disease in the study population.

Based on a survey among Chinese Americans in California with a mean age of 53.3 years, Chen et al. (1992) reported that the prevalence of several CHD risk factors (including smoking among men, hypertension, and hypercholesteremia) was higher in the Chinese sample than in the general California population. However, the prevalence of alcohol use in the Chinese sample was lower. Low level of English speaking, low household income, and low level of education were also observed in the Chinese sample.

Yohai (1977) observed that Spanish-speaking immigrants in the United States do not changed their basic diet patterns. However, they do adopt certain American food

habits, such as the use of carbonated beverages, fried snacks, and sweets. Many of them gain weight after arriving in this country and acknowledge that they have tried many new processed foods. Also, they report that they exercise less in the US than they did before.

Dietary practices of Southeast Asian refugee adolescents were studied by Story and Harris (1988). The study sample included 207 Southeast Asian refugee high school students who had been in the US for five years or less. Results of the study indicated that these children had maintained strong ties to their native foods. Besides rice, high status foods in Southeast Asia such as fruits, meats, and soft drinks remained highly preferred in the US. However, milk, which is generally unavailable in Southeast Asia, had been accepted and consumed by more than half of the youth on a daily basis.

Comparisons on the Level of CHD Risk Factors in China and in Western Countries

The incidence of CHD in China is much lower than in western countries. According to Tao et al. (1989), the average crude death rate from CHD in China in 1984 was about 20 per 100,000, which was approximately one-tenth of that for the United States and slightly lower than that for Japan. The level of serum total cholesterol in China is also lower than that in western countries. In the 1950s in Shanghai, the serum total cholesterol levels in healthy men above 40 years were found to be around 160 mg/dl, which was 70-80 mg/dl lower than healthy Americans of the same age group. The serum total cholesterol levels in Chinese patients with myocardial infarction were only about 25-30 mg/dl higher than the healthy Chinese.

Within China, CHD mortality in urban areas is higher than rural areas. Between three major cities, the age

standardized mortality rate for population aged 35-74 was higher in Beijing than the rates in Shanghai and Guangzhou (Figure 2.3).

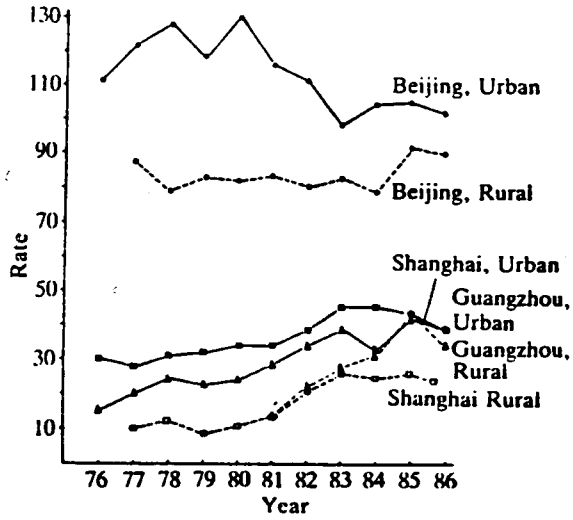

Figure 2.3 CHD Mortality Rates in China, 1976-1986

Based on the WHO MONICA Project (1988), Table 2.2 compares differences in the levels of the CHD risk factors between Beijing, China and Stanford, USA.

Table 2.2 Levels of the CHD Risk Factors in Beijing and Stanford in Men, Age-Standardized

Risk Factors	Beijing	Stanford
Regular Smokers	58.2%	40.0%
Mean Body Mass Index (kg/m^2)	23.4	25.8
Mean Systolic BP (mmHg)	130	128
Mean Diastolic BP (mmHg)	86	83
Mean Total Cholesterol(mmol/l)	4.2	5.4

Stehle et al. (1991) compared the differences in CHD risk factor patters in China (Wuhan), Japan, and Germany.

Over a five year follow-up period, the incidence of myocardial infarction was five times higher in the German group (433 per 100,000 persons per year) than in the Chinese group (84 per 100,000 persons per year). The prevalence of the CHD risk factors in the Chinese was also lower. Table 2.3 summarizes the prevalence rates of the risk factors for the three groups in Stehle's study.

When hypertension, obesity, hyperlipidemia, smoking, and hyperglycemia are considered, only about 25% of the Germans had none or one risk factor while the corresponding percentages for the Chinese and the Japanese were about 80%. The authors suggest that China should place emphasis on anti-smoking campaigns and treatment of hypertension while the major tasks for Germany should be on control of obesity and hyperlipidemia.

Table 2.3 Prevalence Rates of CHD Risk Factors in the Wuhan Study

Risk Factors	China	Japan	Germany
Hypertension	11%	18%	20%
Smoking	69%	55%	17%
Obesity (BMI>25)	11%	17%	66%
Blood Cholesterol			
Mean TC	155 mg/dl	200 mg/dl	217 mg/dl
Mean LDL	93 mg/dl	120 mg/dl	145 mg/dl
Mean HDL	49 mg/dl	53 mg/dl	48 mg/dl
Triglyceride	98 mg/dl	123 mg/dl	146 mg/dl
Hyperlipidemic	12%	50%	75%
Energy Intake	2818 kcal	-	3597 kcal
Protein	82 g	-	87 g
Fat	96 g	-	130 g
animal origin	55 g	-	89 g
cholesterol	165 mg	-	483 mg
Carbohydrates	407 g	-	236 g

Based on the Wuhan Study, Bernhardt et al. (1991) suggest that the low serum lipid levels in China are the result of diet composition. For the study population, the staple foods were rice, vegetables, and soybean products. Meat and other animal products were consumed only in small amounts. Because a high level of LDL cholesterol is essential for the development of atherosclerosis, Bernhardt et al. (1991) hypothesized that for the Chinese population, because the low concentration of total and LDL cholesterols in the blood vessels, there would be no, or only a slow, development of atherosclerosis, despite the presence of other risk factors such as hypertension and cigarette smoking.

In a study of serum lipids in Beijing, Kesteloot et al. (1985) reported findings similar to those in Wuhan. Total serum cholesterol levels in Beijing were significantly lower than those in Belgium in both males and females in all age groups. On the other hand, comparing Beijing to Belgium, HDL levels were only significantly lower in Beijing females but not in males. The study also found that in Beijing, total cholesterol levels were significantly lower in farmers than in non-farmers. Total serum cholesterol level increases more rapidly with age in non-farmers than in farmers. The authors contributed these findings to a higher consumption of beef and eggs in the city for the population studied (based on my experience, pork was the most consumed meat in Beijing, beef consumption was low even for urban residents because of low supply).

Campbell (1989) has particularly focused on the dietary pattern in rural China. He found that after adjusting for bodyweight, energy intake was approximately 20% higher in China than in the United States. However, energy intake from animal sources in China was significantly lower. The mean body mass index was 20.5 in the Chinese males compared to 25.8 for a comparable population in the US. Meanwhile,

plasm cholesterol was much lower in China (88-165 mg/dl) than in the US (155-274 mg/dl). The author concluded that physical activity levels in this population of Chinese may have contributed for the low prevalence of obesity.

Table 2.4 (Berenson, 1986) compares the diet components in different regions in the World. The table shows that consumptions of milk, meat, and fruit in China are much lower than in other regions, especially Europe.

Table 2.4 Average Regional Diets in the World (kg/year)

Region or Country	Cereal	Roots and tuber	Vege-table	Fruit	Meat	Fish	Milk
Europe	121.1	72.7	86.7	81.4	75.3	20.2	154.9
China	171.7	58.8	85.2	5.5	15.0	8.9	1.9
East Asia	206.6	28.4	54.3	48.3	21.5	24.4	33.6
Eastern Mediterranean	188.2	19.3	91.6	101.4	30.4	8.4	74.3
South America	129.5	67.6	34.2	83.1	48.4	14.4	70.8
Cent. America	113.2	46.0	38.8	98.6	42.3	18.7	82.2
Africa	127.4	134.8	25.9	45.2	16.8	15.0	28.9
North Africa	161.9	20.0	63.4	63.9	24.0	7.3	77.2

In spite of the low incidence of CHD and the low prevalence of risk factors in China, during the past 40 years, the relative proportions of CHD in hospital admissions and coronary atherosclerosis in autopsies have increased significantly. In the meantime, there is a noticeable rise in the prevalence of various risk factors. Without adjusting for age composition, the overall prevalence of high blood pressure for individuals 15 years and older had changed from 5.1% in 1959 to 7.7% in 1979. Based on a national survey in 1984, 61% of men and 7% of women were smokers. For middle-aged men in Beijing, total serum cholesterol values have increased 30-40 mg/dl from

1958-59 to 1983-84 (Tao et al., 1989). A parallel increase in the consumption in dietary fat and cholesterol had also been observed, especially during the past ten years following economic reform. It was reported that the consumption of foods of animal origin had increased from 26.5 kg/year per person in 1957 to 47.7 kg/year in 1984 (WHO, 1990).

Historically, due to the great disparity in socioeconomic status in the Chinese society, the basic diet for the common people is high-cereal and high-vegetable. For the feudal nobles and the rich, however, the cereal-based dietary pattern is high in meat and fish (WHO, 1990). The saying, "chicken, duck, fish, and meat" was equivalent to a good meal and high social status.

Measurements of CHD Risk Factors, Their Changes, and Acculturation

Ideally, to measure changes from one time to another, the variables under study should be measured longitudinally at different time points. Such a luxury is not always available for retrospective studies, such as this research. Nevertheless, if a major life event has occurred, such as immigration, it is very likely that individuals will be able to recall their living pattern, such as diet, prior to that event. In addition, it is suggested that in the absence of preexisting data, an extended time period (one year or longer), should be used for the evaluation of dietary history (Hankin, 1989).

For epidemiological dietary studies of the elderly, Hankin (1989) provided five criteria for questionnaire development: (1) include food items that are representative of the population's usual diets because of large differences in eating pattern and food preparation among different ethnic groups; (2) measure both qualitative and quantitative

aspects of food intakes; (3) objectively specify food types and serving sizes; (4) establish validity by comparing diet history with measured food records; and (5) assessing reproducibility by administering the questionnaire to a random sample of the study population on two occasions under identical conditions.

Quantitative measurement of food intake has been opposed by some researchers. In a study of food records of 194 nurses, Hunter et al. (1988) found that within-person variation of portion sizes was much greater than the between-person variation. The authors concluded that food frequency was a greater determinant of dietary intake than quantitative measurement and using a standard serving size did not introduce a large error in the individual estimates.

Because of the importance of dietary fat on the risk of CHD and the considerable time consumed in administering a full scaled diet questionnaire, Kinlay, Heller, and Halliday (1991) developed a simple to score questionnaire with only ten questions intended to measure dietary fat intake. Compared to a 180-item food frequency questionnaire, the correlation coefficients for saturated fat intake were .60 in adults and .54 in children. For total fat intake, the correlation coefficients were .46 in adults and .40 in children. The authors suggested that a simple score could be used to evaluate group changes in fat intake.

The validity and reliability of dietary histories have been evaluated by a number of studies. In comparing a dietary history with food records among the major ethnic groups in Hawaii, Hankin et al. (1991) found that a quantitative diet history provided reasonably accurate estimates of the usual dietary intakes, especially when the frequency of consumption is relatively high.

Jain et al. (1980) compared the dietary history of 16 men with food records kept by their partners. A high positive correlation between the two methods showed a

sufficient validity and reliability for the dietary history method.

Using the same semi-quantitative food frequency questionnaire in 37 men and 33 women, Rohan and Potter (1984) compared the original results with the retrospective results and the current results obtained three years later. Although the retrospective results seemed to be affected by the current diet, high correlations were found between the original results and the retrospective results.

In a study on the reliability of four widely used health risk appraisals, Smith, McKinlay, and McKinlay (1989) found that the reporting between two time points are rather consistent on family history, cigarette smoking, and relative weight. Reporting on blood pressure and cholesterol, diet, physical activity, and stress were less stable but the correlation coefficient still ranged from .45 to .87 for blood pressure, .52 to .57 for diet, .60 to .70 for physical activity, .58 to .65 for cholesterol, and .62 for stress.

For measurement of acculturation, Padilla (1980) presented a model of acculturation which consisted of two central components: cultural awareness and ethnic loyalty. These components can be applied to either the original culture or a host culture. Cultural awareness refers to an individual's knowledge of a specific culture such as language, history, and food. Ethnic loyalty, is the individual's preference of one cultural orientation over the other. Based on Padilla's model, Richman et al. (1987) devised five sub-components of acculturation for native Indians in Peru. These sub-components include (1): language use; (2) customs (preference of music, food, and dress); (3) ethnic identity; (4) sociability (ethnic group of friends); and (5) perceived discrimination in the mainstream society.

In a group of Japanese Americans, Marmot and Syme (1976) identified three indices of acculturation which

included: (1) cultural upbringing, (2) cultural assimilation, and (3) social assimilation. Cultural upbringing information were derived from a list of questions that include years spent in Japan, age left parents' home, ever lived on a farm, where schooling took place (Japan or US), years spent in Japanese language school, religion while growing up, friends while growing up, and wife's cultural background (if married). Cultural assimilation questions used in the study include ability to read Japanese, frequency of speaking Japanese to wife, frequency of speaking Japanese to children, and frequency of speaking Japanese to friends. The section on social assimilation included ethnicity of friends now, ethnicity of co-workers, ethnicity of employer, frequency of socializing with co-workers, and importance of religion. In addition, based on food items (Japanese vs. western) consumed during the previous 24 hours, a food preference score was given to each individual. A high score represented a Japanese food preference and a low score represented a western food preference.

In a study of acculturation and alcohol consumption among Mexican Americans, language use alone was used as the indicator of acculturation (Markides et al., 1988). The scale of acculturation in this study include four questions relating to Spanish or English usage: language of TV programs watched, language of radio programs listened to, language used with one's spouse, and language used with friends.

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Currently, no study has been conducted among Chinese students regarding lifestyle changes as related to CHD risk factors. This current study should therefore contribute to the CHD literature and should be of interest to those who in the fields of health who may deal with the increasing number of Asian immigrants or students.

CHAPTER III

METHODS AND PROCEDURES

This chapter describes the methods and procedures used in this study. The discussion will be in the following sequence: overall research design, selection of subjects, questionnaire development, collection of data, and analysis of data. Literature regarding questionnaire development, especially on diet history evaluation, has been reviewed in Chapter II. Therefore, only the process of questionnaire development is discussed in this chapter. The concept of the statistical methods used in this study will be reviewed in Chapter IV along with the study results.

Overall Research Design

This study was a cross-sectional survey assessing lifestyle changes that are related to CHD risk in male Chinese students at Oregon State University. Using a structured questionnaire, lifestyle profiles in China and in the United States were developed for each subject. When a change between the two profiles was reported, the subject was asked about the reasons for the change.

Selection of Subjects

The study population included all male students or scholars from the People's Republic of China (mainland China) who were attending Oregon State University (OSU) during spring term 1992. The frame for the target population was the Directory of the Chinese Students and Scholars Association at OSU. The population size was about 150. Of this population, the great majority of the subjects were graduate students or post-doctoral researchers in the

age range of mid-20s to mid-30s. They had been in the United States for varied lengths of time, from several months to several years. For most of them, their meals were prepared at home either by themselves or by their spouses (personal knowledge). Because of the small number of female Chinese students at OSU, only male subjects were included in the study. A convenience sample of 50, with an intention of covering individuals with differing lengths of US stay, was selected. The sample largely consisted of the author's friends or acquaintances. The characteristics of the selected students in the sample were not expected to be systematically different from the other OSU Chinese students who were not selected. In addition, the sample accounted for about one third of the population. When inferential statistical methods were applied, the sample was assumed to be representive of the total population.

Questionnaire Development

The initial questionnaire was developed in English based on review of the literature and review of several related questionnaires developed by experts in nutrition and international epidemiology (through personal correspondence).

The initial draft of the questionnaire was modified and expanded extensively after it was first presented to the committee members of the researcher. A number of questions regarding diet and acculturation were added or reworded based on committee input. The format of the expended questionnaire was again modified based on input provided by a senior researcher from the OSU Survey Research Center. The questionnaire was then translated into Chinese by the researcher.

After the questionnaire was approved by the committee members of the researcher, a pilot survey of five subjects

was conducted to further validate the face validity. Then, a few minor changes on wording were made. The English version of the final questionnaire may be seen in Appendix A.

The final questionnaire contained eight categories of information: (1) bodyweight and blood pressure, (2) diet, (3) alcohol consumption, (4) cigarette smoking, (5) physical activity, (6) psychological stress, (7) acculturation factors, and (8) demographic factors.

Questions on dietary intake included a present profile, a previous profile, and the perceived quantitative dietary changes. The present profile covered the twelve months period before the interview time, or the total time of stay in the United States if the subject had not been in the US for twelve months. The previous profile covered the last twelve months when the subject was in China.

For the present and the previous profiles of dietary intake, questions were designed to identify perceived changes between the two profiles rather than to measure the complete and exact quantitative intake. The two profiles included food frequencies for the same food items that were representative among Chinese students with emphasis on fat and cholesterol consumption.

It was suggested by Hunter et al. (1988) that food frequency was a greater determinant of dietary intake than portion size due to large within-person variation. For Chinese students living with a family, the whole family usually eats from the same plates. Meats are usually cooked with vegetables. Also, many people tend to cook more than the amount that they can eat in one meal (personal knowledge). For these reasons, a standard size for each food item, rather than portion size, was used for quantitative measurement of dietary intake. In addition, perceived dietary changes were measured using a five-point scale (substantially increased, increased, no change,

decreased, and substantially decreased) as a supplemental quantitative measurement. For questions on alcohol consumption, cigarette smoking, physical activity, and psychological stress, the emphasis was also on changes occurred in the US.

The question set on acculturation included contact and participation factors (Berry, 1986). Reliability analysis (SPSS/Inc, 1988) was performed for items on acculturation.

Collection of Data

After making an appointment by telephone to set a date, the subjects were interviewed by the author in Chinese during spring term 1992, using the Chinese version of the structured questionnaire. The final sample size was 50. During the interview, a tape ruler was used to measure the current waist size.

For the present profile, blood pressure was recorded during the interview with a sphygmomanometer after the subject was seated at rest for at least five minutes. Two measurements of blood pressure were made consecutively at the beginning of the interview and the average of the two was used for analysis.

Analysis of Data

The completed questionnaires for the 50 subjects were coded and entered using Lotus 1-2-3 and saved as an ASCII file. Analysis of data was performed using SPSS/PC+ V4.0. A few dietary variables, such as total fat consumption and total dairy product consumption, were construct by grouping individual food items. Changes on diet between the two profiles were computed by subtracting the standardized frequency on each item in the previous profile from the present profile. A detailed definition list for the

variables may been seen in Appendix B.

1. Univariate and bivariate analysis

In order to describe and summarize the distributions of each variable in the study, basic descriptive statistics including means, standard deviations, and frequencies were generated in the initial analysis.

In order to compare the differences between the present and the previous profiles, and between different demographic groups, paired t-test and t-test were performed for continuous variables and chi-square analysis were made for categorical variables. In addition, correlation coefficients between factors of interest were calculated to explore potential associations between the variables.

2. Multivariate Analysis

Multiple linear regression analysis was performed using identified profile differences (changes) on bodyweight, dietary factors, alcohol consumption, cigarette smoking, physical activity, and psychological stress as the dependent variable in separate models. These variables can be approximated as interval variables. For each of these regression models, demographic factors and acculturation factors were entered as the independent variables. The purpose was to identify potential significant associations between the dependent and the independent variables while confounding effects of the independent variables were controlled.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter presents the analyses and the results of the study. The analyses follow the hypotheses initially generated for this study. For each of the statistical methods applied in this study, a brief explanation is provided. The hypotheses of the study were:

1. **Ho**: For the Chinese students at OSU, there is no significant difference between the present profile and the previous profile on the following CHD risk factors:
   a. bodyweight
   b. diet
   c. alcohol consumption
   d. cigarette smoking
   e. physical activity
   f. psychological stress

   Ha: For the Chinese students at OSU, there is a significant difference between the present profile and the previous profile on the above CHD risk factors.
2. **Ho**: There is no significant association between the demographic factors (such as marital status, time of stay in the US) and changes of the CHD risk factors (if there is any change).

   Ha: There is a significant association between the demographic factors and changes of the CHD risk factors (if there is any change).
3. **Ho**: There is no significant association between acculturation and changes of the CHD risk factors (if there is any change).

   Ha: There is a significant association between acculturation and changes of the CHD risk factors (if there is any change).

Demographics of the Subjects

The sample of the study consisted of 50 male students or scholars from the People's Republic of China studying at Oregon State University during spring term 1992. The average age of the sample was 31.7 years and their average US stay was 3.6 years. Ninety-eight percent of the subjects were pursuing a program at OSU at a graduate or higher level. Of the 50 students, 40 were working as a teaching or research assistant and the remaining ten obtained their financial support from other sources.

In regard to marital status, 43 were married and 7 were single. Six of the married subjects lived as single (their wives were either in China or were working in another city in the US).

Because of potential differences in dietary habits due to their geographic origin in China, the students were also divided into two groups by their place of birth (north verses south with the Yangtze River as a division). Of the 50 students, 22 were from the north and 28 were from the south. Appendix C is the geographic distribution of the students based on their place of birth at the provincial level. The biographic characteristics of the sample are summarized in Table 4.1.

Table 4.1 Biographic Characteristics of the Subjects

Variable	Mean/Number	Percent	SD	Minimum	Maximum
AGE	31.7	-	3.7	24.7	44.4
USSTAY (years)	3.6	-	1.8	.1	7.3
PROGRAM					
Master	13	26.0			
PhD	33	66.0			
Post-Doctoral	2	4.0			
Visiting scholar	1	2.0			
Under graduate	1	2.0			
ASSISTANTSHIP					
Yes	40	80.0			
No	10	20.0			
MARITAL STATUS					
Single	7	14.0			
Married, living single	6	12.0			
Married, living w/ family	37	74.0			
BIRTH REGION IN CHINA					
North	22	44.0			
South	28	56.0			

Lifestyle Changes

1. Bodyweight and Blood Pressure

Figure 4.1 plots bodyweight changes (the present bodyweight minus the bodyweight in China) of the 50 students by their lengths of US stay. Table 4.2 compared the present and the historic means of bodyweight, body mass index, waist size, and blood pressure. Because comparisons were made on the same individuals between the two time periods, paired t-tests were calculated for each of these variables. In a paired design, individuals are compared with themselves and

the measurements to each other are dependent at the individual level. For each individual, the difference in measurements was calculated. The hypothesis for the experiment was that the mean difference in the population between the two measurements is zero. The statistic used is

$$t=\frac{\bar{D}}{S_D/\sqrt{N}}$$

where $\bar{D}$ is the observed difference between the two means, S_D is the standard deviation of the differences of the paired observations, and N is the number of pairs. If the differences are normally distribution with a mean of zero, the sampling distribution of t is the Students's t with N-1 degrees of freedom (SPSS INC, 1988).

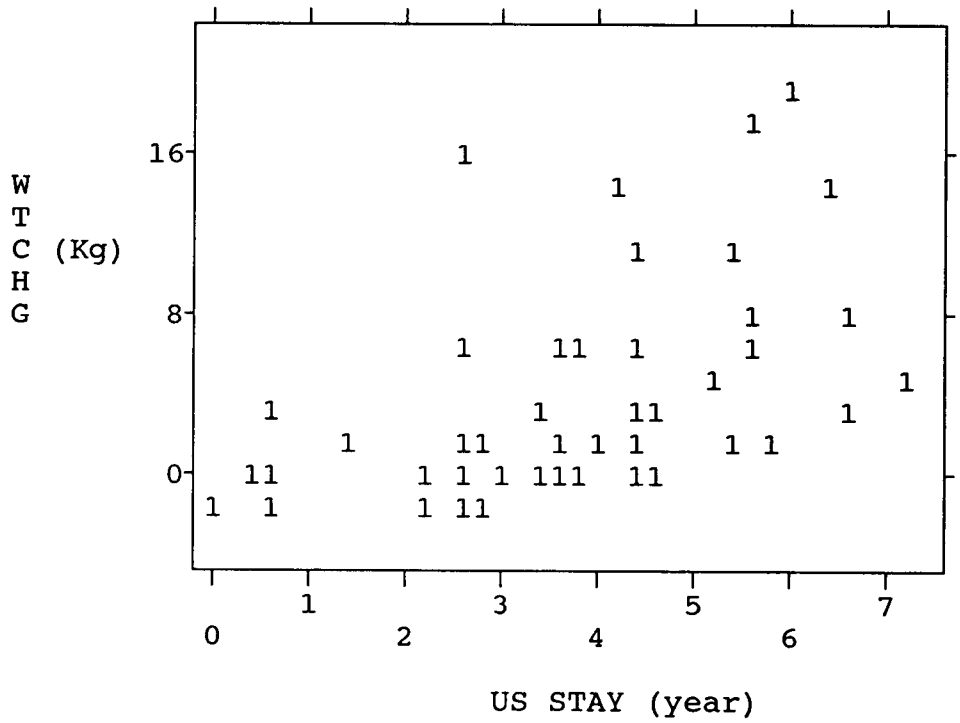

Figure 4.1 Bodyweight Changes by the Lengths of US Stay

Table 4.2 Mean Bodyweight, BMI, and Blood Pressure

	Present	Historic	Sig.
Mean Height (m)	1.7	-	-
Bodyweight (kg)	65.7	61.7	.001
BMI (kg/m^2)	22.3	21.0	.001
Waist Size (cm)	80.7	77.5	.001
Systolic BP (mmHg)	114.4	115.6	.19
Diastolic BP (mmHg)	76.1	74.8	.11

Results showed that during their stay in the United States, the sample means of bodyweight, body mass index, and waist size had increased significantly. There was a clear linear relationship between bodyweight changes and the lengths of US stay. The differences on systolic and diastolic blood pressure between the two time periods were not statistically significant. It should be noted that it is very likely that the historic blood pressure measurements and their recalled values differed from individual to individual.

2. Diet

Reliability of the dietary measurements: A reliable questionnaire gives consistent results when it is administered more than once on the same individual under similar conditions. Reliability is concerned with consistency, stability, and dependability (Courtney, 1980). In this study for the dietary items, a parallel test was performed in which dietary changes were not only measured by the differences in dietary frequencies during the two time periods, they were also measured by perceived changes of dietary items on a five-point rank scale (5=significantly increased, 4=increased, 3=no change, 2=decreased, and 1=significantly decreased). This procedure helps to detect

and overcome recall bias. A test for reliability was performed using Spearman's rank correlation coefficient between the two types of measurements on each of the parallel food items. Spearman's rank correlation coefficient r_s is Pearson's correlation coefficient applied to the rank pairs obtained by replacing the original difference values by its rank (Devore and Peck, 1986):

$$r_s = \frac{\sum [Xrank - (\frac{n+1}{2})][Yrank - (\frac{n+1}{2})]}{n(n-1)(n+1)/12}$$

Table 4.3 shows the Spearman's correlation coefficients for food items between the two sets of questions.

Table 4.3 Spearman's Correlation Coefficients for Food Items between the Two Sets of Questions

Food Items	r_s
Pork	.59
Beef	.37
Chicken	.67
Seafood	.51
Milk	.61
Egg	.54
Tofu	.45
Vegetables	.40
Fruits	.47
Rice	.60
Flour	.41
Tea	.56
Coffee	.74
Soft drinks	.59

Results showed that, except for beef, the correlations between the two types of measurements were moderately high. These correlations indicate that these measurements for the sample are relatively reliable.

The most important aspect of this research was an analysis of dietary changes in the subjects. Although frequencies of many dietary items had changed, the reported mean percentage of food prepared in Chinese style was 78%. Table 4.4 presents the reported frequencies of consumption for the selected food items. Table 4.5 shows the perceived dietary changes.

Consumption of protein, fat and cholesterol: Results showed that while in the United States, the subjects' consumption of beef and chicken had increased significantly. In China, the supply of beef and chicken were largely seasonal, being eaten mostly during holidays. Although the frequency of eating pork (mixed with vegetables) had decreased, 56% of the subjects indicated that their pork consumption had actually increased due to increase in quantity. Pork remained as the most frequently consumed meat among Chinese students in this study.

The use of cooking oil (vegetable oil) had increased in 54% of the students. Also, 52% reported that their consumption of butter, margarine, or mayonnaise, which were rarely available in China, had increased. On the other hand, 74% of the subjects reported that their use of animal oil, especially lard, had decreased. In addition, 50% of the subjects indicated that their consumption of fried food had decreased. In China, many people extracted lard from fat meat for cooking. Deep-fried dough is a frequent breakfast item.

Consumption of organ meat had decreased as well. In addition, 66% of the subjects reported that at present, they always or often trimmed off fat from meat and/or avoided

eating fat meat. Only 38% of the sample had this same practice of fat trimming when they were in China.

Although there was no significant change in fish consumption, consumption of other sea food (including shrimp, crab, oyster etc.) had increased significantly. Changes in the consumption of egg and tofu were not statistically significant.

Total amount of fat, saturated fat, and cholesterol were estimated using food composition of standard size (Appendix D). Results indicated that there was a significant increase in total fat, including total saturated fat. However, there was no significant change in total cholesterol.

Dairy products: Among the 50 students, consumption of milk and ice cream had increased significantly. There was no significant change in yogurt consumption. For the 27 (54%) students who drank milk regularly in China, many reported that they were drinking powered milk rather than fresh milk which was not easily available in China.

Vegetables and fruits: For the Chinese students, consumption of vegetables had decreased significantly since in the US. On the other hand, consumption of fruits had increased significantly. In China, fruit consumption was based on seasonal availability.

Rice and flour: In China, rice is the stable food in the south and flour (steamed bread, noodles etc.) is the stable food in the north. For the Chinese students at OSU, consumption of rice and steamed bread both had decreased significantly. There was no significant change in the consumption of noodles. Consumption of bread, which is not frequently eaten in China, had increased significantly, mostly for breakfast.

Nonalcoholic beverages: For the Chinese students, consumption of soft drinks (Pepsi, Coke etc.), coffee, and fruit juice had increased significantly. On the other hand, 38% of the students reported that their consumption of tea had decreased. Overall, caloric intake may also have increased due to increased intake of sugar in the beverages. In China, soft drinks are mostly consumed in summer and drinking coffee is not customary.

In general, converting the above results using standard portion sizes, consumptions of protein (especially from animal sources), fat, and cholesterol had increased. Consumption of grain products had decreased. Total caloric intake may have increased.

Table 4.4 Mean Frequencies of Dietary Consumptions (times/years)

Food	In China		In the US		Paired T-Test
	X	SE	X	SE	p-value
pork/mixed	410.0	28.8	308.2	26.8	.01
/unmixed	60.8	9.7	65.1	11.7	.69
beef/mixed	2.3	1.2	55.3	18.0	.001
/unmixed	22.2	3.8	35.7	6.5	.05
chicken/mixed	5.9	2.4	13.6	3.9	.10
/unmixed	36.5	7.2	63.3	9.0	.01
organ meat	25.7	3.9	13.1	2.6	.01
lamb	9.1	2.8	4.7	1.6	.05
fish	66.4	9.6	59.8	6.7	.47
other seafood	28.3	8.6	49.5	6.5	.04
eggs	285.0	26.1	305.5	28.0	.57
tofu	117.9	11.3	86.2	11.6	.06
milk	138.9	25.5	343.2	43.4	.001
yogurt	29.3	9.8	44.2	19.9	.51
ice cream	8.0	2.5	47.8	12.6	.001
vegetables	685.7	17.0	615.9	23.7	.01
fruits	241.1	25.2	576.8	49.5	.001
rice	522.5	33.3	443.1	30.0	.03
noodles	154.3	16.3	155.0	14.4	.97
bread	25.3	6.2	259.1	25.2	.001
dumplings	43.2	4.6	24.9	3.1	.001
steamed bread	266.1	32.7	15.3	5.0	.001
tea (cups)	591.7	97.0	533.0	120.4	.57
coffee	7.8	2.9	88.1	20.6	.001
soft drinks	54.4	18.0	244.2	43.7	.001
total fat (g/day)	28.7	1.8	35.3	1.7	.001
total SAF (g/day)	11.7	.8	15.3	.8	.001
cholesterol (mg/day)	369.1	26.2	417.7	22.6	.14

Table 4.5 Perceived Changes in Dietary Items (%)

Food	Sig. Increased	Increased	No Change	Decrease	Sig. Decreased
pork	38.0	18.0	30.0	14.0	0.0
beef	34.0	42.0	18.0	6.0	0.0
chicken	52.0	22.0	16.0	6.0	4.0
Sea foods	40.0	22.0	16.0	20.0	2.0
vege. oil	36.0	18.0	36.0	10.0	0.0
animal oil	0.0	2.0	24.0	44.0	30.0
butter, margarine, mayonnaise	12.0	40.0	48.0	0.0	0.0
fried food	6.0	16.0	28.0	44.0	6.0
milk	60.0	20.0	16.0	2.0	2.0
eggs	32.0	22.0	28.0	18.0	0.0
tofu	4.0	14.0	40.0	32.0	10.0
vegetables	4.0	18.0	44.0	30.0	4.0
fruits	50.0	38.0	12.0	0.0	0.0
rice	8.0	10.0	38.0	42.0	2.0
flour	0.0	14.0	32.0	40.0	14.0
tea	2.0	4.0	56.0	26.0	12.0
coffee	10.0	32.0	54.0	4.0	0.0
softdrink	42.0	34.0	24.0	0.0	0.0
juice	52.0	32.0	16.0	0.0	0.0

3. Alcohol

Table 4.6 summarizes the consumption of alcohol for the sample during the two time periods. For this sample of Chinese students, 30% claimed an increase and 36% reported a decrease in alcohol consumption since in the US. Based on the consumption frequency with standardized quantity, consumption of beer and wine did not change significantly between the two time periods. Consumption of liquor (Chinese liquor containing 50% to 65% of alcohol) had decreased significantly primarily because of non-availability in the US. The change in total alcohol consumption was not statistically significant.

Table 4.6 Alcohol Consumption (mean times/year)

	In China	In the US	Significance
Drink Alcohol	80%	74%	-
Beer	63.9	47.9	.40
Wine	8.7	4.8	.45
Liquor	12.0	.2	.001
Total Alcohol	84.6	52.9	.13

4. Smoking

Table 4.7 presents the smoking patterns of the sample. If a subject had smoked 100 or more cigarettes in his lifetime, he was defined as a smoker (National Center for Health Statistics, 1989). Seven subjects, although they still smoked at present, only smoked occasionally. They were defined as occasional smokers. For the current smokers, the number of cigarettes smoked per day had decreased significantly since in the US (mean cigarettes per day from 11.6 to 7.0, p-value=.012).

Table 4.7 Smoking Status of the Subjects

Status	Number	Percent
Nonsmoker	27	54.0
Quit before came to the US	3	6.0
Quit smoking since in the US	2	4.0
Current smoker	11	22.0
Occasional smoker	7	14.0

5. Physical activity

For the Chinese students in the sample, 68% reported that their level of physical activity had decreased since being in the US. They not only exercised less, but also their time spent on biking and walking reduced significantly. One of the reasons for the reduced level of physical activity was use of the automobile. Eighty-two percent of the subjects owned a car at the time of the interview. The average time of purchasing a car was reported to be 13.2 months after arrival in the US. All subjects who had been in the US for more than nine months owned a car.

Taking a nap after lunch is a common practice in China. Seventy-two percent of the subjects took a nap everyday when they were in China. Only 6% of the sample continued this practice at present in the US. Table 4.8 compares the physical activities of the sample during the two time periods.

Table 4.8 Physical Activities of the Sample

Physical Activity	Present	In China	Sig.
Regular exerciser	52%	54%	-
Mean exercise time/week(min)	73.8	173.4	.001
Bike, walk time/week (min)	184.4	334.6	.001
Taking nap everyday	6%	72%	-
Sleeping time/night (hrs)	7.6	7.9	.03

6. Psychological stress

In this study, psychological stress denotes the perceived life pressure in general. For the sample of Chinese students, 78% reported that their level of psychological stress had increased since coming to the United States. Forty-six percent of them considered that their current level of psychological stress was high while only 12% considered their stress level was high while in China.

7. Acculturation factors

For the Chinese students, the average daily conversation time in Chinese (verses in English) was 65.1%. Nearly all of them (92%) read a Chinese newspaper every week and 90% said that their friends were mainly Chinese. Table 4.9 summarizes the acculturation factors for the sample.

Table 4.9 Acculturation Factors of the Sample

	Number	Percent
Read Chinese Newspaper every week	46	92
Read non-school related English books	29	58
Average % of time speaking in Chinese	50	65
Do not like American music	19	38
Do not go to church regularly	42	84
Friends: mainly Chinese	45	90
half Chinese	10	10
Residence: do not share	27	54
share with Chinese	17	34
share with American	6	12

Reasons for the Changes of CHD Risk Factors

Based on Results reported for the Chinese student in this sample, lifestyle changes that are related to CHD risk factors can be summarized as follows:

(1) negative increases: bodyweight, dietary fat, dairy products, sugar from nonalcoholic beverages, psychological stress;

(2) negative decreases: physical activities;

(3) positive increases: consumption of fruits and sea food;

(4) positive decreases: cigarette smoking.

There were no significant changes in blood pressure or alcohol consumption.

One of the objectives of the study was to identify the underlying reasons for these changes, especially to determine if acculturation and demographic factors played a role. This objective was addressed by summarizing results from open-ended questions and through statistical analyses.

1. The open-ended questions

When asked about what were the most important reasons for changes in bodyweight, the most frequent answers given were diet, reduced physical activity, and increasing age.

Although 92% of the sample considered that their diet had changed in the US, they maintained a high percentage use of the Chinese diet (79% of the food served was prepared in Chinese style). The most noticeable changes in the meals concerned breakfast in which milk, cereal, and bread had replaced steamed bread, fried dough, rice porridge, and soybean milk. For the Chinese students, 82% considered their diet in the US was better than the diet in China mainly because of increased consumption of high protein food. Availability, relative lower price, and convenience were regarded as the most important reasons for dietary changes. In China, food usually accounted for 50 to 70% of the total income. Beef, chicken, and sea food in China, for example, were not easily available and were relatively expensive. For the Chinese students at OSU, however, only about 10 to 30% of the monthly income was spent on food.

Lack of smoking environment was considered to be the most important factor for reduction in cigarette smoking for the current smokers among the Chinese students. On the OSU campus, for example, smoking in buildings is prohibited. Some of the smokers also stated that cigarette smoking in the US does not function as a social intermediary as it does in China.

Less biking and walking were reported as the most responsible factors for decreased physical activity. In China, the bicycle is one of the main means of daily transportation. Automobile use was stated as a main reason for decreased physical activity by many of the Chinese students. Popular reasons for the reduced level of exercise included limited time (due to study, work etc.) and no friends with which to play.

Reasons given for increased psychological stress included pressure of school work, financial condition, and worrying about future. Nevertheless, many subjects also remarked that they felt more free in the US in regard to their work and their daily life in general.

2. Statistical Analysis

Pearson's correlation coefficient

Pearson's correlation coefficient, denoted by r, is a summary measure which quantifies the strength of linear association between two variables. It is defined as

$$r=\frac{\sum (X_i-\bar{X})(Y_i-\bar{Y})}{(N-1)S_xS_y}$$

where N is the number of cases and S_x and S_y are the standard deviations of the two variables (SPSS/PC, 1988).

This section examines the correlation between identified lifestyle changes in Chinese subjects and their demographic, and acculturation factors. The identified changes that were analyzed include: bodyweight, diet, physical activities, and psychological stress. Appendix E shows the correlation matrix between the factors. Results indicated that increase in bodyweight is positively associated the length of US stay (r=.53), monthly spending on food (r=.48), and perceived increase in pork consumption (r=.42). On the other hand, monthly income, monthly spending on food, and increased consumption of pork, beef, chicken, and seafood are all moderately correlated with the length of US stay. The matrix also shows that increase in physical activity is negatively correlated with bodyweight changes (r=-.44), the length of US stay (r=-.35), and household/individual income (r=.44).

Multiple Linear Regression Analysis

In multiple regression, several predictors (independent variables) are used to model a response (dependent) variable. The linear function between the response variable and the p predictors is:

$$Y = B_0 + B_1X_1 + B_2X_2 + \ldots + B_pX_p + e$$

where B_0 is called the intercept which is the value of Y when X_s equals zero. $B_{1\ldots p}$ is called the slope which is the rate of change in Y for a unit change in X_i. The e is the statistical error which accounts for deviation of a model from the regression line (Weisberg, 1980). In multiple regression analysis, multiple independent variables are controlled simultaneously. As a result, the exclusive effect of a single independent variable on the response variable, while the other variables are held constant, can be assessed.

In this study, the identified changes on bodyweight, total dietary fat, physical activity, and psychological stress were entered as the dependent variable in separate regression models. Demographic factors and acculturation factors are entered in each model as the independent variables. The purpose was to identify significant associations between the dependent and the independent variables while confounding effects were controlled.

(1) Bodyweight

Multiple regression models require the assumption that error e is normally and independently distributed with a mean value of zero and a common variance σ^2 (Weisberg, 1980). Initial examination of the data by plotting the standardized residuals against the predicted values showed that the variance is unequal (funnel shaped). In addition, the histogram of the standardized residuals indicates that the distribution deviated from normal distribution. As a result, transformation of the dependent variable (changes on

bodyweight) was performed. Concerning the existence of negative values (minimum -2), the dependent variables was transformed by adding a constant of 3 and taking base 10 logarithm (log(WT+3)).

In the multiple regression model, the independent variables were entered using the stepwise method. Since this could introduce potential confounding effects due to removing some variables from the model, a number of models were tested by forcing different sets of independent variables into the regression equation. The variables that were included in a base model are shown in the following. Selection of the model was subjective with the correlation matrix as a reference.

$$\begin{aligned}\text{Log(WT+3)} = {} & B_0 + B_1\text{Age} + B_2\text{USSTAY} + B_3\text{FAT} + B_4\text{DAIRY} + B_5\text{SUGAR} + B_6\text{ACTIVITY} \\ & + B_7\text{STRESS} + B_8\text{WESTFOOD} + B_9\text{ENGLISH} + B_{10}\text{FOODCOST} \\ & + B_{11}\text{SINGLE} + B_{12}\text{REGION} + B_{13}\text{FAID}\end{aligned}$$

The result shown in Table 4.10 indicated that length of US stay and perceived changes in physical activity were significant predictors of changes in bodyweight. The longer a student stayed in the US, and the more decrease in physical activity, the more increase in bodyweight.

Table 4.10 Multiple Regression Model with Bodyweight (Log(WT+3)) as the Dependent Variable

Variable	B	SE B	Beta	T	Sig T
USSTAY	.10	.02	.52	4.44	.001
PHY. ACTIVITY	-.07	.03	-.25	-2.10	.04
(CONSTANT)	.51	.13		3.96	.001

R Square	.43
Adjust R Square	.40
Standard Error	.26

The R Square (the coefficient of determination) indicated that the two variables explained about 42.8% of the total variability in the dependent variable Log(WT+3).

Some of the demographic and acculturation variables are dichotomous with values of 0 and 1 (such as SINGLE, REGION, FAID, CHURCH, and FRIEND). These variables were entered separately into the base regression model as dummy variables. None of them was a significant predictor for the changes in bodyweight.

(2) Total dietary fat

With total dietary fat as the dependent variable, different regression models were tested. The length of US stay was the only significant predictor for total fat. Table 4.11 shows the result when USSTAY remained in the model with the stepwise method.

Table 4.11 Multiple Regression Model with FAT as the Dependent Variable

Variables	B	SE B	Beta	T	Sig T
USSTAY	2.30	1.09	.29	2.11	.04
(Constant)	-1.71	4.40		-.39	.70

R Square	.08
Adjusted R Square	.07
Standard Error	13.92

(3) Physical Activity

A number of multiple regression models with changes in physical activity (perceived rating) as the dependent variable were explored. The variable FAID, whether the student had financial aid from school, was the only

significant predictor for physical activity. Students with financial aid from school reported a more distinct decrease in physical activity. It is very likely that students who did not have assistantship had to work part time and therefore perceived themselves as having a higher level of physical activity. Table 4.12 shows the result of a model in which the included variables were forced to enter.

Table 4.12 Multiple Regression Model with Physical Activity as the Dependent Variable

VARIABLES	B	SE B	Beta	T	Sig T
SINGLE	.09	.42	.04	.22	.82
FRIEND	.47	.50	.13	.94	.35
AGE	-.02	.04	-.05	-.40	.69
FAID	1.33	.43	.45	3.11	.001
STRESS	-.23	.17	-.19	-1.32	.20
USSTAY	.05	.09	.08	.58	.57
ENGLISH	1.04	.90	.17	1.15	.26
(Constant)	3.94	1.65		2.38	.02

R Square	.33
Adjusted R Square	.22
Standard Error	1.05

(4) Psychological Stress

When selected independent variables were entered to predict changes in psychological stress, the variable "SINGLE", whether the student was living as single is the only significant predictor. It was understandable that living alone in a foreign country could be stressful. Table

4.13 shows the result of the selected model in which the independent variables were forced to enter.

Table 4.13 Multiple Regression Model with Psychological Stress as the Dependent Variable

VARIABLES	B	SE B	Beta	T	Sig T
SINGLE	.90	.36	.41	2.5	.02
Activity	-.06	.14	-.07	-.39	.70
FRIEND	.51	.44	.18	1.18	.25
AGE	-.03	.04	-.12	-.85	.40
USSTAY	.04	.09	.07	.42	.68
ENGLISH	.13	.80	.03	.16	.87
FAID	-.59	.44	-.25	-1.33	.19
(Constant)	3.26	1.37		2.37	.02

R Square	.22
Adjusted R Square	.09
Standard Error	.93

(5) The Total CHD Score

A total CHD score was constructed for each student by summing up the scores on changes of bodyweight, total fat consumption, physical activity, and psychological stress. The relationship of the total CHD score with demographic and acculturation factors were studied using multiple regression models with the total CHD score as the dependent variable. The result indicated that the length of US stay and financial aid were significant predictors for the total score (Table 4.14).

Table 4.14 Multiple Regression Model with Total CHD Score as the Dependent Variable

Variables	B	SE B	Beta	T	Sig T
USSTAY	.67	.18	.45	3.70	.001
FAID	2.04	.82	.31	2.49	.02
(Constant)	3.50	1.41		2.49	.02

R Square	.40
Adjusted R Square	.38
Standard Error	2.13

Summary of the Findings

For the sample of Chinese students at OSU, the means of bodyweight, total dietary fat, dairy products, nonalcoholic beverages, and psychological stress had increased significantly since being in the United States. Meanwhile, their level of physical activity had decreased. On the other hand, their consumption of sea food had increased. For cigarette smokers, the number of cigarettes per day had decreased. There were no significant changes in blood pressure or alcohol consumption.

The most common reasons considered for the above changes included (1) diet, reduced physical activity, and increasing age for changes in bodyweight; (2) availability, relative lower price, and convenience for changes in diet; (3) lack of smoking environment for the observed reduction in cigarette smoking; (4) automobile use, limited time, and no friend to play with for decreased physical activity; and (5) pressure in school work, financial difficulty, and worrying about future for increased psychological stress.

Results from multiple regression analysis indicated that the length of US stay and the levels in physical

activity were significant predictors for bodyweight changes. The length of US stay was also a significant predictor for changes in total dietary fat. Whether a student had financial aid for school was the only significant predictor for changes in physical activity. Finally, living as single was the only significant predictor for changes in psychological stress.

CHAPTER V

SUMMARY, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to examine lifestyle changes that are related to the risk factors of coronary heart disease among Chinese students in the United States. A sample of 50 male Chinese students at Oregon State University was interviewed using a structured questionnaire. Lifestyle profiles in China and in the United States were obtained. Both profiles consisted of eight categories of information: (1) bodyweight and blood pressure, (2) diet, (3) alcohol consumption, (4) cigarette smoking, (5) physical activity, (6) psychological stress, (7) acculturation factors, and (8) demographic factors. Because there was no existing literature on lifestyle changes for the target population, this study would provide a baseline profile on lifestyle changes for the Chinese students in the United States.

Results indicated that for this group of Chinese students, bodyweight, total dietary fat consumption, dairy products consumption, soft drink consumption, and psychological stress had increased significantly during their stay in the United States. Meanwhile, their level of physical activity had decreased. These changes, especially if continued, may have the potential to increase their risk of coronary heart disease.

On the other hand, there was no significant change in blood pressure or alcohol consumption among study subjects. For those who reported being cigarette smokers, cigarette consumption had decreased.

In this study, attempts were made to explore the reasons for lifestyle changes. A number of demographic and

acculturation factors were examined through open-ended questions in the questionnaire and through multiple regression analysis.

In their responses to the open-ended questions, the most common reasons given for changes in bodyweight were diet, decreased level of physical activity, and increasing age. Diet changes were attributed to food availability, relative price, and convenience. For the observed decrease in cigarette smoking among current smokers, lack of smoking environment was considered the most important factor. Automobile use, limited spare time because of school work, and no friend to play with were given as the reasons for decreased physical activity. Finally, pressure in school, financial difficulty, and worrying about the future were considered to be the reasons for the reported increase in psychological stress.

Results from multiple regression analysis indicated that the length of US stay and decrease in physical activity were significant predictors for bodyweight gain. The length of US stay was also a significant predictor for the change in total dietary fat. Also, receiving financial aid from school was associated with a decrease in physical activity. Living as "single" (including those married whose wives were not in Corvallis) was significantly associated with increased level of psychological stress. This study failed to identify any significant associations between Acculturation factors (English language use, American food consumption, having American friends etc.) and changes of the CHD risk factors.

Discussion

The findings indicated that the general pattern of lifestyle in the group of OSU Chinese students had changed in a direction that was favorable for the development of

coronary heart disease.

Results of this study supported the theory that dietary changes and physical activity play major roles in weight gain (Romieu et al., 1988). Increase in body weight, and possibly in serum cholesterol, may also be the result of increasing age (Berns et al., 1989). The length of US stay can also be labelled as "increase in age". Similar aging patterns have been observed in urban Chinese populations (He et al., 1991).

Changes in diet were not merely the result of adoption of certain American foods, but largely the result of changed dietary components of food prepared in Chinese style. In average for the Chinese students, 78% of the food eaten was served in Chinese style but with an increased amount of meat, especially pork. Another change in diet was reflected in the regular consumption of certain foods that were usually "seasonal" or scarce in China. Due to year round availability in the US, consumptions of fruits, fruit juice, soft drinks, ice cream, seafood, and meat (such as chicken and beef) had increased significantly.

American food practices that were adopted by the Chinese students included fresh milk, other dairy products, bread, and soft drinks. This was similar to changes found in other immigrant populations from Asia (Story and Harris, 1988; Yohai, 1977). The most significantly changed meal was breakfast in which milk, bread, and cereal had replaced the traditional Chinese breakfast (soy milk, steamed bread, fried dough etc.). These changes were largely due to availability and convenience. On the other hand, many Chinese students (34%) rated their present fat consumption as high (while only 16% considered their fat consumption in China was high). More of the subjects had begun the practice of trimming off the fat from meat (66% at present versus 38% in China) or avoiding eating chicken skin (20% verses 14%). Lard consumption had also decreased. This

group of Chinese students were generally aware of the negative impact of high dietary fat and cholesterol on health. It is possible that when the consumption of some food items (such as pork and chicken) reaches certain level, people become more health conscious about what they eat.

It appeared that the Chinese diet consisted of a wider spectrum of food items than the American diet. Almost all food items available in American market are acceptable by Chinese culture. In the US, many typical Chinese food and seasonings, such as tofu and soy sauce, were also available in Asian food stores.

To summarize, the Chinese students in the United States generally preferred foods that were: (1) valued but limited in China, (2) relatively inexpensive, and (3) convenient to prepare. Furthermore, it was mentioned by a number of Chinese students that they generally bought more raw foods instead of processed or packaged foods than Americans.

This group of Chinese students appeared to be light alcohol drinkers. It seemed that total alcohol consumption did not change for the group of Chinese students due to the counter effect of increased beer availability, decreased (Chinese) liquor availability, and decreased social activity for drinking. In China, many people have the practice to binge drink liquor during holidays. It was reported (Brenner, 1987) that on population bases, heart disease mortality is positively associated with liquor consumption but inversely related with beer consumption.

In China, almost 70% of the adult males smoke cigarettes and anti-smoking campaigns carried out in the past have had little effect (Stehle et al., 1991). For this group of Chinese students, the smoking rate was lower than in China. Forty percent of them smoked at the time when they left China and 36% reported smoking at the time of the interview. For cigarette smokers in the sample, the number of cigarettes smoked per day had decreased significantly.

From the answers given by these smokers, it seemed that establishing and emphasizing the rights of nonsmokers with prohibition of smoking in public places was an effective way of reducing smoking. Eliminating the social function of smoking also appeared to be important.

Less biking or walking and less physical exercise had contributed to the decrease in physical activity. The significant decrease in biking or walking was due to the relatively short distance from their residence to the OSU campus as well as the use of an automobile. It appeared that owning a car was a major American attraction to the Chinese students. Eighty-two percent of the subjects owned a car at the time of the interview and all subjects who had been in the US for more than nine months owned a car.

The change in nap habit among the Chinese students could be the result of the school schedule and social acceptance. A few of the subjects commented that the more nutritious diet in the US had made them feel more energized and less drowsy.

Acculturation factors identified in this study (English speaking, American food, church going, having American friends etc.) were not associated with particular patterns of change in CHD risk factors. This supported the idea that cultural absorption is not a uniform process as indicated by the acculturation model (Yu, 1991). The findings also seemed to favor the "behaviorist-materialist" theory versus the "ideational" theory (Pelto, 1981). The experience of these students was more than a replacement of the Chinese culture to American culture. The majority changes in CHD risk factors were the result of environmental (material) and social-economic changes that were not necessarily related to culture differences (i.e. values, beliefs, and the ways of thinking). However, the failure to identify any significant associations between acculturation factors and changes of the CHD risk factors could be the result of the small

variation in the degree of acculturation among this group of Chinese students as well as the small sample size.

In the process of examining lifestyle changes for this group of Chinese students, social and cultural changes occurring in China should not be ignored. Because of fast economic growth in China, lifestyle changes, especially concerning food consumption, as well as the adoption of other western cultural practices, have also occurred in China during recent years. In addition, for the subjects in this age group, even if they had not come to the US, some of the life events (such as graduation, starting a new job, marriage, having a child etc.) would also happen and impact their lifestyle and their level of CHD risk factors.

On the other hand, cultural barriers are more likely to affect the social and psychological well being of individuals. For example, the students reported that "no friend to play with", "decreased social activity", and "worrying about future" had impacted their level of physical activity, alcohol drinking, and psychological stress.

Conclusions

Results of this study indicated that for the group of Chinese students in the United States, their lifestyle, as related to CHD risk factors, has changed significantly. These changes in general may make them more prone to develop coronary heart disease.

The findings from this study support the model by Paige (1983) that food choice (which can be generalized to other aspects of lifestyle) is determined by a series of screens which include environment, cultural, social, and personal factors. Environment factors (availability, relative cost, and convenience) seemed to be the most important factors for these changes.

Although CHD incidence in China is lower than that in

the United State and the "typical" Chinese food may be healthier than the "typical" American food in terms of dietary fat and cholesterol, the Chinese diet could still introduce high fat and high cholesterol if too much food of animal sources are included.

Because the etiology of CHD is multifactorial, it is important to understand that diet alone is not a panacea for preventing the development of CHD. All CHD risk factors, as well as risk factors of other chronic diseases (such as cancer and stroke), should be reduced as much as possible.

Recommendations

1. Future Research

Future research should strive to address limitations inherent in the present study. Longitudinal comparison would be ideal. For example, comparisons could be made between a group of subjects (students or immigrants) who are going abroad with a matched group (on age, education etc.) who will stay in their home country. Measurement on time varying variables should be given at different time points. In addition, the measurement instruments (such as for diet and acculturation) should be improved and laboratory tests (such as blood cholesterol) should be included. Further, the effect of lifestyle changes on the incidence of CHD and other diseases (such as cancer and stroke, which are more prevalent in Chinese populations) should be investigated.

Another research approach would be to examine and compare the health knowledge, beliefs, and behaviors of Chinese college students in the United States, Chinese college students in China, and American college students. This type of study could help determine how cultural influences, health education, and health policies mediate the development of healthy lifestyles. It might help lay the ground work for a better understanding of health education

and health policies within a cultural context.

2. Health Education

Health education efforts should be targeted at specific populations, such as international students, in the United States. For example, information on the risks of smoking and smoking regulations on campus should be included as part of the university introduction material. Also, newsletters on nutrition education, alcohol drinking (which is also important for safe driving), physical exercise, and stress management, could be developed for international students. Exercise groups for these students could also be organized.

Through cross-cultural studies, the concept that people from different cultural groups can learn from each other should be encouraged. The US society as whole, and health educators in particular, need to help people in different ethnic groups to realize the importance of acculturation and assimilation in regard to their lifestyle behaviors and health. For example, different dietary practices and their impact could be included in a variety of health education curricula.

3. Policies in Developing Countries

The most important insight coming out from this study, perhaps, is its implication for the development of health education strategies in developing countries. The third world countries should not blinding copy the patterns of the western countries in their economic development. The health impact of westernization, whether positive or negative, should be integrated into health education programs. For example, it is time to warn the Chinese people, especially the urban population, about the health risks associated with high fat and cholesterol consumption. China should limit the import of foreign tobacco products and develop new strategies to reduce her huge smoking population.

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APPENDICES

Appendix A. English Version of the Questionnaire

Lifestyle Survey of Chinese Students at Oregon State University

This is a survey on the lifestyle changes of Chinese students at Oregon State University. The study will be part of my Ph.D work.

Participation in this study is entirely voluntary. All individuals contacted have the right to refuse to participate at any time. Also, all responses to this survey will be kept confidential.

In this survey, you will be asked about your life habits. When the term "at present" is used, it refers to the past 12 months in the United States (if you have not been in the US for 12 months, it refers to the time period from your arrival in the US to the present). The term "in China" refers to your last 12 months in China just before you came to the US.

ID Number: _____

Date: _____/____/_____

I. Body Weight and Blood Pressure

1. About how tall are you without shoes (cm)? _____

2. About how much do you weigh without shoes? lb/kg _____

3. What is your present trouser waist size? in/cm _____

4. About how much did you weigh without shoes when you were in China? kg _____

5. What was your trouser waist size in China? inch/cm _____

6. If you have gained weight since in the US, when did you start to gain weight? MOs in the US _____

   6a. What do you consider as the most important factors that have contributed to your weight gain (e.g. diet, less physical activity etc.)?

7. Now, let me measure your blood pressure (systolic/diastolic).

   first measure:_____/_____

   second measure:_____/_____

8. What was your blood pressure in China? _____/_____
   syst. diast.

II. Dietary information

A. Present Diet

Now, I will ask you how often (times per day, week, month, or year) did you usually eat or drink the following food items during the past twelve months (or less) in the US.

Item	Frequency
1. pork in mixed dishes, eg. stir fried with vegetables	__/ D W M Y
2. pork in unmixed dishes eg. braised, roast, meat balls	__/ D W M Y
3. beef in mixed dishes eg. stir fried with vegetables	__/ D W M Y
4. beef in unmixed dishes eg. braised, roasted	__/ D W M Y
5. chicken in mixed dishes eg. stir fried with vegetables	__/ D W M Y
6. chicken in unmixed dishes eg. roast, steamed, braised	__/ D W M Y
7. organ meat, eg.; liver, kidney, tripe of pork, beef, chicken	__/ D W M Y
8. lamb	__/ D W M Y
9. fish, any kind	__/ D W M Y
10. shellfish, any kind, eg. clams, shrimp, oysters, crab	__/ D W M Y
11. eggs (numbers)	__/ D W M Y
12. tofu, any kind,	__/ D W M Y
13. milk	__/ D W M Y
14. yogurt	__/ D W M Y
15. ice cream	__/ D W M Y
16. vegetables, any kind	__/ D W M Y
17. fruits, any kind	__/ D W M Y

Item	Frequency
18. rice	__/ D W M Y
19. noodles, any kind	__/ D W M Y
20. steamed bread	__/ D W M Y
21. Chinese dumplings	__/ D W M Y
22. bread	__/ D W M Y
23. tea	__/ D W M Y
24. coffee	__/ D W M Y
25. soft drinks	__/ D W M Y

26. At present, who prepares most of your meals?

yourself 1
your spouse 2
your parent 3
other (specify:_____) ... 4

27. What percent of your present diet can be considered as Chinese style? % _____

28. At present, what do you usually eat for breakfast, for lunch, and for dinner on a typical day?

breakfast:	lunch:	dinner:
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

29. How often (times per week or per month) do you eat in a restaurant or in a dining hall? _____

30. Overall, would you say your present diet is high, medium, or low in fat and why?

high 1
medium 2
low 3

B. Historic profile

Now, using the same list of food items of present diet, I will ask you how often did you usually eat or drink these items when you were in China.

Item	Frequency
1. pork in mixed dishes, eg. stir fried with vegetables	__/ D W M Y
2. pork in unmixed dishes eg. braised, roast, meat balls	__/ D W M Y
3. beef in mixed dishes eg. stir fried with vegetables	__/ D W M Y
4. beef in unmixed dishes eg. braised, roasted	__/ D W M Y
5. chicken in mixed dishes eg. stir fried with vegetables	__/ D W M Y
6. chicken in unmixed dishes eg. roast, steamed, braised	__/ D W M Y
7. organ meat, eg.; liver, kidney, tripe of pork, beef, chicken	__/ D W M Y
8. lamb	__/ D W M Y
9. fish, any kind	__/ D W M Y
10. shellfish, any kind, eg. clams, shrimp, oysters, crab	__/ D W M Y
11. eggs (numbers)	__/ D W M Y
12. tofu, any kind,	__/ D W M Y
13. milk	__/ D W M Y
14. yogurt	__/ D W M Y
15. ice cream	__/ D W M Y
16. vegetables, any kind	__/ D W M Y
17. fruits, any kind	__/ D W M Y
18. rice	__/ D W M Y

Item	Frequency
19. noodles, any kind	__/ D W M Y
20. steamed bread	__/ D W M Y
21. Chinese dumplings	__/ D W M Y
22. bread	__/ D W M Y
23. tea	__/ D W M Y
24. coffee	__/ D W M Y
25. soft drinks	__/ D W M Y

26. When you were in China, where did you have your meals most often?

dinning hall 1
home 2

27. In a typical day when you were in China, what did you usually eat for breakfast, for lunch, and for dinner?

breakfast:	lunch:	dinner:
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

28. Overall, would you say your diet in China was high, medium, or low in fat and why?

high 1
medium 2
low 3

C. Dietary changes

Now, let's talk about diet changes. Compared to your diet in China, your present consumption of ____ has:

5 Substantially increased
4 Increased
3 No change
2 Decreased
1 Substantially decreased

1.	pork	5	4	3	2	1
2.	beef	5	4	3	2	1
3.	chicken	5	4	3	2	1
4.	Fish and shellfish	5	4	3	2	1
5.	vegetable oil	5	4	3	2	1
6.	animal oil (lard etc.)	5	4	3	2	1
7.	butter, margarine, mayonnaise	5	4	3	2	1
8.	fried foods	5	4	3	2	1
9.	milk	5	4	3	2	1
10.	egg	5	4	3	2	1
11.	tofu	5	4	3	2	1
12.	vegetables	5	4	3	2	1
13.	fruits	5	4	3	2	1
14.	rice	5	4	3	2	1
15.	flour, noodles etc.	5	4	3	2	1
16.	tea	5	4	3	2	1
17.	coffee	5	4	3	2	1
18.	soft drinks	5	4	3	2	1
19.	fruit juice	5	4	3	2	1

20. When you have meat at present, do you usually trim off the fat?
    Never 1
    Occasionally . 2
    Often 3
    Always 4

21. When you had meat in China, did you usually trim off the fat?
    Never 1
    Occasionally . 2
    Often 3
    Always 4

22. When you have chicken at present, do you usually eat with the skin?
    Never 1
    Occasionally . 2
    Often 3
    Always 4

23. When you had chicken in China, did you usually eat with the skin?

Never 1
Occasionally . 2
Often 3
Always 4

24. In general, are there any changes in your diet since you came to the US?

Yes 1
(IF NO, SKIP TO 20) No 2

24a. If yes, what do you consider as the most important reasons for the change?

25. Are there any food items that you ate often in China but not in the US?

26. Are there and food items that you did not eat in China but you eat often in the US?

27. In general, compared to your diet in China, do you consider your present diet to be better, about the same, or not as good as your diet in China?

better 1
(SKIP 27a IF THIS CHOICE) about the same 2
not as good 3

27a. Why do you think it is "better" or "not as good"?

III. Alcohol Consumption

1. At present, do you drink alcoholic beverages at all (at least once a year)?

   yes 1
   (IF NO, SKIP TO 3) no 2

2. How often (times per day, week, month, or year) and how much (glass size) do you usually drink each time?

item	frequency	serving size
beer	___/ D W M Y	12oz x ____
wine	___/ D W M Y	small medium large x ____
liquor	___/ D W M Y	small medium large x ____

3. Did you drink alcoholic beverages at least once a year when you were in China?

   yes 1
   (IF NO, SKIP TO IV) no 2

4. How often (times per day, week, month, or year) and how much (glass size) did you usually drink each time?

item	frequency	serving size
beer	___/ D W M Y	12oz x ____
wine	___/ D W M Y	small medium large x ____
liquor	___/ D W M Y	small medium large x ____

5. Compared to in China, your present level of alcohol consumption has:

   Substantially decreased 1
   Decreased 2
   No change 3
   Increased 4
   Substantially increased 5

6. If your alcohol consumption has changed since in the US, what do you consider as the most important reasons for the change?

IV. Cigarette Smoking

1. Have you smoked at least 100 cigarettes in your entire life?

yes 1
(IF NO, SKIP TO QUESTION SET V) no 2

2. What is your present status in regards to cigarette smoking?

exsmoker, quit before came to the US 1
exsmoker, quit since in the US 2
exsmoker, quit later in the US 3
present smoker 4
occasional smoker 5

2a. If you are a present smoker, on the average, how many cigarettes do you usually smoke a day?

_____

2b. If you smoked in China, on the average, how many cigarettes did you usually smoke per day?

_____

2c. If you have quit smoking (or reduced smoking) since in the U.S.; what do you consider as the most important reasons?

V. Physical activity

1. At present, do you participate in physical exercise on a weekly bases (not including walking or biking)?

yes 1
(IF NO, SKIP TO 2) no 2

1a. What type of physical exercise do you participate?

1b. About how many minutes do you spent on these physical exercise per week? _____

2. At present, about how many minutes per week do you spend on outdoor walking or biking? _____

3. When you were in China, did you participate in physical exercise on a weekly bases (not including walking or biking)?

yes 1
(IF NO, SKIP TO 4) no 2

3a. What type of physical exercise did you participate?

3b. About how many minutes did you spend on these physical exercise per week? _____

4. When you were in China, about how many minutes per week did you spend on outdoor walking or biking? _____

5. At present, do you own a car?

yes 1
(IF NO, SKIP TO 6) no 2

5a. When (month, year) did you first buy you car?

_____/_____
YR MO

6. Compared to in China, your present level of physical activity has:

	significantly decreased 1
	decreased 2
(IF NO CHANGE, SKIP TO 8)	no change 3
	increased 4
	significantly increased 5

7. If your level of physical activity has changed, what do you consider as the most important reasons for the change?

8. At present, about how many hours do you sleep per night?

_____

9. At present, how often do you take a nap after lunch?

	everyday 1
	three or four times a week . 2
	one or two times a week 3
	less than once a week 4
(IF THIS, SKIP TO 10)	do not take nap at all 5

9a. How many minutes do you usually take for a nap?

_____

10. When you were in China, about how many hours did you sleep per night?

_____

11. When you were in China, how often did you take a nap?

	everyday 1
	three or four times a week .. 2
	one or two times a week 3
	less than once a week 4
(IF THIS, SKIP 11a)	do not take nap at all 5

11a. How many minutes did you usually sleep for a nap?

_____

VI. Psychological stress

1. At present, do you consider your level of psychological stress as high, medium, or low in general (consider you work, family, and school etc.)?

high 1
medium 2
low 3

2. Do you consider your level of psychological stress in China as high, medium, or low in general (consider you work, family, and school etc.)?

high 1
medium 2
low 3

3. Compared to your stress level in China, your present level of psychological stress has:

significantly decreased 1
decreased 2
(IF NO CHANGE, SKIP TO VII) no change 3
increased 4
significantly increased 5

4. If your level of psychological stress has changed, what do you consider as the most important reasons for the change?

VII. Cultural Factors

1. At present, do you read a Chinese newspaper at least once a week?

yes 1
no 2

2. Do you read books in English for recreation?

yes 1
no 2

3. On a weekly basis, in average, what percentage of your talking is in Chinese?

≤ 20% 1
21 - 40% 2
41 - 60% 3
61 - 80% 4
> 80% 5

4. Do you like American music?

yes 1
No 2
so so 3

5. Do you go to a church at least once a month?

yes 1
no 2

6. Are your friends mainly Chinese or American?

Chinese 1
American 2
half Chinese ... 3

7. Whom are you sharing a room with?

I (my family) live alone 1
I am sharing with Chinese 2
I am sharing with American 3
I am sharing with people
from other countries 4

8. For health reasons, is there any lifestyle changes that you want to make in the future?

9. In general, how do you feel about your life in the US?

VIII. Demography

1. When were you born? ____/____/____
YR MO DA

2. When did you come to the US: ____/____/____
YR MO DA

3. What is your program of study at OSU?

Master 1
Doctoral 2
Post Doctoral 3
Visiting scholar . 4
Undergraduate 5

4. What is your major of study at OSU? _____. |_|

5. What is your marital status?
Single 1
Married, wife not in Corvallis, no child 2
Married, wife and child not in Corvallis 3
Married, wife in Corvallis, no child 4
Married, wife in Corvallis, child in China 5
Married, wife and child in Corvallis 6

5a. When did your wife come to join you? ____/____/____
YR MO DA

5b. If you have a child (or children), what is the age of your child (or children)? _____

6. Where is your place of birth? _____. |_|_|
(province/city)

7. Are you receiving financial aid from school?
yes ... 1
no 2

8. What is your (or your household) average monthly income?
< $ 500 1
$500 - $999 2
$1,000 - $1,499 ... 3
$1,500 or more 4

9. About how much do you/your family spend on food per month?

$_____

Appendix B. List of Variables

1. Demographic Variables

AGE (yr):	interview date - birth date.
USSTAY (yr):	interview date - date of entry to US.
PROGRAM:	study program at OSU.
MAJOR:	major of study at OSU.
SINGLE:	living as single or married.
REGION:	birth region in China (north or south).
F-AID:	finanacial aid from school.
INCOME ($):	individual/family monthly income.
FOODCOST ($):	individual/family monthly cost on food.

2. Acculturation Variables

PAPER:	read Chinese newspaper every week
READING:	recreational reading in English
ENGLISH:	average percent of time speaking English
MUSIC:	like American music
CHURCH:	go to church at least once a month
FRIEND:	friends are mainly Chinese or American
SHARING:	sharing apartment with Chinese or American
WESTFOOD:	% of food served in non-Chinese style

3. Changes in Bodyweight and Blood Pressure

WTCHG (kg):	present bodyweight - bodyweight in China
WAIST (cm):	present waist size - waist in China
BMI (kg/m^2):	present BMI - BMI in China
DBP (mmHg):	present DBP - DBP in China
SBP (mmHg):	present SBP - SBP in China

4. Changes in Dietary Items

PORKCHG:	present frequency of pork consumption (times/year) - the frequency in China

The following items are estimated **changes** that are computed in the same manner as PORKCHG. "Perceived changs" are from ratings of the perceived changes (question IIC).

BEEFCHG	
CHICKCHG	
LIVERCHG:	organ meat
LAMBCHG	
FISHCHG:	fish + other seafood
VEGE OIL:	perceived changes of vegetable oil use
ANIMAL OIL:	perceived changes of animal oil use
BUTTER:	perceived changes of consumption of butter, margarine, mayonnaise etc.

FRIED FOOD:	perceived changes of fried food
MILKCHG	
DAIRYCHG:	milk + yogurt + ice cream
EGGCHG	
TOFUCHG	
VEGECHG	
FRUITCHG	
RICECHG	
FLOURCHG	
TEACHG	
COFFCHG:	coffee
SOFTCHG:	soft drinks
SUGCHG:	perceived changes of soft drink and fruit juice consumption
TFAT:	changes in total fat consumption (the total among of fat per day from pork, beef, chicken, liver, lamb, seafood, dairy products, and egg of standard sizes based on their consumption frequency and fat content; see Appendix D for reference)
SAF:	changes in saturated fat consumption
CHO:	changes in total cholesterol consumption

5. Changes in Alcohol Consumption

BEER:	present frequency - frequency in China
WINE	
LIQUOR	
ALCOHOL:	perceived changes of alcohol drinking

6. Changes in Cigarette Smoking

SMOKER:	smoker or nonsmoker
SMSTATUS:	current smoking status for smokers
SMLEVEL:	number of cigarette per day at present
PSMLEVEL:	number of cigarette per day in China

7. Changes in Physical Activity

EXERCISE:	present exercise time (hrs/wk) - exercise time in China
BIKEWALK:	biking time + walking time (hours/week)
OWNCAR:	whether own a car at present
ACTIVITY:	perceived changes of physical activity

8. Changes in Psychological Stress

STRESS:	perceived changes of psychological stress

Appendix C. Geographic Distribution of the Students

Appendix D. Components of Food Items*

	Portion Size (ounce)	Energy (kcal)	Total Fat (g)	Saturated Fat (g)	Poly-Unsaturated (g)	Cholest-erol (mg)
Pork, mixed	2	160	12	5	1	65
Pork, unmixed	4	320	24	10	2	130
Beef, mixed	2	140	8	3	0.5	50
Beef, unmixed	4	280	16	6	1	100
Chicken, mixed	2	100	3	0.5	0.5	50
Chicken, unmixed	4	200	6	1	1	100
Organ meat	2	130	6	1.5	0.5	250
Lamb	2	120	6	1.5	0.5	60
Fish	2	100	4	0.5	2	20
Shrimp, crab etc.	2	50	0.5		0.5	75
Egg	one egg	79	6	2	1	274
Milk	8	150	8	5		33
Yogurt	8	225	4	2		20
Ice cream	4	135	7	4		30

* Complied from Appendix III of Paige, D. M. editor (1983): Manual of Clinical Nutrition.

APPENDIX E. Correlation Matrix Between the Variables

	WTCHG	TFAT	SAF	CHO	ALCOHOL	ACTIVITY
WTCHG	1.0000					
TFAT	-.0197	1.0000				
SAF	-.1254	.9694**	1.0000			
CHO	.1618	.8293**	.7458**	1.0000		
ALCOHOL	-.1005	.0618	.0739	.0100	1.0000	
ACTIVITY	-.4428**	-.0273	.0400	-.0772	-.1385	1.0000
STRESS	.1623	.0703	.0129	.1737	-.1163	.0636
AGE	.1519	-.0943	-.0945	.0613	-.0264	.0177
USSTAY	.5341**	.2910	.1560	.3250	.1935	-.3536*
ENGLISH	.1827	-.0909	-.0839	.0441	.1768	-.2726
WESTFOOD	-.1875	.0411	.1094	.0424	-.0222	.3552*
CHURCH	-.0536	-.0876	-.0845	-.0676	.0358	-.0201
FRIEND	.1573	.0997	.0737	.2997	.2458	-.1618
SINGLE	-.0835	.0812	.1605	-.0224	.1233	-.0130
REGION	.2526	.2659	.1964	.2876	.2707	-.0661
F-AID	.2738	.1653	.0864	.1148	.1638	-.5942**
INCOME	.3084	.1159	.0149	.1033	.2136	-.4388**
FOODCOST	.4768**	.0453	-.0632	.2193	.0627	-.3633*
PORKCHG	.0811	.7455**	.6360**	.5817**	.2074	-.1135
BEEFCHG	.0051	.0954	.0511	.0409	-.3446*	-.0739
CHICKCHG	.1889	.2853	.2064	.2232	-.1251	-.0072
LIVERCHG	.2711	.2546	.1708	.2155	-.0204	-.2653
LAMBCHG	-.2144	.1160	.1195	-.1445	-.0885	.0998
FISHCHG	.2567	.3627*	.2698	.3228	.0032	-.0996
VEGE-OIL	.1635	.0716	.0051	.1379	.2207	-.1965
ANIMAL OIL	-.0389	-.0440	.0062	-.0685	-.1270	-.0812
BUTTER	-.0870	-.0973	-.0451	-.1703	.3631*	-.0430
FRIED FOOD	.2400	-.0034	-.0209	.0603	-.1539	-.1084
EGGCHG	.1428	.6192**	.5527**	.9355**	.0078	-.0378
MILKCHG	-.2988	.4231*	.6094**	.1910	-.0093	.2518
DAIRYCHG	-.3391*	.3795*	.5819**	.1463	.0248	.2113
TOFUCHG	-.0274	.2102	.2367	.1977	-.1114	.2530
VEGECHG	-.2394	.0264	.0250	-.0205	-.0319	-.0180
FRUITCHG	.2181	-.1861	-.1758	-.0936	-.0424	-.0379
RICECHG	-.0072	.2098	.1781	.1392	.3662*	-.2161
FLOURCHG	-.0520	.0392	.0622	.0697	-.1819	.0583
TEACHG	.2939	-.1030	-.1549	-.0676	-.0300	-.1429
COFFCHG	.2117	.0055	-.0295	.0761	.2357	-.1208
SOFTCHG	-.1041	.1447	.1835	.0755	-.1393	.1697
SUGCHG	-.0025	.1448	.1665	.1101	-.0257	.1099

Note: * p-value ≤ .05 ** p-value ≤ .01

(continued) Correaltion Matrix Between the Variables

	STRESS	AGE	USSTAY	ENGLISH	WESTFOOD	CHURCH
WTCHG	.1623	.1519	.5341**	.1827	-.1875	-.0536
TFAT	.0703	-.0943	.2910	-.0909	.0411	-.0876
SAF	.0129	-.0945	.1560	-.0839	.1094	-.0845
CHO	.1737	.0613	.3250	.0441	.0424	-.0676
ALCOHOL	-.1163	-.0264	.1935	.1768	-.0222	.0358
ACTIVITY	.0636	.0177	-.3536*	-.2726	.3552*	-.0201
STRESS	1.0000					
AGE	-.0842	1.0000				
USSTAY	.0555	.1194	1.0000			
ENGLISH	-.1734	.0867	.2334	1.0000		
WESTFOOD	.1370	-.0174	-.1661	.0810	1.0000	
CHURCH	-.0182	.0260	-.3394*	-.1371	-.2005	1.0000
FRIEND	-.2226	.1965	.2690	.5385**	.0844	-.1455
SINGLE	-.3578*	-.1576	-.2553	.2750	.2585	.1144
REGION	.2153	-.2132	.5146**	.0875	.0056	-.2770
F-AID	-.0835	.0041	.3867*	.1669	-.6024**	.0818
INCOME	.0671	.1978	.6326**	.0749	-.4290**	-.2075
FOODCOST	.1796	.1761	.5360**	-.0001	-.3026	-.1484
PORKCHG	.1151	-.1396	.3838*	-.2152	-.2818	.0050
BEEFCHG	.0336	-.1444	-.0212	-.0210	.3080	.0104
CHICKCHG	-.0831	.0178	.3569*	.0371	.0369	-.1139
LIVERCHG	-.0434	.0172	.5394**	.1173	-.3281	-.0846
LAMBCHG	.0160	-.0736	-.0641	-.2462	-.1484	.1925
FISHCHG	.1760	.0325	.5152**	.0183	-.0976	-.4146*
VEGE-OIL	.2089	-.0137	.1207	-.0128	-.3649*	.1365
ANIMAL OIL	.1071	-.1663	-.2426	.0659	.1624	-.1275
BUTTER	.2045	-.1910	-.1085	.1858	.2087	-.0891
FRIED FOOD	.2619	.1635	.2040	.0238	.3337*	-.2050
EGGCHG	.1956	.1351	.1723	.0885	.0890	-.0129
MILKCHG	-.1826	.0072	-.2552	-.0155	.2840	-.1328
DAIRYCHG	-.1699	.0084	-.2561	.0879	.3298*	-.1072
TOFUCHG	.2297	-.2375	-.0239	-.1480	.2673	-.0161
VEGECHG	-.1205	-.1831	-.1464	-.0793	-.3353*	-.0564
FRUITCHG	.1321	-.1850	-.0572	.2100	-.0095	-.1432
RICECHG	-.1684	-.1284	.2582	.2520	-.5099**	.1134
FLOURCHG	.0089	.0413	-.3368*	-.2328	.2007	.0893
TEACHG	.0759	.2175	.1680	-.0909	-.1285	.0305
COFFCHG	.0400	-.1078	.0120	.1145	-.2143	-.0403
SOFTCHG	.1858	.0758	-.2507	.0080	.4279**	.0506
SUGCHG	.2015	.0237	-.2408	.0619	.3197	.0307

(continued) Correlation Matrix Between the Variables

	FRIEND	SINGLE	REGION	F-AID	INCOME	FOODCOST
WTCHG	.1573	-.0835	.2526	.2738	.3084	.4768**
TFAT	.0997	.0812	.2659	.1653	.1159	.0453
SAF	.0737	.1605	.1964	.0864	.0149	-.0632
CHO	.2997	-.0224	.2876	.1148	.1033	.2193
ALCOHOL	.2458	.1233	.2707	.1638	.2136	.0627
ACTIVITY	-.1618	-.0130	-.0661	-.5942**	-.4388**	-.3633*
STRESS	-.2226	-.3578*	.2153	-.0835	.0671	.1796
AGE	.1965	-.1576	-.2132	.0041	.1978	.1761
USSTAY	.2690	-.2553	.5146**	.3867*	.6326**	.5360**
ENGLISH	.5385**	.2750	.0875	.1669	.0749	-.0001
WESTFOOD	.0844	.2585	.0056	-.6024**	-.4290**	-.3026
CHURCH	-.1455	.1144	-.2770	.0818	-.2075	-.1484
FRIEND	1.0000					
SINGLE	.1064	1.0000				
REGION	-.0269	-.1580	1.0000			
F-AID	.1667	-.2736	.1410	1.0000		
INCOME	.0458	-.4104*	.2402	.6176**	1.0000	.7511**
FOODCOST	.1886	-.5851**	.1795	.4462**	.7511**	1.0000
PORKCHG	-.0197	-.1382	.2882	.3811*	.3310*	.1358
BEEFCHG	-.1302	.1767	-.0805	-.1625	-.0680	.0554
CHICKCHG	.2088	-.0870	.2724	.1015	.0576	.1031
LIVERCHG	.0789	-.2580	.3104	.3251	.4584**	.3322*
LAMBCHG	-.2865	.1104	-.2182	.0033	-.1197	-.4032*
FISHCHG	.1621	-.0377	.2580	.1828	.2968	.1859
VEGE-OIL	-.1283	-.2369	.2094	.2887	.1623	.0936
ANIMIAL OIL	-.0762	.0730	-.0799	-.1397	-.3273	-.2132
BUTTER	.0778	.1782	.1128	-.0437	-.1292	-.2366
FRIED FOOD	-.1732	-.1075	.1272	-.0899	.0596	.1136
EGGCHG	.3328*	-.0112	.1925	.0150	-.0039	.2014
MILKCHG	.0555	.3526*	-.0788	-.2280	-.3159	-.3547*
DAIRYCHG	.0478	.3275	-.0666	-.2297	-.3084	-.3214
TOFUCHG	.0289	.0247	-.0276	-.1922	-.2604	-.1957
VEGECHG	.0674	-.2164	-.2288	.1747	-.0116	.0542
FRUITCHG	-.0013	-.0777	-.0906	.0099	-.1806	-.0337
RICECHG	.2830	.0080	.2288	.4459**	.2483	.0887
FLOURCHG	-.2625	.0186	-.3817*	-.2367	-.2533	-.1817
TEACHG	-.0974	-.1883	.1494	.1380	.2423	.1959
COFFCHG	.1448	-.1560	-.0460	.2608	.2148	.3413*
SOFTCHG	-.2225	.2495	-.1232	-.3860*	-.3266	-.3171
SUGCHG	-.1504	.1718	-.1429	-.2565	-.2198	-.1508

(continued) Correlation Matrix Between the Variables

	PORKCHG	BEEFCHG	CHICKCHG	LIVERCHG	LAMBCHG	FISHCHG
WTCHG	.0811	.0051	.1889	.2711	-.2144	.2567
TFAT	.7455**	.0954	.2853	.2546	.1160	.3627*
SAF	.6360**	.0511	.2064	.1708	.1195	.2698
CHO	.5817**	.0409	.2232	.2155	-.1445	.3228
ALCOHOL	.2074	-.3446*	-.1251	-.0204	-.0885	.0032
ACTIVITY	-.1135	-.0739	-.0072	-.2653	.0998	-.0996
STRESS	.1151	.0336	-.0831	-.0434	.0160	.1760
AGE	-.1396	-.1444	.0178	.0172	-.0736	.0325
USSTAY	.3838*	-.0212	.3569*	.5394**	-.0641	.5152**
ENGLISH	-.2152	-.0210	.0371	.1173	-.2462	.0183
WESTFOOD	-.2818	.3080	.0369	-.3281	-.1484	-.0976
CHURCH	.0050	.0104	-.1139	-.0846	.1925	-.4146*
FRIEND	-.0197	-.1302	.2088	.0789	-.2865	.1621
SINGLE	-.1382	.1767	-.0870	-.2580	.1104	-.0377
REGION	.2882	-.0805	.2724	.3104	-.2182	.2580
F-AID	.3811*	-.1625	.1015	.3251	.0033	.1828
INCOME	.3310*	-.0680	.0576	.4584**	-.1197	.2968
FOODCOST	.1358	.0554	.1031	.3322*	-.4032*	.1859
PORKCHG	1.0000					
BEEFCHG	-.2396	1.0000				
CHICKCHG	.0998	.1773	1.0000			
LIVERCHG	.3213	-.0557	.3217	1.0000		
LAMBCHG	.1824	.1036	-.0121	-.0471	1.0000	.0324
FISHCHG	.2702	.0901	.3826*	.3202	.0324	1.0000
VEGE-OIL	.4004*	-.4282**	-.2207	.0910	.1115	.0397
ANIMAL OIL	-.2421	.2422	-.0197	-.0921	-.0040	-.0897
BUTTER	-.0697	-.1075	-.2523	-.1496	.0053	.0766
FRIED FOOD	-.1086	.2549	-.0484	.1213	.1020	-.0637
EGGCHG	.3861*	-.0246	.0246	.0015	-.2497	.1407
MILKCHG	-.1030	-.0328	.1202	-.0718	.0495	.1227
DAIRYCHG	-.1696	-.0157	.0485	-.1179	.0206	-.0353
TOFUCHG	.1115	.0764	-.2048	-.1954	.0328	.0433
VEGECHG	.1897	-.1753	-.0510	-.1398	-.1242	-.0427
FRUITCHG	-.1390	-.1176	-.1339	-.0445	.0721	.0112
RICECHG	.2380	-.0941	.2101	.2349	.0712	.1280
FLOURCHG	.0635	-.0114	-.2248	-.2306	.1264	-.2711
TEACHG	-.0518	.1196	.2522	.0009	.0507	.0096
COFFCHG	.0944	-.1604	.0992	.0004	-.3510*	.2130
SOFTCHG	-.0089	.3226	-.2504	-.1646	-.0631	-.1209
SUGCHG	.0358	.2415	-.1993	-.1616	-.2276	-.0184

(continued) Correaltion Matrix Between the Variables

	VEGE-OIL	ANIMAL OIL	BUTTER	FRIED FOOD	EGGCHG	MILKCHG
WTCHG	.1635	-.0389	-.0870	.2400	.1428	-.2988
TFAT	.0716	-.0440	-.0973	-.0034	.6192**	.4231*
SAF	.0051	.0062	-.0451	-.0209	.5527**	.6094**
CHO	.1379	-.0685	-.1703	.0603	.9355**	.1910
ALCOHOL	.2207	-.1270	.3631*	-.1539	.0078	-.0093
ACTIVITY	-.1965	-.0812	-.0430	-.1084	-.0378	.2518
STRESS	.2089	.1071	.2045	.2619	.1956	-.1826
AGE	-.0137	-.1663	-.1910	.1635	.1351	.0072
USSTAY	.1207	-.2426	-.1085	.2040	.1723	-.2552
ENGLISH	-.0128	.0659	.1858	.0238	.0885	-.0155
WESTFOOD	-.3649*	.1624	.2087	.3337*	.0890	.2840
CHURCH	.1365	-.1275	-.0891	-.2050	-.0129	-.1328
FRIEND	-.1283	-.0762	.0778	-.1732	.3328*	.0555
SINGLE	-.2369	.0730	.1782	-.1075	-.0112	.3526*
REGION	.2094	-.0799	.1128	.1272	.1925	-.0788
F-AID	.2887	-.1397	-.0437	-.0899	.0150	-.2280
INCOME	.1623	-.3273	-.1292	.0596	-.0039	-.3159
FOODCOST	.0936	-.2132	-.2366	.1136	.2014	-.3547*
PORKCHG	.4004*	-.2421	-.0697	-.1086	.3861*	-.1030
BEEFCHG	-.4282**	.2422	-.1075	.2549	-.0246	-.0328
CHICKCHG	-.2207	-.0197	-.2523	-.0484	.0246	.1202
LIVERCHG	.0910	-.0921	-.1496	.1213	.0015	-.0718
LAMBCHG	.1115	-.0040	.0053	.1020	-.2497	.0495
FISHCHG	.0397	-.0897	.0766	-.0637	.1407	.1227
VEGE-OIL	1.0000					
ANIMAL OIL	-.0782	1.0000				
BUTTER	.1796	.0978	1.0000			
FRIED FOOD	.0231	.2722	-.0303	1.0000		
EGGCHG	.1608	-.0593	-.1433	.0710	1.0000	
MILKCHG	-.3180	.1814	.1026	-.0825	.1084	1.0000
DAIRYCHG	-.2966	.2047	.1009	-.0178	.0919	.9474**
TOFUCHG	-.0415	.1320	.1595	.0234	.2062	.1761
VEGECHG	.0368	.0249	.0679	-.4927**	-.0200	-.0450
FRUITCHG	.3607*	.3161	.2383	.1229	-.0263	-.0191
RICECHG	.1125	.0208	.0652	-.3466*	.0449	.0044
FLOURCHG	.1467	.0001	.0147	.1167	.1483	.0254
TEACHG	.0832	-.1529	-.1563	.1946	-.0779	-.1812
COFFCHG	.0734	.0453	.1201	-.1805	.0722	-.0596
SOFTCHG	-.0905	.3291*	.2091	.1931	.0826	.1089
SUGCHG	-.0543	.3450*	.2622	.1047	.1153	.0789

(continued) Correlation Matrix Between the Variables

	DAIRYCHG	TOFUCHG	VEGECHG	FRUITCHG	RICECHG	FLOURCHG
WTCHG	-.3391*	-.0274	-.2394	.2181	-.0072	-.0520
TFAT	.3795*	.2102	.0264	-.1861	.2098	.0392
SAF	.5819**	.2367	.0250	-.1758	.1781	.0622
CHO	.1463	.1977	-.0205	-.0936	.1392	.0697
ALCOHOL	.0248	-.1114	-.0319	-.0424	.3662*	-.1819
ACTIVITY	.2113	.2530	-.0180	-.0379	-.2161	.0583
STRESS	-.1699	.2297	-.1205	.1321	-.1684	.0089
AGE	.0084	-.2375	-.1831	-.1850	-.1284	.0413
USSTAY	-.2561	-.0239	-.1464	-.0572	.2582	-.3368*
ENGLISH	.0879	-.1480	-.0793	.2100	.2520	-.2328
WESTFOOD	.3298*	.2673	-.3353*	-.0095	-.5099**	.2007
CHURCH	-.1072	-.0161	-.0564	-.1432	.1134	.0893
FRIEND	.0478	.0289	.0674	-.0013	.2830	-.2625
SINGLE	.3275	.0247	-.2164	-.0777	.0080	.0186
REGION	-.0666	-.0276	-.2288	-.0906	.2288	-.3817*
F-AID	-.2297	-.1922	.1747	.0099	.4459**	-.2367
INCOME	-.3084	-.2604	-.0116	-.1806	.2483	-.2533
FOODCOST	-.3214	-.1957	.0542	-.0337	.0887	-.1817
PORKCHG	-.1696	.1115	.1897	-.1390	.2380	.0635
BEEFCHG	-.0157	.0764	-.1753	-.1176	-.0941	-.0114
CHICKCHG	.0485	-.2048	-.0510	-.1339	.2101	-.2248
LIVERCHG	-.1179	-.1954	-.1398	-.0445	.2349	-.2306
LAMBCHG	.0206	.0328	-.1242	.0721	.0712	.1264
FISHCHG	-.0353	.0433	-.0427	.0112	.1280	-.2711
VEGE-OIL	-.2966	-.0415	.0368	.3607*	.1125	.1467
ANIMAL OIL	.2047	.1320	.0249	.3161	.0208	.0001
BUTTER	.1009	.1595	.0679	.2383	.0652	.0147
FRIED FOOD	-.0178	.0234	-.4927**	.1229	-.3466*	.1167
EGGCHG	.0919	.2062	-.0200	-.0263	.0449	.1483
MILKCHG	.9474**	.1761	-.0450	-.0191	.0044	.0254
DAIRYCHG	1.0000					
TOFUCHG	.1492	1.0000				
VEGECHG	-.0950	-.0025	1.0000			
FRUITCHG	-.0674	-.0550	.0892	1.0000		
RICECHG	.0154	-.0716	.2574	-.1073	1.0000	-.5544**
FLOURCHG	-.0024	-.0188	.0661	.2360	-.5544**	1.0000
TEACHG	-.2066	-.0499	-.2986	-.0294	.1042	-.1054
COFFCHG	-.1247	.0044	.3391*	.1088	.3024	-.1055
SOFTCHG	.1696	.2833	-.0521	-.0695	-.3578*	.2492
SUGCHG	.1079	.2806	.1087	-.0170	-.2091	.1952

(continued) Correlation Matrix Between the Variables

	TEACHG	COFFCHG	SOFTCHG	SUGCHG
WTCHG	.2939	.2117	-.1041	-.0025
TFAT	-.1030	.0055	.1447	.1448
SAF	-.1549	-.0295	.1835	.1665
CHO	-.0676	.0761	.0755	.1101
ALCOHOL	-.0300	.2357	-.1393	-.0257
ACTIVITY	-.1429	-.1208	.1697	.1099
STRESS	.0759	.0400	.1858	.2015
AGE	.2175	-.1078	.0758	.0237
USSTAY	.1680	.0120	-.2507	-.2408
ENGLISH	-.0909	.1145	.0080	.0619
WESTFOOD	-.1285	-.2143	.4279**	.3197
CHURCH	.0305	-.0403	.0506	.0307
FRIEND	-.0974	.1448	-.2225	-.1504
SINGLE	-.1883	-.1560	.2495	.1718
REGION	.1494	-.0460	-.1232	-.1429
F-AID	.1380	.2608	-.3860*	-.2565
INCOME	.2423	.2148	-.3266	-.2198
FOODCOST	.1959	.3413*	-.3171	-.1508
PORKCHG	-.0518	.0944	-.0089	.0358
BEEFCHG	.1196	-.1604	.3226	.2415
CHICKCHG	.2522	.0992	-.2504	-.1993
LIVERCHG	.0009	.0004	-.1646	-.1616
LAMBCHG	.0507	-.3510*	-.0631	-.2276
FISHCHG	.0096	.2130	-.1209	-.0184
VEGE-OIL	.0832	.0734	-.0905	-.0543
ANIMAL OIL	-.1529	.0453	.3291*	.3450*
BUTTER	-.1563	.1201	.2091	.2622
FRIED FOOD	.1946	-.1805	.1931	.1047
EGGCHG	-.0779	.0722	.0826	.1153
MILKCHG	-.1812	-.0596	.1089	.0789
DAIRYCHG	-.2066	-.1247	.1696	.1079
TOFUCHG	-.0499	.0044	.2833	.2806
VEGECHG	-.2986	.3391*	-.0521	.1087
FRUITCHG	-.0294	.1088	-.0695	-.0170
RICECHG	.1042	.3024	-.3578*	-.2091
FLOURCHG	-.1054	-.1055	.2492	.1952
TEACHG	1.0000			
COFFCHG	-.1257	1.0000		
SOFTCHG	-.3157	-.2039	1.0000	
SUGCHG	-.3696*	.2712	.8870**	1.0000