# Health Status And Dietary Intakes Of Elderly Mainland Chinese In Auckland

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# ABSTRACT

**Objective:** To produce baseline data on the food consumption patterns, dietary intakes, anthropometric measurements and physical activities of Mainland Chinese elderly over 60 years living in Auckland, and reveal any changes in these measurements after immigration. The impacts on health status were assessed.

**Subjects:** Twenty-five men and twenty-five women aged over 60 years, who were born in Mainland China and have immigrated to New Zealand.

**Method:** Three 24-hour recalls were used to evaluate dietary intake. Questionnaires were pre-tested before survey, and were used to determine the demographic details, eating habits, food consumption patterns, life style and physical activity patterns. Anthropometric measurements included body weight, height, skinfolds, elbow breadth, body circumferences, blood pressure, blood glucose level, body mass index (BMI), waist/hip ratio, arm muscle circumference, arm muscle area, and percentage body fat were also calculated.

**Results:**

- Because of the language barrier the use of New Zealand health services, such as visiting a general practitioner, was low.
- On average BMI in men (24.5kg/m$^2$) was lower than that in women (24.8kg/m$^2$). Men also had larger waist circumferences than women, but they had similar hip circumferences. Thus, men had a larger waist/hip ratio (0.87) than women (0.84) ($p<0.05$). Men and women had similar mean systolic and diastolic blood pressures (130.5mmHg, 83.8mmHg vs. 130.5mmHg, 81mmHg), however, men's mean blood glucose level were higher than women's (6.0mmol/l vs. 5.5mmol/l).
- According to the WHO BMI standards, 48% of male and 52% of female subjects in the present study were considered overweight. Only one man had impaired glucose

tolerance. BIA readings indicated 60% of men and 64% of women had a percentage body fat over 25% and 32% respectively.

- Using the criteria in the New Zealand Health Survey, 64% of male subjects and 44% of female subjects were highly active compared to 53.8% of their New Zealand counterparts.
- In this study, the average energy intakes of Chinese elderly were 8,932kJ and 7,032kJ for men and women respectively. Average protein per kilogram of body weight intakes were 1.24g/kg and 1.21g/kg for men and women. Mean total energy from protein was 15.8% and 17.2% for men and women respectively. Of all study subjects, 88% had fat intakes between 15% and 33% of total energy, which met the New Zealand Nutrition Taskforce recommendation. Total mean energy from carbohydrate for the male and female subjects were 55% and 54.7% respectively.
- Compared to the Chinese RDA's and Australia RDI's, the intakes of calcium, zinc, vitamin A and vitamin D were insufficient. All subjects also had insufficient dietary selenium according to the Australia RDIs. Their iron status requires further research.
- Systolic and diastolic blood pressures, and blood glucose levels in male study subjects were positively correlated with BMI. Body weight, waist circumference, hip circumference, waist to hip ratio and BMI for men were also positively correlated with systolic blood pressure. However, no significant correlations were observed for female subjects.
- Education level was positively related to rice consumption and vitamin A intake, and negatively related to meat intake, salted vegetable intake, salt intake and sodium intakes for both men and women. Family income was positively related to meat consumption. Therefore, socio-economic status may influence the food habits and nutrient intakes of the study subjects.

**Conclusion:**

- A trend towards increasing BMI and body fat has been found in a Chinese elderly population in New Zealand. The maintenance of traditional dietary habits and

encouragement to increase physical activity levels are important in this population group.

- Energy, protein and carbohydrate intakes of the Chinese elderly were sufficient. Inadequate intakes of calcium, zinc, vitamin A, vitamin D, selenium and fiber were the main nutritional problems in this group. Therefore, foods rich in these nutrients should be recommended for the migrant Chinese elderly. Some nutrient supplements may be necessary. Dietary intakes should be monitored with time.
- Socioeconomic factors, such as education and family income, affect food habits and nutrient intakes in this population.

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# CHAPTER 1. INTRODUCTION

One of the New Zealand Ministry of Health goals in Healthy People 2010 is to target risk factors for disease in special populations. The Asian population is the fastest growing population in New Zealand and ethnic Chinese are the largest Asian subgroup in New Zealand (Statistics New Zealand, 2001a). In 2001, the ethnic Chinese population in New Zealand was over 100,000. About 70 percent of these Chinese New Zealanders were part of the "new wave" of immigrants who came to New Zealand after 1987. This "new wave" resulted from the introduction of the 1987 Business Immigration Policy (BIP) and the 1991 'Point System' designed to import immigrants with professional skills and capital for investment (Ip, 1995). Following the wave of immigration of younger Chinese, a large number of elderly dependent Chinese immigrated to New Zealand under the Family Reunion Category to live with their sons or daughters. According to Statistics New Zealand (1986, 1996), there were only 2,641 elderly Chinese immigrants aged 50 years and over in 1986, and this number increased to 7,089 in 1996. In this new environment, many of the new elderly Chinese immigrants are not only perceived to be suffering from language difficulties, changing relationships between family members, discontent, stress, and cross-culture shock, but they also face new health problems. As elderly family members of an ethnic minority group, they have not received much attention in New Zealand society. These elderly Chinese are at the age when they need extra medical attention. However, little research has been conducted on Chinese immigrants' dietary patterns and health needs, especially elderly Chinese immigrants.

A relationship exists between diet, nutrition, health and disease (Willett, 1990). Food intake is thought to influence the risk of developing cardiovascular disease, diabetes mellitus, hypertension, hyperlipidaemia and some cancers (Hsu-Hage et al., 1993). A typical Chinese diet consists primarily of rice, vegetables, and noodles; the major ingredients of the Western diet are breads and cereals, animal protein, fats and sugar. These dietary patterns explain why the prevalence of coronary heart disease in China is among the lowest in the world (The WHO Monica Project, 1988). Compared to Chinese

persons living in Asia, Chinese immigrants tend to have higher rates of several chronic diseases, including hypertension, diabetes, heart disease and cancers of the colon, breast, and prostate (Chen et al., 1993; Whittemore et al., 1995; Whittemore et al., 1990).

In this study, dietary intakes, body composition, blood pressure, and blood glucose level in a sample of Chinese elderly living in New Zealand will be assessed to provide insight into their dietary trends and their potential impact on health status and aging.

# CHAPTER 2. LITERATURE REVIEW

## 2.1 THE EFFECT OF IMMIGRATION ON NUTRITIONAL STATUS AND DISEASE INCIDENCE

### *2.1.1 Introduction*

A relationship exists between diet, nutrition, health and disease (Willett, 1990). The process by which immigrant (or minority) groups adopt the behavior and cultural traits of the host country (or majority group) is referred to as acculturation (Negy & Woods, 1992). Immigrants may experience a number of acculturation conflicts as they become more exposed to the traditions, values, and norms of the majority society. They are faced with the challenge of resolving issues related to the existence of two differing world views, those of their own culture and those of the dominant culture.

Most immigrant groups bring with them their own 'dietary culture'; their traditional beliefs and practices relating to food. Not only does this ensure a sense of cultural continuity with their countries of origin, but it also plays many symbolic, religious and social roles in their daily lives. Food habits are one of the important indicators of acculturation.

Culture and ethnicity play an important role in patterning food behaviour in immigrant groups (Sanjur, 1995). An acculturation study in the United States found that disease patterns in immigrants whose food consumption remains consistent with their traditional culture, more closely resemble those of the home country (Lee & Huang, 2001). In a sociocultural model, major determinants of food habits are the traditional food culture, food availability, and household economy (Axelson, 1986). Migrant populations are particularly sensitive to these determinants because of an inevitable pressure to change after migration (Powles et al., 1988; Newnan, 1986).

The major ingredients of the North American diet are bread and cereals, animal protein, fats, and sugar. A diet that results in increased body weight and prevalence of coronary heart disease, stroke, and certain types of cancer (Lee & Huang, 2001). As immigrants

become acculturated, they are more likely to suffer similar kinds of illness as their host countries. An early study on Japanese immigrants in North America showed they developed the same disease patterns as North Americans (Kagan et al., 1974). Romero-Gwynn conducted a study on obesity in Mexican Americans living in California and found that obese immigrants had become acculturated and given up much of their traditional diet in exchange for one higher in fats and sugars (Romero-Gwynn, 1992).

Using general characteristics to define immigrant populations can be dangerous because of the numerous differences that exist. Diseases and customs that apply to one immigrant group may not hold true for another group. For example, differential coronary heart disease rates occur in the three major ethnic groups in Singapore due to ethnic differences in prevalence of diabetes, insulin resistance, central obesity, hypertension, smoking and lipid profile. These differences are related to not only genetic factors but also to food behaviours (Tan et al., 1999). In the United States, a study found that the problem of obesity in Hispanic populations was multifactorial, reflecting genetic, environmental, cultural, and socio-economic factors (Sanjur, 1995). Another study reported differences in mean blood pressure levels within and among three population groups (Hispanic Americans, Native Americans, and Asian/Pacific Islander Americans) in America; such differences are also apparent in comparisons of these groups with American white and black populations. Although they appear modest, these differences are sufficient to result in increased mortality rates in populations with higher levels of hypertension (Guillermo, 1992). Lifestyle influences, e.g. activity levels, smoking etc, appear to underlie most of these differences (Havas et al., 1996). A study of the elderly in USA found physical inactivity, abdominal obesity, hypertension and cigarette smoking had different effects on the prevalence of cardiovascular disease in type II diabetes patients of different ethnicity (Sundquist et al., 2001). According to the America mortality data, Asian Americans had lower heart disease and diabetes than white Americans (Yu et al., 1985).

### *2.1.2 Studies on Chinese immigrant populations*

#### *2.1.2.1 Dietary changes*

When the Chinese from China move to a new country, they experience differences in language and values, which lead to feelings of loss, rejection, and frustration (Furnham

& Bochner, 1986). One Chinese immigration study in North American found that the strongest predictors of acculturation to a Western diet were younger age, high education, employment outside the home, and longer percentage of life in North America (Jessie et al., 2001). Generally, the elderly may face more intense culture shock, because they experience a changing cultural environment along with the aging process (Lee & Ellenbecker, 1998).

Studies on Chinese respondents show significant differences between the food habits of their country of origin and their country of residence (Kim et al., 1993: Ho et al., 1966). This cultural congruence with country of origin remains true whether studying food habits and beliefs (Newman & Ludman, 1984), food and life-cycle events (Newman et al., 1988), food and health behaviours (Newman et al., 1991; Newman, 1995), or salt and sugar intake of the Chinese populations living in more than one country (Newman, 1999).

Chinese have lower rates of most chronic diseases associated with high saturated fat, high energy Western diets. However studies comparing the health of migrants with that of the home and host population have documented that migrants usually make lifestyle changes away from that of the home country toward that of the country of settlement. The changes in food habits of various Chinese immigrant groups have been well documented.

Early in 1978, Grivetti conducted a study on first generation Chinese Americans to determine the difference in consumption of traditional and non-traditional foods, when living in China and after living in the USA (Grivetti & Bequette, 1978). The results showed that this Chinese group gradually changed their intake of some foods, for example they ate more meat, dairy products and beverages (e.g. soft drinks, alcohol drinks) but less seafood. Their food patterns were closer to those in North America, than those in China. Other studies also showed that Chinese immigrants in North American ate more meat and dairy products (Lee et al., 1994; Lee, 1994).

Western dietary acculturation was significantly associated with higher fat intakes. Pan et al reported a significant post immigration increase in consumption of fats and sweets among 71 Asian-immigrant students living in the United States (Pan et al., 1999). Another study showed that 78% of migrants Chinese drink milk, 78% ate cheese, 56%

ate at Western fast-food restaurants and 72% ate between meals. All these practices were likely to increase fat intakes (Satia et al., 2001). Fifty six Chinese-American women aged 18 to 35 years in San Diego, California area reported consuming about 34% of energy from fat, mirroring the national average (Schultz et al., 1994). In a study comparing dietary habits, physical activity, and body mass index between 2,488 healthy Chinese residing in North America and those in China, differences in the fat intake of the two populations had been found. Chinese in China consumed more total energy and carbohydrate but less fat (males 74.5 g in China vs. 82.0 g in North America, females 56.0 g in China vs. 68.8 g in North America) than did Chinese in North America (Lee et al., 1994).

Generally speaking, studies showed higher fruit and vegetable consumption in China than in Western countries. Several studies found that Chinese in China had higher fruit and vegetable intakes than those in North America, even among people of Chinese descent (Whittemore et al., 1995; Whittemore et al., 1990; Lee et al., 1994). However, one study of 244 Chinese women living in Canada found that their consumption of fruit and vegetables was higher after immigration. This may be associated with higher socio-economic status, which may provide more exposure to nutrition education messages in English, such as 5 Plus a Day. Another explanation may be that more acculturated respondents have incorporated "new" food such as fruit juices into their diets, while retaining some traditional food items, such as green leafy vegetables (Satia et al., 2001).

The younger, highly educated Chinese employed outside the home had the highest Western dietary acculturation scores, while the elderly migrants were more likely to keep their traditional eating habits (Satia et al., 2001).

#### 2.1.2.2 Change in the incidence of chronic disease

The higher rates of some chronic diseases seen in Chinese-Americans and Chinese-Canadians have been largely attributed to environmental factors, especially changes in dietary intake and physical activity (Whittemore et al., 1995; Lee et al., 1994).

Although the Asian population has traditionally represented a low-risk group in terms of coronary heart disease (CHD), the increased Westernization of this group has led to a concomitant increase in CHD (Webster 1997; Lien et al. 1998). There are many studies

showing a higher CHD rate in Chinese immigrants compared to that in China. Westernized Chinese individuals in Hong Kong, Sydney, and San Francisco, California, were found to have thicker inner walls in their carotid arteries than study participants in Pan Yu, a town in Guangdong Province in southern China (Woo et al, 1999a). In Australia, while Asian mortality from CHD is significantly less than the Australian-born population, rates tend to increase after their first 10 years of residence in Australia (National Heart Foundation, 1996). Adult Melbourne Chinese immigrants have a cardiovascular risk profile comparable to all Australians (Hsu-Hage & Wahlqvist, 1993). The prevalence of treated hypertension in Chinese immigrant women was similar to that among their Australian counterparts (Hsu-Hage et al., 1995). Furthermore, it was shown that Melbourne Chinese had plasma total cholesterol and triglyceride levels similar to the Australia norm. It was hypothesised that an increase in cardiovascular risk in Asian Australians after migration is attributable to changing life-style and dietary practices.

In America, for every age group examined, Asian-born Chinese living in New York had higher total cholesterol levels than both urban and rural Chinese in Shanghai (Pinnelas et al., 1992). Chinese living in Mainland China have a 4-7 times lower rate of colorectal cancer than Chinese migrants to America. Their risk increases with number of years of living in America. As they become acculturated and change to a Western diet, they develop colorectal cancer at the same rate as Americans. Relative to their diet in China, the migrants to America begin to eat more meat and fat, and less grains. (Whittemore et al., 1990)

The apparent growth of Asian susceptibility to CHD, fuelled by factors such as changing dietary behaviors and high incidence of smoking, reinforces the importance of identifying Asian migrants' knowledge, beliefs and health seeking behaviors about CHD in order to plan culturally sensitive future services.

### *2.1.3 Chinese immigrants in New Zealand*

#### 2.1.3.1 Asian immigrant and Chinese population in New Zealand

New Zealand's Asian population is projected to grow from 186,000 in 1996 to 370,000 by 2016. This represents an increase of 184,000 or 99 percent during the 20-year period. The age structure of the Asian population will undergo significant change in coming

years. Given the prospects of continued below replacement fertility and increasing life expectancy, the Asian population will become progressively older. Half the Asian population will be older than 34 years by 2016, compared with a median age of 27 years in 1996. (This compares with 45 and 33 years respectively for the total New Zealand population.) The 65+ age groups are projected to increase by 22,000, from 5,000 in 1996 to 27,000 in 2016. The Asian share of the total New Zealand population will more than double, from three percent to seven percent in this time (Statistics New Zealand, 2001a). The Asian resident population count in 1991, 1996 and 2001 is shown in Table 2.1.

**Table 2.1: Asian population in New Zealand in 1991,1996 and 2001**

| | **Asian ethnic population (Census year)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Age group | **1991** | | | **1996** | | | **2001** | | |
| | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| <60 years | 47,526 | 47,991 | 95,520 | 79,677 | 85,551 | 165,231 | 105,099 | 116,439 | 221,544 |
| 60 years and over | 1,869 | 2,370 | 4,236 | 3,651 | 4,623 | 8,274 | 7,545 | 8,376 | 15,915 |
| Total | 49,395 | 50,361 | 99,756 | 83,328 | 90,174 | 173,505 | 112,644 | 124,815 | 237,459 |

Adapted from Statistics New Zealand, 2001a

The Chinese settled in New Zealand early in 1866 (Vasil & Yoon, 1996). At that time, the majority of the Chinese worked as gold-seekers in Otago and the West Coast. Nearly all were males of Cantonese rural origin. Since the government instituted the "open door" immigration policy in the late 1980s, there has been a new wave of Chinese immigrants into New Zealand from all over Asia (Tay, 1996). More than seventy percent of Chinese live in Auckland (Ho et al., 1997).

Chinese residents' country of origin is shown in Table 2.2, and the proportion that are New Zealand born is shown in Table 2.3.

**Table 2.2: Origin of Chinese residents in New Zealand in 1991, 1996 and 2001**

| Chinese Ethnic Groups | Chinese resident populations (Census Year) | | |
|---|---|---|---|
| | 1991 | 1996 | 2001 |
| Chinese (Mainland) | 44,136 | 78,663 | 100,203 |
| Hong Kong Chinese | 69 | 225 | 87 |
| Kampuchean Chinese | 3 | ~ | 12 |
| Malaysian Chinese | 60 | 357 | 489 |
| Singaporean Chinese | 174 | 312 | 303 |
| Vietnamese Chinese | ~ | 15 | 69 |
| Taiwanese Chinese | ~ | 2,721 | 3,768 |
| Chinese (not sure) | 471 | 27 | 48 |
| Total Chinese | 44,793 | 81,309 | 104,580 |

Source: Statistics New Zealand, 2001a

**Table 2.3: Proportion of New Zealand born Chinese in New Zealand**

| Ethnic Group | 1991 | 2001 | Change |
|---|---|---|---|
| New Zealand born Chinese | 15,264 | 25,473 | 10,209 |
| Overseas-born Chinese | 28,401 | 78,519 | 50,118 |
| Total Chinese | 44,793 | 104,583 | 59,790 |

Source: Statistics New Zealand, 1998c

Over the past decade, the Chinese population in New Zealand has grown from 44,793 in 1991 to 104,583 in 2001. Although the median age of the Chinese ethnic group was 28.8 years, the overseas-born Chinese population had a much higher median age (34.2 years) than the New Zealand born Chinese population (12.4 years). Over half (56 percent) of New Zealand-born Chinese were aged less than 15 years in 2001, reflecting the fact that new immigrants often start families in New Zealand. The overseas-born Chinese were also concentrated in Auckland (69 percent) (Statistics New Zealand 1998c). About 70 percent of these Chinese New Zealanders were part of the "new

wave" of immigrants who came to New Zealand after 1987. This resulted from the introduction of the 1987 Business Immigration Policy (BIP) and the 1991 'Point System' designed to import immigrants with professional skills and capital for investment (Ip, 1996). The great majority of immigrants who entered New Zealand from Mainland China came under the "skills" categories (79%), where skills, education, and youth counted most. According to the migration policy, most Chinese from Mainland China qualified to migrate when they were in their late 20s or early 30s. So their modal cohort was around 30 years (Friesen & Ip, 1997). Following the wave of immigration of younger Chinese, a large number of elderly dependent Chinese immigrated to New Zealand under the Family Reunion Category to live with their son or daughter. According to Statistics New Zealand (1986, 1996), there were only 2,641 elderly Chinese immigrants aged 50 years and over in 1986, and this number increased to 7,089 in 1996. The young immigrants who were chosen by New Zealand for their qualifications, expertise, age, health and wealth meant that they were generally highly educated young urban dwellers. Most of them have good family backgrounds, which were able to give them a good education. Therefore most of their parents are likely to come from urban areas with higher education and wealth.

In the new environment, many of the new elderly Chinese immigrants are perceived to be suffering from language difficulty, changing relationships between family members, discontent, stress, and cross-culture shock. They also face new health problems. As elderly family members of an ethnic minority group they have not received much attention in New Zealand society.

### 2.1.3.2 Dietary intake of Chinese immigrants in New Zealand

The New Zealand population is culturally diverse. The well-being of immigrants to New Zealand will therefore have a significant impact on the national health profile. The causes of poor health are complex. A society's understanding of the determinants of health has an important influence on the strategies it uses to maintain and improve the health of its population (Mustard, 1996).

The Chinese are one of the fastest growing ethnic groups in New Zealand. Although there are more than 100,000 Chinese in New Zealand, little research on their dietary patterns, health and health needs has been carried out. Language and cultural obstacles

have challenged health workers and policy makers seeking to understand the health status and needs of this population.

Of the published studies on New Zealand Chinese only three are in the nutrition area.

- Tan's study examined the impacts on health of dietary change in Mainland Chinese women aged between 20 to 45 years. She found that all mean anthropometric measurements were higher in the longer resident (>4years) group than in the newly arrived group (<2years). Immigrant Chinese women had excessive fat/energy ratios, inadequate intakes of calcium, and high intakes of sodium in their diets (Tan, 2001).

- Lu's study assessed the food and nutrient intake, activity levels and body composition of migrant Chinese children (aged between 7 to 10 years of age) living in Auckland, and compared the results with data from European children of the same age in New Zealand. The study found a trend towards increasing fat and protein intake of this study group. Vitamin A intake of these subjects was low (Lu, 2002).

- Soh examined the food consumption patterns of pre-school Chinese children, sources of nutrition information and nutrition concerns of immigrant Chinese families living in Dunedin. She found that Chinese parents determine the pre-school Chinese children's food pattern and most kept to their traditional food habits. She also found that less than 40% of children were eating the recommended number of serving of fruits and vegetables (Soh et al., 2000).

There is no information available on the older Chinese populations, who may be at greater risk of nutritional deficiencies.

## 2.2 CHANGES WITH AGE

### *2.2.1 Factors affecting nutritional status of the elderly*

#### 2.2.1.1 Changes in normal physiology

After reaching middle age, the physiologic functions of the body tend to decline with time. Aging changes include loss of teeth, decreased secretion of digestive fluids and

weakened gastrointestinal peristalsis that can directly impede the absorption of nutrients from ingested foods. The relationship between a reduced appetite and nutritional status of the elderly has been well studied. Loss of smell and taste are common in the elderly. Lack of either can lead to reduced appetite, which has been recognized as an important predictor of malnutrition among the elderly (Mowe & Bohmer, 2002). Nutrient absorption may also be affected. For example, decline in the rate of hydrochloric acid secretion by the stomach results in hypochlorhydria, which has a negative impact on vitamin $B_{12}$ absorption (Byrd & Russell, 1993; Russell, 1997) and age related decline in intestinal vitamin D receptor protein concentration has been estimated to account for 12% to 30% of the age-related change in calcium absorption (Kinyamu et al, 1997).

#### 2.2.1.2 Changes of social status

Aging is often accompanied by various socio-economic changes. Social isolation and loneliness are issues of relevance to the health of older people. The lack of social relationship is as much a risk factor for health as cigarette smoking, high blood pressure, obesity and lack of physical activities (Tang et al., 1995). Epidemiological studies show an associated lower mortality risk where people are part of a network of family and friends (Rowe & Kahn, 1987). De Castro and de Castro reported that less energy is eaten at meals taken alone than at meals eaten in company, with the difference in energy intake between the two situations being a substantial 30% (de Castro & de Castro, 1989). Furthermore, there is a positive association between the frequency of eating restaurant food and body fatness (McCrory et al., 1999). Because of social isolation and functional disabilities, older adults may eat out less frequently.

Other social-economic factors include income, education and occupation. A Canadian study that looked at health status as measured in relation to income adequacy, education and occupation amongst older people living in the community, found that income adequacy was the most consistent predictor of health status (Cairney & Arnold, 1996). The third American National Health and Nutrition Survey demonstrated that food insufficiency exists among the US elderly population, and that its prevalence is associated with the income status of the elderly (Alaimo et al., 1998). Poverty and living alone are important factors associating with decreased dietary variety for the elderly (Roberts, 2002; Fanelli & Stevenhager, 1985; Ausman & Russell, 1999). Decreased

dietary variety might lead to decreased energy intake, thus positively associating with weight loss among the elderly (McCrory et al., 1999).

#### 2.2.1.3 Increased prevalence of chronic diseases

According to American Health and Nutrition Survey data, more than 50% of the elderly over 65 years of age suffer from one form of disability and 33% of the elderly suffer from at least one type of severe disability (Alaimo et al., 1998). Arthritis, hypertension, heart disease, hearing impairments, orthopaedic impairments, cataracts, sinusitis and diabetes are the most frequently found health problems that pose difficulties for the elderly in carrying out activities of daily living.

The leading cause of death among older people worldwide is vascular disease and associated chronic conditions (Murray & Lopez, 1997). According to WHO data, of more than 50 million deaths worldwide in 1997, 50% were due to vascular disease (WHO, 1998).

The epidemic growth of type II diabetes is one of the clearest outcomes of the nutrition transition in recent years. Its prevalence is currently higher in developed than in developing countries, but is increasing at a much more rapid rate in the developing countries (King et al., 1998). In China the prevalence of diabetes in adults aged 25–64 in 1994 (2.5%) was 300% greater than it had been in 1984 (Pan et al., 1997). Diabetes incidence was associated with age.

Increased prevalence of obesity, heart disease, cancer, arthritis, osteoporosis, diabetes and other chronic disease among aged people can result in changes in the diet, decrease in strength and ability to shop or cook, and disturbances in the ability of the body to utilize nutrients normally.

#### 2.2.1.4 Use of therapeutic drugs

For individuals taking medication for long periods of time, drug-nutrient interactions may lead to vitamin or mineral deficiencies. The elderly are prescribed more drugs than any other age group because of the high prevalence of many chronic diseases. As well, over-the-counter drugs are also commonly used among older people. Hanlon et al.

found high rates of use of over-the-counter drugs in the >=65 years United States population (Hanlon et al., 2001). The elderly cannot metabolize and excrete drugs as well as younger adults. Therefore the effects of the drug may last longer in the elderly person. In addition, drugs can interact, resulting in exaggeration of toxic or undesired effects.

Medications can affect how the body uses nutrients. They can decrease appetite, cause nausea or vomiting, or a dry mouth e.g. cancer medications. This can affect nutritional health by reducing food intake (Nesse et al., 1980). Some medications can decrease nutrient absorption. The cholesterol-lowering medications cholestyramine and colestipol (both known as bile acid sequestrants), may reduce the body's ability to absorb vitamin A. Medication can also increase the loss of a nutrient. Large amounts of aspirin can cause increased loss of folate. Also, large amounts of aspirin over long periods of time may cause stomach bleeding that could result in iron deficiency, and over time anaemia (Schlenker, 2000).

Nutrient supplements themselves can result in nutrient interactions. In excessive amounts vitamins and minerals act like drugs instead of nutrients and may interact with other nutrients or may even be toxic. For example, large amounts of zinc can interfere with copper and iron absorption. Similarly, large amounts of iron can interfere with zinc absorption (Garrow, 2000).

### *2.2.2 Surveys of dietary intake in the elderly*

A worldwide study conducted between 1970-1988 among non-institutionalised older people found that inadequate intakes of fruits and vegetables and milk or milk products are common. Calcium, zinc, magnesium, vitamin $B_6$, folate and potassium were likely to be the nutrients least adequately supplied in the diets of older people and complex carbohydrate and fiber intakes were below recommended levels (Horwath, 1989). Another study reviewed the results of 37 studies on dietary intake of water-soluble vitamins in adults over 60 years published between 1980 and 1993. This review confirmed that dietary intakes were most frequently below country specific recommendations for vitamin $B_6$ and to a lesser extent folate (Van der Wielen et al, 1994). Although relative to current recommendations dietary intakes of thiamine,

riboflavin and vitamin $B_{12}$ generally appeared to be adequate for older adults, some studies suggested that requirements for these vitamins might be higher in old age (Russell & Suter, 1993).

Large-scale national surveys in Britain, USDA Food Consumption Surveys NHANES I, II and III and the national Diet and Nutrition Survey found inadequate intake of many nutrients including energy, fat, riboflavin, calcium, zinc and vitamins $B_6$, A and C in high percentages of older people (Briefel et al., 2000; USDA, 1995; Finch et al., 1998).

The Australia National Nutrition Survey obtained data from 902 males and 1,058 females aged 65 and over and investigated the proportion of Australian adults >65 years with nutrient intakes less than 70% of the current Australia RDIs. The results showed that intakes of vitamin A, magnesium, potassium and calcium were less than 70% RDI in 12-24% males and 14-61% females. In addition 10% and 43% females had low intakes of folate and zinc respectively. None of the participants had intakes of niacin or vitamin C less than 70% RDI (Bannerman et al., 2001).

A study used 3 day 24-hour recall to evaluate dietary intake in169 Chinese, 90 Korean and 50 Japanese elderly (65 and over) living in Chicago America. It showed that calcium was mainly inadequate in the diet of these subjects. There was also a lack of protein and vitamin A and C in their diets (Kim et al., 1993).

Thus most of elderly studies showed that inadequate intake of calcium, zinc, vitamin A, vitamin C and vitamin $B_6$ were common among these populations.

### *2.2.3 Change in dietary intake with aging and its impacts*

Food intake gradually declines throughout adult life. Between ages 20 and 80, mean energy intake is reduced by up to 1,200 kcal in men and 800 kcal in women (Wakimoto & Block, 2001). This age-related reduction in food intake has been documented in virtually every large-scale study of healthy, community-dwelling elderly (Vellas et al., 1996). The causes of this are thought to be reduced physical activity, decreases in resting energy expenditure, and loss of lean body mass, which together produce a decrease in demand for calories (Hunter et al, 2001; Klausen et al., 1997).

Malnutrition is more common in elderly persons than in younger adults. Typical causes are chewing or swallowing disorders, cardiac insufficiency, depression, social deprivation and loneliness. Ageing itself, however, leads neither to malabsorption nor to malnutrition, with the exception of a higher frequency of atrophic gastritis in older persons (Pirlich & Lochs, 2001). Malnutrition in elderly people is therefore a consequence of somatic, psychic or social problems. Undernutrition is associated with a worse prognosis and is an independent risk factor for morbidity and mortality.

On the other hand, overweight among the elderly has also caused much concern, especially in developed countries. The latest U.S National Health Survey indicated that, while the United States population as a whole increased total energy intake in the last decade, some of the greatest increases occurred in older adults (Briefel et al., 1995). In addition, recent evidence suggests that impairment in the ability to adapt to dietary change, even in the absence of obvious social and physical constraints, may occur with age. Roberts et al. conducted a 77 day investigation among 35 healthy young and elderly men and found that the elderly, when compared to younger men, had an impaired ability to adjust food intake and normalize body weight following periods of overeating and under eating (Roberts et al., 1994). Roberts concluded that weight loss (or weight gain) in older subjects might be caused by the combination of a reduction in the ability to regulate food intake and other factors, rather than by any one factor alone (Roberts, 2002).

The elderly tend to take more nutrition supplements than the young. Most of them take supplements without medical advice. However, excess intake of some supplements may cause health problems. For example, zinc and small doses of vitamin E can help improve immune response in older subjects. However, large doses of vitamin E were associated with impaired immune responses (Chandra, 1997). In a study of 178 elderly public home residents in England, zinc supplementation was found to decrease plasma lipid peroxides in this elderly population (Fortes et al., 1997).

Discrepancy between actual mineral intakes and recommended amounts has been observed in different groups of elderly subjects. A number of surveys show magnesium, zinc, selenium and chromium intakes by old persons to be lower than the corresponding reference nutrient intakes. In contrast, intakes of iron by the same age group are generally adequate or higher than recommended, and it has been suggested that

increased storage of iron in the elderly may be related to the development of age-related diseases through the increase in oxidative stress. Magnesium and selenium deficiencies among the elderly are also well documented, especially among the institutionalized and people with pathologies. Chromium deficiency is associated with type II diabetes mellitus (Vaquero, 2002). Assessment of the trace elements status in the elderly is difficult as bioavailability may change. Therefore, formulation of mineral recommendations is complex and personalized recommendations may be necessary.

### *2.2.4 Nutrient intakes and chronic disease with aging*

Imbalances in nutrient intakes are now recognized as increasing dietary risk factors for certain diet-related chronic degenerative diseases, such as saturated fat and cholesterol in coronary artery disease. However, all of the chronic degenerative diseases are multifactorial in nature, and diet is only one of many risk factors at work before they become manifest.

Low dietary intakes of vitamin $B_6$ and folate are linked with an increased risk of carotid-artery stenosis in older adults (Selhub et al, 1995). Increased intakes of multi-vitamins and fish oils also have been found to reduce cardiovascular disease (Saldeen & Mehta, 2002). Chen et al. examined the relation between serum vitamins A, C, and E, α-carotene, and β-carotene levels and blood pressure among 15,317 men and women >=20 years of age who participated in the Third National Health and Nutrition Examination Survey in United States. Serum vitamins A and E levels were positively and significantly associated with both systolic and diastolic blood pressure, whereas α-carotene and β-carotene were inversely and significantly associated with systolic, and vitamin C with diastolic blood pressure in multivariate linear regression analyses. These findings indicate that antioxidant vitamins may be important in the underlying cause and prevention of hypertension (Chen et al., 2002). High salt intake and low dietary potassium are also associated with hypertension, and thus may increase the risk of cardiovascular disease (US Department of Health and Human Services, 1997; Taubes 1998; Johnson & Kligman, 1992; Cutler, 1997).

Somewhere in the process of aging there may be the onset of a chronic inflammatory state. Nutrients with anti-inflammatory properties, such as vitamin E and n-3

polyunsaturated fatty acid, may reduce the level of chronic inflammation and thereby ameliorate tissue and functional loss during ageing (Grimble, 2003). Relationships between nutrient intake and cognitive diseases have been shown in studies of the elderly. Although some studies showed increased antioxidant and decreased fat intake had positive effects on cognitive function among elderly, for example, vitamin E intake (Morris et al., 2002), recent studies showed results to the contrary. Neither dietary supplements, nor total intake of carotenes, vitamins C and E was associated with a decreased risk of cognitive diseases in Luchsinger's study (Luchsinger et al., 2003). In Engelhart's study, a high intake of total, saturated, and trans fat and cholesterol and low intake of MUFA, PUFA, n-6 PUFA, and n-3 PUFA was not associated with increased risk of dementia or its subtypes (Engelhart et al., 2002).

### *2.2.5 Change of body composition with aging*

Changes in body composition (decreased lean muscle mass and increased fat mass) results in a decrease in basal metabolic rates, energy needs, and capacity for physical activity (Hoffman, 1993). Novak assessed the body composition of more than 500 men and women between the ages of 18 and 85. He found that body fat increased from 18% to 36% and 33% to 44% in men and women, respectively (Novak, 1972). Cohn and coworkers use total body neutron activation procedures to determine the principal component of the decline in fat-free mass was a decrease in muscle mass, with minimal change in nonmuscle mass (Cohn et al., 1983).

Sarcopenia has been defined as the loss of muscle mass and strength that occurs with aging (Roubenoff, 2001; Muller et al., 1995; Borkan & Norris, 1977; Morley, 1997). Loss of strength in healthy elderly individuals has been estimated at one point five percent per year, and loss of power at approximately three point five percent per year (Sidney, 1981). In the healthy population of the New Mexico Elder Health Survey, the prevalence of sarcopenia increased from 13-24% in persons 20 to 70 years of age to greater than 50% in persons over 80 years of age (Baumgartner et al., 1998).

Sarcopenia appears to be exacerbated by a sedentary lifestyle, nutritional factors, and chronic disease and is associated with impaired functional performance, increased physical disability, and increased risk of fall. A decrease in lean body mass is a

characteristic of aging regardless of energy intake (Forbes, 1976). Weight loss, especially if involuntary, is not a normal part of aging and usually represents some underlying disease process. Functional decline may occur separately from sarcopenia and weight loss (as in a hip fracture or stroke) but often occurs together with these two factors. A recent study of 497 hospitalized patients 65 years of age found that 21% were consuming less than 50% of required energy and that this under-nutrition was associated with increased in-hospital, and 90-day mortality (Sullivan et al., 1999). Community-based studies also show the age-related progression toward frailty. In a follow-up study to the National Health and Nutrition Examination Survey, fifty percent of subjects aged 65–74 had lost at least 5% of their body weight, and 26% of women and 14% of men had lost at least 15% (Williamson, 1993).

Although research indicates that age-related changes in body composition may be modifiable by environmental variables, particularly physical activity, the potential role for diet remains unclear. Despite experimental evidence in support of a direct relationship between energy and/or protein intakes and muscle outcomes (Gray-Donald et al., 1995; Castaneda et al., 1995; Campbell et al., 1995), many observational studies of diet and sarcopenia report null effects (Baumgartner et al., 1998; Baumgartner et al., 1999; Starling et al., 1999).

Old age, presence of disease, poor self-perceived health, poor functional ability, lower level of physical activity, lack of dentures, depression and cognitive impairment were all factors associated with lower anthropometric values. In old-old populations, both age and disease affect anthropometric indices, the change seems being more marked in men (Woo et al., 1995). However, a reduction in food intake is still a predominant cause of weight loss occurring with old age.

### *2.2.6 Change of physical activity with aging*

#### 2.2.6.1 Physical activity and health of the elderly

With aging, physical functional decline is expected. It is thought that between 10% and 25% of persons aged 65 and older are frail, and this proportion increases with age (Fried & Walton, 1998).

The first Surgeon General's Report on Physical Activity and Health released in July 1996 concluded that regular sustained physical activity could substantially reduce the risk of developing or dying from heart disease, diabetes, colon cancer, and high blood pressure (US Department of Health and Human Services, 1996). According to this report, demographic groups at highest risk for inactivity are the elderly, women, minorities, those with low income or less educational background, and those with disabilities or chronic health conditions. A study of 3,075 well-functioning black and white men and women aged 70 to 79 examined the association of physical activity with the decline in mobility in older men and women. It found that physical activity, and especially a regularly active lifestyle slowed the decline in mobility. A beneficial effect was observed for both sports and nonsports activities, independent of the presence of chronic disease (Visser et al., 2002).

Regular physical activity can also play a major role in ameliorating age-related decline in the musculoskeletal systems (Lampman & Savage, 1988; Fiatarone & Evans, 1990; Bendall et al., 1989) and may also prevent the development of, or effectively treat, diseases such as osteoarthritis, osteoporosis and arthritis. Regular exercise reduces body fat stores, increases muscle strength and endurance, strengthens bones, reduces the risk of falls (Buchmer et al., 1993; Wolf et al., 1996) and importantly improves mental health (U.S. Department of Health and Human Services, 1996).

Older individuals who have remained active throughout their lives maintain much of their physical strength, endurance and stamina. Relative to the sedentary elderly, the individual who is habitually active has greater lean body tissue, a lower percentage of body fat and greater bone density. The elderly individual who is physically active is better able to perform activities of daily living and, in general, has a better quality of life. Furthermore, physically active men have a one to two year increased life expectancy compared with inactive men (Paffenbarger et al, 1988).

### 2.2.6.2 Recommended activities for the elderly

Since sarcopenia in the elderly is the most important influence on functional decline in this age group, exercise to increase muscle mass or reduce its rate of loss, will have major benefits on the health of this age group. Strength or resistance training is useful in increasing muscle mass (Evans & Cyr-Campbell, 1997). Aerobic exercise is important

in the treatment of some chronic diseases, such as non-insulin dependent diabetes and cardiovascular disease, and in the maintenance of bone health (Evans, 1997).

Tai Chi is a traditional form of exercise recognized as a suitable aerobic exercise for the elderly. One study examined the two-year trends in cardiorespiratory function among older Tai Chi practitioners and sedentary subjects and found that practicing Tai Chi regularly may delay the decline of cardiorespiratory function in older individuals (Lai et al., 1995). Another study compared heart rate, three minute step test heart rate, modified sit and reach, total body rotation test in 28 male Tai Chi practitioners against 30 sedentary men and found long term regular Tai Chi exercise has favourable effects on the promotion of balance control, flexibility, and cardiovascular fitness in older adults (Hong et al., 2000).

## 2.3 NUTRITION AND THE ELDERLY IN CHINA

### *2.3.1 Food consumption*

#### 2.3.1.1 Food pattern and nutrient intakes in China

The most recent nation-wide nutrition survey in China was held in 1992. A total of 27,000 families consisting of 99,749 subjects were selected from all provinces in China. Household food consumption data was weighed and recorded for three days, and 24 hour diet recall interviews were used to collect food intake data from all individual members of the household for three consecutive days (Ge et al., 1996).

The food consumption pattern and nutrient intake of subjects were presented in separate tables by areas and income levels. The food patterns and nutrient intakes were averaged for all adult subjects (20 years and above) regardless of sex or age, thus the values in this survey are for men and women combined. Men consume more food than women, thus the values are inevitably higher than the normal values for women and lower than those for men. In the rural areas of China, there is no significant difference of dietary intake between weekday and weekend. People generally maintain similar activity and dietary intake throughout the week.

The average daily intake of cereals was 405g (consisting of rice 223g, wheat flour 165g and other grains 17g); vegetables 327g; fruit 80g; meats 100g (61 percent of which was

pork); milk, egg and fishery products 36, 29 and 44g respectively; oil 37g and salt 13g. The intake of cereals and tubers was higher in the low-income group than that in the medium and high-income groups. The intake of animal foods, fruits, vegetable oil, sugar and alcohol was lower in the low-income group than that in the medium and high-income groups (Ge et al., 1996).

The contributions of different food and nutrient intakes of urban Chinese to total energy intake are shown in Table 2.4. The average nutrient intakes per day as a percentage of the Chinese Recommended Dietary Allowances in Urban China are shown in Table 2.5.

**Table 2.4: Food and nutrient intakes of urban Chinese as percentages of total energy intake (mean)**

| Items | Percentage |
|---|---|
| **Energy by food** | |
| Cereals | 57% |
| Beans/peas | 2% |
| Tubers | 2% |
| Animal food | 15% |
| Others | 24% |
| **Energy by nutrients** | |
| Protein | 13% |
| Fat | 28% |
| **Protein by food** | |
| Cereals | 49% |
| Beans/peas | 6% |
| Animal food | 32% |
| Other food | 14% |
| **Fat by food** | |
| Animal food | 39% |
| Plant food | 61% |

Source Ge et al., 1996

The data collected in the 1992 National Nutritional Survey showed that on average, the energy intake was 10,011kJ per person per day, accounting for 99.8% of the Chinese

Recommended Dietary Allowances (RDA). The average daily protein and fat intake was 75g and 78g respectively. The average intake of niacin, ascorbic acid and vitamin E was sufficient, whereas that of zinc, selenium and thiamine was between 80% and 90% of the RDAs. The consumption of calcium, retinol equivalents and riboflavin was lower than that recommended in the Chinese RDAs.

**Table 2.5: Daily nutrients intakes as a percentage of the Chinese Recommended Dietary Allowances in urban China**

| Nutrients | Mean intake/day | Percentage of Chinese RDA % |
|---|---|---|
| Energy (kJ) | 10011 | 100 |
| Protein (g) | 75 | 99 |
| Fat (g) | 78 | ~ |
| Carbohydrate (g) | 341 | ~ |
| Fiber (g) | 12 | ~ |
| Retinol (ug) | 277 | ~ |
| Ret. Eq (ug) | 606 | 74 |
| Thiamin (mg) | 1 | 86 |
| Riboflavin (mg) | 0.9 | 69 |
| Niacin (mg) | 17 | 128 |
| Ascorbic acid (mg) | 96 | 162 |
| Vitamin E (mg) | 37 | 362 |
| Potassium (mg) | 1886 | ~ |
| Sodium (mg) | 7259 | ~ |
| Calcium (mg) | 458 | 53 |
| Phosphorus (mg) | 1077 | ~ |
| Magnesium (mg) | 339 | ~ |
| Iron (mg) | 26 | 184 |
| Manganese (mg) | 7 | ~ |
| Zinc (mg) | 13 | 89 |
| Copper (mg) | 3 | ~ |
| Selenium (ug) | 52 | 104 |

Source: Ge et al., 1996

Inadequate intakes of retinal and riboflavin were also shown in some nutrition surveys conducted in some areas of China (Ma et al., 1992; Zhang et al., 1992; Ge and Chang, 2001).

Calcium was the most deficient nutrient in the Chinese diet (Ge and Chang, 2001), with intakes of around 400-500mg/day (Zhang et al., 1997; Ge et al., 1996; Ge et al., 1995), accounting for only 50% of the RDA. Calcium deficiency is a risk factor for osteoporosis in later life. The consumption of dairy products is very low in China. The lack of pastureland for grazing means that dairy products are simply too expensive to produce in China in comparison with alternative foods, such as soybean and pork products. The national average for milk consumption was reported as being only 11kg per capita per year for all the urban population (Chen 1997). Another reason is that a high percentage of Chinese have symptoms such as intestinal gas, distension, flatulence, cramps, and diarrhea when they consume dairy foods. This is known as lactose resistance and is caused by an insufficiency of the enzyme lactase in the small intestine. They are unable to hydrolyze the lactose. Since the disaccharide is not absorbed, it acts as an osmotic load, causes an outpouring of fluid into the small intestine, provoking increased gastrointestinal motility, and gives rise to severe discomfort, water intake, and diarrhea (Bolin et al, 1979; Elliott WH & Elliott DC, 1997). The situation is somewhat different in large cities, where middle-class families, through Western influence, came to consume a certain amount of milk and butter (Simoons, 1991).

In the absence of dairy products the soybean becomes the main source of protein and calcium in the Chinese diet. Soybeans have the added advantage of building up the nitrogen content of the soil in which they are grown, an important factor in a country which does not rely completely on chemical fertilizers. Soy beans also provide the Chinese with a number of popular seasonings; soy sauce, sweet, brown and hot bean paste, sweet and spicy sauce, and salty fermented black beans. Soybeans are unique among the legumes because they are a concentrated source of isoflavones (Moyad, 1999). Isoflavones have weak estrogenic properties and the isoflavone genistein influences signal transduction. Soyfoods and isoflavones have received considerable attention for their potential role in preventing and treating cancer and osteoporosis (Messina, 1999).

Salt intake/day in China varied geographically, ranging from 13-17 g per person per day in the north to 11-15 g in the south (Chen, 1997). Salt intake by Chinese was very high by Western standards (Tian et al., 1996).

In the 1992 National Nutritional Survey, data on the elderly was not presented separately. Stookey's study in 1991 and 1993 studied 1,397 men and 1,424 women elderly subjects over 60 years in 1991 and 1993. The energy, fat and protein intakes of these subjects are shown in Table 2.6. Another survey on the health of 100 urban elderly conducted by Side et al. in China also studied the nutrient intakes. They are shown in Table 2.7.

**Table 2.6: Energy, fat and protein intakes of Chinese elderly in 1991 and 1993**

| **Mean (SD)** | **1991** | | **1993** | |
|---|---|---|---|---|
| | **Men (n=660)** | **Women (n=737)** | **Men (n=688)** | **Women (n=736)** |
| Energy (kJ) | 10498 | 8822 | 9925 | 8554 |
| Fat (As % of energy) | 26.8(11.2) | 27.4(11.6) | 27.1(11.1) | 27.2(11.2) |
| Protein (As % of energy) | 11.7(2.4) | 11.7(2.3) | 11.9(2.5) | 12.0(2.4) |

Adapted from Stookey, 2000

The Chinese elderly studies showed that the intakes of energy for elderly men and women were equal to or slightly above the RDA. Protein intakes were close to the RDA, which well meets the needs of the elderly. Fat intake provided 27%-32% of the total dietary energy, exceeding the Chinese recommendation of 20-25% from Chinese Nutrition Society (1989), although below the level (30%) according to WHO standards. When compared with the RDA, intakes of calcium, retinal, riboflavin and ascorbic acid were rather low.

Results from these surveys show that the diets of all Chinese share the common characteristics of high carbohydrate content, mainly from starch, and relatively low fat content. Calcium intakes, retinal, riboflavin and fiber intakes were low.

**Table 2.7: Daily mean nutrient intakes for elderly age>=70 years from urban areas of China**

| | Men | | Women | |
|---|---|---|---|---|
| | n=50 | | n=50 | |
| | Mean | % RDA | Mean | %RDA |
| Energy (kJ) | 8.06 | 107 | 7.38 | 110 |
| (kJ/kg body-wt) | 102 | ~ | 140 | ~ |
| Protein (g) | 59 | 91 | 54 | 99 |
| % Total energy from protein | 12.3 | ~ | 12.4 | ~ |
| Fat (g) | 65 | ~ | 57 | ~ |
| % Total energy from fat | 30.3 | 121 | 31.1 | 124.4 |
| Carbohydrate (g) | 276 | ~ | 250 | ~ |
| % Total energy from carbohydrate | 57.1 | ~ | 56.4 | ~ |
| Calcium (mg) | 439 | 55 | 370 | 46 |
| Iron (mg) | 18.0 | 150 | 16.3 | 135 |
| Retinol (ug) | 648 | 81 | 617 | 77 |
| Thiamin (mg) | 1.3 | 111 | 1.2 | 100 |
| Riboflavin (mg) | 0.8 | 68 | 0.7 | 60 |
| Ascorbic acid (mg) | 59 | 98 | 56 | 93 |
| Nicotinic acid (mg) | 11.3 | 94 | 9.6 | 80 |

Data from Side et al., 1991

### 2.3.1.2 Factors affecting food choice in China

- **Socio-economic factors**

According to the Chinese National Nutrition Survey, people in higher income groups had better nutrient intakes than those in lower income groups (Ge et al., 1996). Data from the 1991 (n=1,657) and 1993 (n=1,773) China Health and Nutrition Surveys showed that urban residents with high income consumed less rice and more plant oil, high fat red meats and eggs (Stookey et al., 2000). Distinct differences in dietary patterns and nutrient intakes were found between subjects living in urban and rural areas. The diet of urban people was richer in fat and high quality protein compared with that of rural people. A survey conducted in Tianjin city in China showed that total energy

intake from fat was about 31% in the urban diet and about 21% in the rural diet. Cholesterol intake was much higher among urban people (Tian et al., 1996). A study examined the effects of parental education on the pattern of food consumption and macronutrient (energy, protein, and fat) intake for 3,543 Chinese households in eight provinces of China. The results showed that food consumption patterns are associated with educational levels, for example egg and fruit consumption (Bhandar, 1998).

- **Geographic and climate factors**

It is not surprising that Chinese food is characterized by an assemblage of plants and animals that have grown abundantly in China for many centuries. The main staple in China is rice. China can support a larger population than nations which concentrate on growing wheat, because two to three times as much rice as wheat can be grown in a single acre. Rice is the major cereal staple for southern and eastern China, but consumption of wheat and coarse grains including corn, millet, sorghum replace rice in several northern and central regions (Chen et al., 1990). Wheat is grown in the northern quarter of China in the area north of the Yangtze River and south of Inner Mongolia. It is made into noodles, pancakes and dumplings. (Bread is currently being introduced.) The most important components of the daily diets are grains and cereals, which provide most of the daily energy intake.

The available meat is largely pork and chicken, which can be raised in very little space. China has the largest pork consumption in the world. Currently, per capita red meat consumption in China has reached 35.4 kg, with pork comprising 60-84.7% of this (Ge et al., 1996; Xiong et al., 1999).

Another geographic factor, which has affected food patterns over the centuries, is the scarcity of fuel available for fires. Cooking needs to be done quickly. Dicing, slicing, shredding or cubing food into small pieces before cooking prepares it for quick stir frying or steaming and braising in hot liquid off the fire. And, with small pieces of meat or vegetables, there is always a little bit to go with every bit of rice or noodles. Stir frying, one of the common Chinese cooking techniques, also preserves the flavor and texture of the food, and uses little oil, compared to Western frying techniques.

People in southern areas consume more vegetables than those in the north, because the climate in the south is warm enough to sustain their growth.

- **Cultural factors**

The regulation of diet as a disease preventive or cure is certainly as Western as it is Chinese. Common Western examples are the diet for arthritics and the recent organic food craze. But the Chinese case is distinctive for its underlying principles. The bodily functions, in the Chinese view, follow the basic 'Ying-Yang' principles. Many foods are classifiable into those that possess the yin quality and those of the yang quality. When 'Ying' and 'Yang' forces in the body are not balanced, problems result. Proper amounts of food of one kind or the other may then be administered (i.e., eaten) to counterbalance the 'Ying' and 'Yang' disequilibrium. If the body is normal, overeating of one kind of food would result in an excess of that force in the body, causing disease.

'Ying' and 'Yang' foods can be classified as 'hot' and 'cold'. The notions of 'hot' and 'cold' do not refer to actual temperature, but rather to certain symbolic values associated with each category of foodstuffs. Because "health" in Chinese traditional medicine is defined as a balance between these categories, ill-health is treated by adding 'hot' or 'cold' foods or medicines to the diet, in order to restore the balance. Chinese immigrants living in foreign countries still tend to keep this culture. In Tann and Wheel's study, a group of London Chinese mothers believed that their diet should be modified according to the general health of the infant receiving their breast milk (Tann & Wheeler, 1980). In some cases, the modified diet leads to a considerable restriction in available foods sources. For example, people who are weak in 'Yang' have excess 'Ying' in their body. So they are supposed to avoid 'cold' foods, such as vegetable and fruit. If this modified diet is taken for a long period, nutrient imbalance will occur.

### 2.3.1.3 Changes on food consumption in recent years

China is one of the world's most rapidly growing economies, having achieved, from 1978 to 1997, an annual average rate of growth in real Gross Domestic Product (GDP) per capita of 8.5% (Barry et al., 2001). Accompanying these economic changes has been a rapid improvement in food security and marked changes in dietary structure (Ge et al., 1996; Popkin et al., 1993).

Dramatic changes in the diets, activity and body composition of the Chinese population occurred during the 1980s and 1990s. Economic reforms and open policies increased

the production of major foods, eliminated food scarcity on the national level and stimulated a shift in food consumption patterns (Popkin, et al., 1993; Chen, 1996). Food and nutrition studies in China showed that the problem of basic food needs has been resolved since the mid-1980s, but the consumption of animal foods is still relatively low when compared to Western countries (Department of Chinese Scientific Cooperation Work, 1988). Data on Chinese national food consumption demonstrated a 50% decline in the intake of grains and potatoes and a quadrupled intake of meat, eggs, milk and aquatic products since 1982 (Chen, 1996). Milk and egg products increased nearly four-fold, aquatic products more than doubled and staple food production increased more than 30% during the 1990s (Ma et al., 1992).

With the improved economy, the energy, protein and fat intake of Chinese people also increased significantly. Dietary intakes of energy, protein and fat in China between 1959 and 1992 are shown in Table 2.8.

**Table 2.8: Average dietary intake of energy, protein and fat in China between 1959 and 1992 (per capita per day)**

| Year | Energy (kJ) | Protein (g) | Fat (g) |
|---|---|---|---|
| 1959[1] | 8,619 | 57 | - |
| 1982[2] | 10,393 | 67 | 49.3 |
| 1992[2] | 9,740 | 68 | 58.3 |

Source: [1] Chen & Ge, 1995

[2] Ge et al, 1996

Average national food consumption in 1992 and 1982 is shown in Table 2.9. Based on the national food consumption data, there is a clear trend towards a slight decrease in grain consumption and a significant increase of animal food and oil. In addition over the last ten years, the consumption of tubers by residents in China has declined. Tubers are rich in starch, fiber and a variety of vitamins and minerals. Their "westernized" or "affluent" Chinese diet contains inappropriately high amounts of energy and fat and inappropriately low amounts of dietary fiber and may lead to higher incidence of a variety of chronic disorders. Analyses of the food supply in 21 Asian nations during 1975–1994 also showed an overall decline in the availability of complex carbohydrates

and an increase in total fats (Drewnowski & Popkin, 1997). In addition, hydrogenated fats increasingly replace vegetable oils (Vorster, 1999).

**Table 2.9: Average national food consumption in 1992 and 1982 (g/per day)**

| | 1992 National Nutritional Survey | 1982 National Nutritional Survey |
|---|---|---|
| Cereals | 439 | 498 |
| Tubers | 87 | 163 |
| Bean and bean products | 11 | 15 |
| Vegetables | 312 | 298 |
| Fruits | 50 | 28 |
| Meats | 58 | 42 |
| Milk and milk products | 14 | 9 |
| Eggs | 16 | 10 |
| Fish and shrimp | 28 | 12 |
| Oils and fat | 29 | 18 |

Source: Ge et al. ,1996

### *2.3.2 Body measurements of the elderly in China*

An expert group of the World Health Organization reported that Asian populations are at risk from weight-related diseases at lower BMI values. Asian people with a BMI of only 23.3 (compared to 25 for other ethnic groups) may be at increased risk of obesity-related diseases (WHO, 2004). Elderly individuals of Chinese descent are known to have considerably lower mean BMI than elderly individuals from Brazil, Northern Europe and the USA (WHO Expert Committee, 1995).The WHO BMI range for normal weight adults up to age 70 is 18.0-25.0. However a BMI range of 22.0-27.0 was felt by most authorities to be more appropriate for the elderly, though this was not based on any universally recognised standard (Bartlett et al., 1998). The mean BMI reported in a study of non-diseased, non-cognitively impaired Chinese men and women, aged 70-90 years, ranged from 20.1 to 22.3 (Woo et al., 1995). In China, the pattern of age-related change in body composition appears associated with modifiable variables, such as income, urban residence, activity and protein and energy intake (Stookey et al., 2001).

Only body weight and height measurements of Chinese subjects were included in the Chinese National Nutrition Survey (Ge et al., 1996). Little anthropometric research on Mainland Chinese elderly has been carried out. Side et al conducted an anthropometric survey on elderly Chinese aged>=70 years. A total of 441 subjects comprising 260 urban elderly (126 men and 134 women) and 181 rural elderly (83 men and 98 women) participated in this study. The mean anthropometric indices and blood pressure measurements of these urban elderly are shown on Table 2.10. The Mean BMI of these subjects was within the normal range of the WHO BMI variables.

**Table 2.10: Mean anthropometric indices and blood pressure measurements in elderly (>=70 years) urban Chinese**

| | **Men (n =126)** | | **Women (n=134)** | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| Height (m) | 1.67 | 0.11 | 1.54 | 0.06 |
| Body weight (kg) | 65.9 | 11.2 | 54.4 | 10.8 |
| Body mass index | 23.2 | 3.3 | 23.0 | 4.4 |
| Systolic blood pressure (mmHg) | 141 | 25 | 145 | 22 |
| Diastolic blood pressure (mmHg) | 82 | 12 | 82 | 11 |
| Waist circumference (cm) | 88.3 | 9.6 | 84.9 | 11.1 |
| Hip circumference (cm) | 99.9 | 9.4 | 98.4 | 11.2 |
| Upper arm circumference (cm) | 28.1 | 7.6 | 26.3 | 4.2 |
| Triceps skinfold thickness (mm) | 14.1 | 4.1 | 16.7 | 5.8 |
| Upper arm muscle circumference (cm) | 23.7 | 6.7 | 21.0 | 5.7 |
| Waist to hip ratio | 0.88 | 0.05 | 0.86 | 0.06 |

Adopted from Side et al., 1991

### *2.3.3 Life style and disease in China*

The life expectancy of Chinese people has increased significantly from 1949 to 1995 due to the improving economic situation. Average life expectancy for the total population increased from 35 years in 1949 to 68.6 in 1995.

The mortality rate from major diseases in China has also changed. Based on the statistics from the Ministry of Health, the mortality rates from acute infectious diseases and tuberculosis have decreased significantly since 1957 (Ministry of Health BeiJing, 1992). (Table 2.11)

In contrast, cancer, cerebrovascular disease and ischemic heart disease have become the leading causes of death. Chronic diseases now account for more than 70% of the total mortality in China. Among these non-communicable diseases, cardiovascular diseases, including coronary heart disease (CHD), hypertension and stroke, have increased dramatically in the years since 1957 and have become the number one cause of death in China (Li & Lu, 1997). Therefore, the change of lifestyle and diet of the Chinese people, along with the development of the national economy, has caused significant changes in disease patterns in China in recent years.

**Table 2.11: Changes in mortality rate of major diseases in China (1/100000 people)**

| Year | Acute infectious disease | Cancer | Hypertension | CHD | Diabetes | Cerebrovascular disease |
|---|---|---|---|---|---|---|
| 1957 | 56.60 | 36.9 | - | - | - | - |
| 1962 | 25.02 | 40.92 | - | - | - | - |
| 1975 | 34.32 | 111.49 | - | 27.35 | 3.59 | - |
| 1980 | 4.39 | 113.41 | - | 38.55 | - | 135.35 |
| 1985 | 2.59 | 113.86 | - | 37.84 | - | 117.52 |
| 1990 | 1.15 | 128.03 | 6.00 | 47.48 | 8.12 | 121.84 |
| 1992 | - | 125.76 | 8.82 | 51.29 | 9.65 | 122.69 |

Source: Ministry of Health Beijing, 1992

The incidence of malnutrition in Chinese adults (BMI < 18.5) was 11.6% in 1982 and 9.0% in 1992 for urban areas, and 12.9% and 8.0% for rural areas, indicating a descending trend over the 10 years (Ke & Da, 2001). However, the problem of over-nutrition is emerging. The prevalence of overweight and obesity in young adults (BMI > 25) increased from 9.7% to 14.9% for urban areas and from 6.15% to 8.4% for rural areas in a 10 year period (1982 - 1992) (Ke & Da, 2001).

In China, obesity has been clearly associated with higher income in both rural and urban regions (Du et al., 1999). However, a closer evaluation of the impact of income on dietary change also suggests shifts that may lead to greater obesity among low income groups ( Guo et al., 2 000). When economic development occurs, people tend to have light work, and less physical activity results from the development of technology taking the place of manual operation. The use of cars and lifts results in a significant decrease of physical activity. A study on weight change in Chinese from 1989 to 1997 concluded that overweight (body mass index, BMI>or=25 kg/m$^2$) doubled in females (10.4-20.8%) and almost tripled in males (5.0 to 14.1%) in this period. Low physical activity was a strong predictor of weight gain. Compared to those whose weight remained stable (+/-2 kg/8 years), males and females who experienced large weight gain (>5 kg/8 years) were three times more likely to engage in light rather than heavy work-related physical activity (Bell et al., 2001).

### *2.3.4 Dietary guidelines for the Chinese elderly population*

The Dietary Guidelines for Chinese Residents are founded on the principles of nutritional science and the present national situation in China. The Chinese Dietary Guidelines were officially released in April 1997 (Lippincott et al., 1999). They are listed below:

1. Eat a variety of foods, with cereals as the staple.
2. Consume plenty of vegetables, fruits and tubers.
3. Consume milk, beans, dairy or bean-products every day.
4. Consume appropriate amounts of fish, poultry, eggs and lean meat; reduce fatty meat and animal fat in the diet.
5. Balance food intake with physical activity to maintain a healthy body weight.
6. Choose a light diet that is also low in salt.
7. If alcoholic beverages are drunk, do so in limited amounts.
8. Avoid unsanitary and spoiled foods.

For the specific requirements of groups, such as the elderly, who have different nutritional needs, the Expert Commission proposed 'The Recommendations for Particular Groups of People' as a supplement to the Guideline for the general population.

For the aged, the guideline also includes the following points:

- Take easily digestible foods along with some foods made of coarse grains.
- Participate in moderate physical activities to keep intake and output of energy in balance.

## 2.4 NUTRITION AND THE ELDERLY IN NEW ZEALAND

### *2.4.1 Elderly population in New Zealand*

In New Zealand, sixty-five is recognized as the point from which people are known as elderly. It is also the age at which entitlement to retirement income in New Zealand will be guaranteed. The population is ageing rapidly in New Zealand. By 2031, New Zealanders 65 years and older will represent about 19.5% of the population, up from 11.8% in 1996 (National Health Committee, 1998a). By about 2021 there will be more people over the age of 65 than under the age of 15. The biggest increase in older people will be amongst people aged 85 and over, due to increased longevity and the post World War II baby boom generation reaching this age group from about 2035 (Ministry of Health, 2002b). Asian communities account for a small, but rapidly growing proportion, of the older population in New Zealand. In 2001, 2.2 percent of people aged 65 and over affiliated with an Asian ethnic group. By 2016 older Asian people are projected to increase to 4 percent of the population aged 65 and over (Ministry of Health, 2002b).

### *2.4.2 Life expectancy and causes of mortality rate in New Zealand*

Like most other countries, life expectancy in New Zealand is increasing. Between 1960 and 1998, female life expectancy at birth rose by 6.5 years (from 73.9 to 80.4). Male life expectancy also increased by 6.5 years, from 68.7 to 75.2 over the same period (Ministry of Health 2002b). The New Zealand data also suggests that future gains in life expectancy are possible (Ministry of Health 1999). Generally males have a lower life expectancy due to the greater exposure to risk factors such as tobacco and alcohol use and occupational hazards (Statistics Canada, 1997).

Life expectancy and independent life expectancy in older age in New Zealand are shown in Table 2.12. Mortality rates in older ages have been decreasing in New Zealand,

with the biggest reduction being in the 65–74 age group (Ministry of Health 2002b). The most common cause of death for both men and women over 65 years old is ischaemic heart disease, with the rate increasing markedly with increasing age, particularly for males. Other causes include other circulatory disorders, stroke, respiratory diseases and cancer (Ministry of Health 1999b).

**Table 2.12: Life expectancy and independent life expectancy in older age (New Zealand)**

| Life expectancy | All New Zealanders | Male | Female |
|---|---|---|---|
| Life expectancy at birth | 77.8 | 75.2 | 80.4 |
| Life expectancy at age 65 | 17.8 | 16.1 | 19.5 |
| Independent* life expectancy at age 65 | 10.9 | 9.9 | 11.9 |

* Implies free of disability requiring assistance
Source: Statistics New Zealand, 2001b

### *2.4.3 Socio-demographic characteristics of older people*

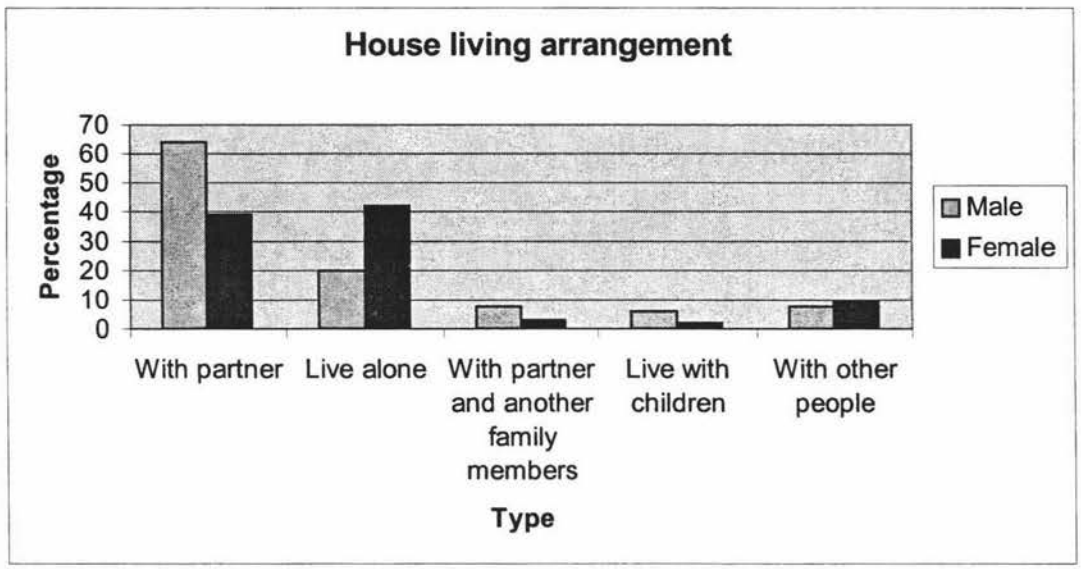
The New Zealand National Health Committee report on the socioeconomic determinants of health, found overwhelming evidence that inequalities affect health (National Health Committee 1998c). Key findings in that report were that low socioeconomic groups experience poorer health outcomes, and that socioeconomic inequalities have a cumulative health impact over time. This is coupled in older age with the effect of lifetime deprivation (for example childhood nutrition) and disease.

The proportion of older people living alone has been increasing since the 1960s, with fewer older people living with their children or relatives. This could be due to a number of factors, including greater prosperity amongst older people, decreasing family closeness, greater geographical mobility resulting in more dispersed family networks, or more services supporting older people to live in the community. (Figure 2.1) The proportion of older people who live on their own is likely to grow in the future, as

increasing proportions of working-age people currently live alone and have few children (Statistics New Zealand, 1998).

At the 2001 Census, 12 percent of people aged 65 and over were in the labour force, either in full or part-time work, or seeking work (Statistics New Zealand, 2001c). There is potential for labour force participation to increase further in the future, particularly for the 65–69 age group, given the improving health status and longevity of older people.

**Figure 2.1: Household living arrangements of people aged 65 and over: 2001 census**




Source: Statistics New Zealand, 2001c

Census data shows that older people have lower average incomes than the working age population. However, as older people own their own house, the accommodation costs are low (Statistics New Zealand, 2001c).

### *2.4.4 Food pattern and nutrient intakes*

New Zealanders obtain the energy and nutrients they require from a wide variety of foods and beverages, and less frequently, from dietary supplements. Ninety-four percent of all New Zealanders ate a regular diet, which included animal products.

The principal sources of energy in the New Zealand diet are: bread (11 percent); potatoes and kumara, including fat/oil added when cooking (seven percent); butter and margarine (six percent); and milk, alcoholic beverages, cakes and muffins, non-alcoholic beverages and sugar/sweets (all five percent) (University of Otago, 1999). The ratio of energy supplied by fat, carbohydrate and protein has continued to change, and a reduction in energy from fat has been observed for both males and females, from 42.8% for men and 42.9% for women (age 50-65) in 1977 to 35% for men and women (age 45-65) in 1997 (Birkbeck, 1977, Russell et al., 1999).

In New Zealand, the Mosgiel Community Study of Health and Nutrition in Old Age provides the largest and most representative study so far available specifically on the nutrition and health of older people (Horwath & Campbell, 1992). Mean intakes of most nutrients were above recommended levels; the only exceptions were low mean intakes of zinc and copper, and among women only, a low mean calcium intake. The proportion of people with intakes below two-thirds of the recommended levels was highest for zinc, copper, calcium and magnesium. Note, however, that the conclusion that few subjects had low vitamin $B_6$ intakes (ie, intakes below two-thirds of the RDI) was based on use of the low end of the current RDI range (ie, 1.0 mg for men, 0.8 mg for women). Actual vitamin $B_6$ requirement levels in old age may be higher than this, and use of the higher cut-off level would have led to vitamin $B_6$ being included in the list of least adequately supplied nutrients in the diets of older Mosgiel adults. Mean protein intakes exceeded the recommendations by 25–30 percent, 44 percent of total fat intake was saturated, and fibre intakes were around 22 g/day.

In the 1996/1997 National Nutrition Survey, compared with other age groups, both males and females 65 years and over had the lowest intakes of energy, protein, fat and calcium. Although iron intake and zinc intakes were adequate for the New Zealand population, the 65 and over age group had the lowest intake compared with other age groups (Russell et al., 1999).

### *2.4.5 Body measurements*

The National Heart Foundation defines a healthy range of BMI as 18.5-25.0 kg/m$^2$ for New Zealanders except Maori and Pacific peoples (National Heart Foundation's

Nutrition Advisory Committee, 1999). Studies in Auckland show an increase in obesity in New Zealand over the last 10 years, with 65% of middle aged men and 45% of middle aged women now overweight or obese (Physical Activity Taskforce, 1998). The proportion of the population classified as overweight was highest in those 65-74 years (male 57.6 percent, females 47.5 percent) (Russell et al., 1999).

### *2.4.6 Chronic diseases*

New Zealand has a high prevalence of coronary heart disease (CHD). CHD mortality rates for men and women 65-84 years were 1,425 and 757 per 100,000 population respectively (New Zealand National Health Committee, 1998). High serum cholesterol is significant risk factor for coronary heart disease. Lipid guidelines developed by the National Heart Foundation recommend a total cholesterol of 3.0-5.0 mmol/l, but only 31 percent of New Zealanders achieved this guideline (Dyslipidaemia Advisory Group, 1996). Twenty-three percent of the New Zealand population has total cholesterol levels higher than 6.5 mmol/l (Russell et al., 1999) and plasma cholesterol levels tend to rise with age (Department of Health, 1991).

Hypertension is common in New Zealand, affecting at least 1 in 10 adults (Russell and Wilson, 1991; Trye et al 1996; Bullen et al., 1996). The prevalence of high blood pressure in New Zealand has declined since the early 1980s (Trye et al., 1996). The decline may be at least partially due to an increase in physical activity, or to a reduction in salt or alcohol consumption over this time (Trye et al., 1996). The mean systolic blood pressure for both men and women over 65+ years was over 150mmHg. Over 70% of men and women over 65+ were considered borderline hypertensive.

Approximately four percent of New Zealanders in the 1996/1997 Health Survey reported that they had been diagnosed with diabetes (Ministry of Health, 2002). Older people mainly suffer type II diabetes. Type II diabetes makes up about 85-90 percent of all diabetes cases in developed countries (WHO, 1994). As in other countries, increasing age is one the major risk factors for Type II diabetes in New Zealand (Ministry of Health 1997).

### *2.4.7 Life style*

Nowadays, New Zealanders are working longer hours, which means less time for physical activity (Statistics New Zealand, 1996). On the other hand, due to technological advances and a shift from manual to information technology industries, much of today's work includes less physical activity than in the past (Statistics New Zealand, 1998b). An increase in sedentary leisure-time activities such as television and video watching, console and computer gaming and other computer-related activities (e.g. Internet surfing) means that many, particularly the young, spend much of their leisure time in the sedentary state rather than being active. Labour saving devices such as cars, remote controls, lifts and washing machines have also contributed to a less active lifestyle.

The National Health Committee's research 'Active for life: A call for action' resulted in the key finding that: all New Zealanders can improve their health and quality of life by including regular, moderate amounts of physical activity in their daily lives (National Health Committee, 1998b). The publication Physical Activity Taskforce Report (Physical Activity Taskforce, 1998) presents a framework for action for the multisectoral support and promotion of physical activity. Both of these reports reinforce the new health and wellbeing message for physical activity. There are significant health benefits from 30 minutes of moderate-intensity physical activity on all or most days of the week. Short, intermittent periods of physical activity (of at least 10 minutes), accumulated over a day to total at least 30 minutes, also have health benefits if performed at a level of moderate intensity. Increasing physical activity is recognised as important to improve the wellbeing of all New Zealanders, and to reduce health costs associated with inactivity.

Interestingly, older people aged 65-74 were among the most active (65 percent), while those aged 75 and over were most likely to be sedentary (25.5 percent) (Ministry of Health, 1999).

## 2.5 AIMS OF THE STUDY

Migrant populations are particularly sensitive to the food culture and new foods available in their adopted country (Axelson, 1986; Powles et al., 1990). Culture and

ethnicity play an important role in patterning food behavior (Sanjur, 1995). Food culture and food supplies in China are very different to those in New Zealand. This may affect the food choices and dietary intakes of Mainland Chinese living in New Zealand.

Acculturation studies have found that disease patterns of immigrants whose food consumption remains consistent with their traditional culture, more closely resemble those of their home country (Marion & Shirley, 1999). Elderly are more likely to retain their culture and food patterns than the young.

Changes in food patterns may affect the health status of the elderly, and thus increase the prevalence of many chronic diseases. In order to improve the health status or this population and reduce health inequalities, it is important to identify and understand the main factors that protect and promote good health, and develop strategies to implement this (Mustard, 1996).

The aims of this study are:

1. To assess dietary intake, activity levels, body composition, blood pressure, body fat distribution and blood glucose level in a sample of migrant Mainland Chinese men and women over 60 years that live in Auckland.
2. To compare the data from this group with that from similar studies in New Zealand and China, and determine if there are any differences with respect to their overall nutritional status and health.
3. To identify any nutritional patterns and lifestyles that may have a negative impact on the health of elderly migrant Chinese, and suggest dietary changes that may ameliorate these.

# CHAPTER 3. METHODS

## 3.1 HUMAN ETHICS APPLICATION

Ethical approval was obtained from The Massey University Human Ethics Committee. In accordance with its policies, informed consent to participate was obtained from every subject before initiating the survey. The consent forms were written both in English and Chinese. Volunteers could choose either version of the consent form to sign. (See Appendix 5 and 6) The experimental protocol was fully explained to the volunteers in the information sheet. (See Appendix 7 and 8) All volunteers could withdraw from the study at any time before the blood glucose test done in the third visit. The information provided by the participants was anonymous and remained confidential. Each volunteer was told he/she would receive a summary of the study results as well as a brief analysis of his/her individual nutrient intake, body composition, blood pressure, blood lipid profile results at the end of the study. (See Appendix 12 and 13)

## 3.2 SUBJECT RECRUITMENT

### *3.2.1 Eligibility criteria for volunteers*

The eligibility criteria of the Chinese volunteers in this study were as follows:

- Only subjects from Mainland China were selected. Those from Hong Kong, Taiwan, Singapore, and Malaysia etc were not included.
- Subjects include both men and women that were permanent residents of New Zealand and aged 60 years and over at the time of contact.
- Those with the following problems were excluded.
    1. Those with known serious diseases such as thyroid problems, renal failure and liver disease etc.
    2. Those with long term medical treatment for chronic disease.
    3. Those with a disability, that affected movement.
    4. Those with restrictive diet, such as for diabetes or renal disease.

Subjects came from all five areas of Auckland city.

### *3.2.2 Study Publicity*

Subjects were recruited in response to publicity aimed at the Chinese community. The study was advertised via the following Chinese networks, written both in English and Chinese:

- Chinese supermarkets and groceries
- Chinese restaurants
- Chinese churches
- Notices boards in public libraries

A concise outline of the study written in Chinese and English was made available at some of these locations. (See Appendix 3 and 4) Men and women interested in volunteering contacted the researcher by phone. Volunteers were then sent the detailed information sheets written both in English and Chinese and consent forms written both in English and Chinese, along with a stamped addressed envelope to return the consent form. Volunteers who returned the completed consent form were enrolled in the study. (See Appendix 5 and 6)

## 3.3 ANTHROPOMETRIC MEASUREMENTS

Anthropometric measurements are sensitive to dietary intake and are regarded as important indicators of an individual's nutritional status (Pressman & Adams, 1990; Frisancho, 1990).

Body measurements including weight, height, skinfolds, breadths and circumferences were taken. The researcher had taken the ISAK anthropometric level one course and had qualified as a level one anthropometrist. All of the measurements followed the International Society for the Advancement of Kinanthropometry (ISAK) standards. The measurements were all made by the researcher. Data recording sheets for all body measurements are shown in Appendix 10.

### *3.3.1 Height*

Height was measured with participants wearing light clothing and without shoes and measured to the nearest tenth of a centimeter using a non-stretchable metal tape fixed on

the wall by means of a vertical plate. A horizontal plate on the same device was placed over the subject's head. The subject stood with back, shoulder blades and buttocks against the wall and heels close together and against the wall. Height was measured three times.

### *3.3.2 Weight*

Weight was measured in light indoor clothing without shoes. A Tanita digital balance scale (Model 1609N), accurate to ±0.1 kilogram, was used to measure weight. The scale was put on a hard and flat floor. Before each measure, the scale was returned to zero. The subject stood still over the center of the platform with body weight evenly distributed between both feet. Weight was also measured three times. The scale was regularly calibrated between measurements.

The height and weight measurements were used to obtain BMI. BMI was calculated as weight (in kilograms) divided by square of height (in meters).

### *3.3.3 Skinfolds*

Skinfold measurement, which are simple to obtain, are less affected by hydration status than weight and are independent of height (Chernoff, 1991).

Body fat can be estimated by measuring the thickness of the subcutaneous fat layer at different sites of the body using a skinfold caliper. Typically two to eight sites are selected for skinfold measurement. In this study, skinfold thickness was measured at the triceps and subscapular sites using a Holtain skinfold caliper. The skinfold measurement was taken by pinching up two thicknesses of skin plus subcutaneous adipose tissue and no muscle fascia or organs. Fingers maintained the skin pinch throughout the measurement. All measurements were made on the right side of the body and the cycle repeated until three measurements within 0.5 millimetre of each other were obtained. All skinfolds were measured three times. The following two skinfolds were measured:

- **Triceps skinfold**

This skinfold was raised with the left thumb and index finger on the marked posterior mid-acromiale-radiale line. The fold was vertical and parallel to the line of the upper

arm. The skinfold was taken on the most posterior surface of the arm over the triceps muscle when viewed from the side. The marked skinfold site was just visible from the side indicating that this was the most posterior point over the triceps whilst held in the anatomical position (at the level of the mid-acromiale-radiale line). For measurement, the arm should be relaxed with the shoulder joint slightly externally rotated and elbow extended by the side of the body.

- **Subscapular skinfold**

The subject should be standing erect with the arms by the side. The undermost tip of the inferior angle of the scapula was located and marked as the subscapulare point. The skinfold was raised with the left thumb and index finger at the marked site two centimeters along a line running laterally and obliquely downwards from the subscapulare landmark at an angle (approximately 45°) as determined by the natural fold lines of the skin.

### *3.3.4 Elbow breadth (biepicondylar humerus)*

The distance was measured between the medial and lateral epicondyles of the humerus when the arm was raised anteriorly to the horizontal and the forearm flexed at right angles to the upper arm. The biepicondylar humerus was measured by a vernier bone caliper. The calipers were placed directly on the epicondyles so that the arms of the calipers point upward at about a 45° angle to the horizontal plane. A firm pressure with the index fingers was maintained as the value was read.

### *3.3.5 Body circumferences*

A nonstretch tape was used with a device to ensure that constant tension was applied. The cross hand technique was used for measuring all girths and the reading was taken from the tape where, for easier viewing, the zero was located more lateral than medial on the subject. When reading the tape the measurer's eye was at the same level as the tape to avoid any error of parallax. All circumferences were measured three times.

- **Upperarm circumference**

The circumference of the upper arm (hanging in a relaxed position by the side of the body) was measured at the level of the mid-acromiale-radiale. The tape was positioned perpendicular to the long axis of the humerus. The upperarm circumference was used to calculate the arm muscle circumference and arm muscle area using the equations from Suriah et al., 1998.

  - Arm muscle circumference (cm) = arm circumference (cm)-. πx triceps skinfold [mm])
  - Arm muscle area = $Cm^2/4\pi$

  where Cm = muscle circumference in cm

- **Waist circumference**

This measure was taken at the level of the narrowest point between the lower costal (rib) border and the iliac crest. If there was no obvious narrowing then the measurement was taken at the mid-point between these two landmarks. The measurer stood in front of the subject to correctly locate the narrowing of the waist. The measurement was taken at the end of a normal expiration with the arms relaxed at the sides. Waist circumference was measured with the waist unclothed. Men who had a waist circumference greater than 102cm and women who had a waist circumference greater than 88cm have an increase risk of type II diabetes and cardiovascular disease (WHO, 1997a). Both men and women's waist circumferences were divided into two categories using these criteria.

- **Hip circumference**

The hip circumference was taken at the level of the greatest posterior protuberance of the buttocks which usually corresponds anteriorly to about the level of the symphysis pubis. The measurer stands at the side of the subject to ensure the tape was held in a horizontal plane when measuring this site. The subject stood with feet together and with the gluteal muscles relaxed. The hip circumference was measured over the subject's underwear. Measurements were to the nearest millimetre.

- **Waist to hip ratio (W/H ratio)**

The waist and hip circumferences were used to calculate the W/H ratio.

W/H Ratio=Waist (cm)/ Hip (cm)

## 3.4 MEDICAL MEASUREMENTS

### *3.4.1 Blood pressure*

Sitting blood pressure was measured three times on the right arm. A standard mercury sphygmomanometer was used with appropriate cuff sizes. The arm was at mid-chest level and relaxed and supported when the pressure was taken. The level of the mercury column was raised approximately 30 mm above the point at which the pulse disappeared. The column was then reduced slowly. Systolic blood pressure was measured at the first appearance of a pulse sound (Korotkoff phase 1) and diastolic blood pressure at the disappearance of the pulse sound (Korotkoff phase 5), and were expressed to the nearest two mmHg. The pressure was dropped to zero between recordings (The National Heart Foundation of New Zealand Scientific Committee, 1977). Five minutes was allowed between each measurement, with the subjects resting in the sitting position.

According to WHO criteria, systolic<140 mmHg and diastolic <90 mmHg can be considered as normal blood pressure. Systolic ≥ 140 mmHg, < 160 mmHg; and/ or diastolic ≥90 mmHg, <95 mmHg can be considered as borderline hypertension. Systolic ≥160mmHg or diastolic ≥ 95 mmHg can be considered as hypertension.

### *3.4.2 Blood glucose level*

Blood glucose level was measured by a Precision Q.I.D Blood Glucose Monitoring System, a product manufactured and supported by MediSense, Inc. A drop of blood was taken from each subject's fingertip using a new finger prick device for each measurement. The monitor automatically read the blood glucose level. The subjects did not eat or drink any beverage for two hours before testing.

Diabetes and impaired glucose tolerance were based on the value of the two hour sample following WHO definitions (Nicol et al., 1986): ≥11.1mmol/l for diabetes; ≥7.8 and <11.1 mmol/l for impaired glucose tolerance.

## 3.5 BODY FAT MEASUREMENTS

Percentage of body fat was measured by the following two methods:

1. Body Bioelectrical Impedance analysis reading.
2. Using predictive equations with circumference and skinfold values.

Some experts discourage using the skinfold method to assess body composition of elderly clients. With aging, adipose tissue is redistributed, with relatively more subcutaneous and internal fat stored on the trunk than the extremities (Chumlea & Baumgartner, 1989). Age-related decreases in the elasticity and hydration of the skin, as well as shrinkage in the size of the fat cells, may increase the compressibility of subcutaneous adipose and connective tissues (Kuczmarski, 1989). Experts, therefore, recommend using alternative methods, such as circumference measures or BIA, to estimate body composition in the elderly.

### *3.5.1 Body Bioelectrical Impedance analysis (BIA)*

BIA was measured using a BIM 4A BIA machine made in Australia.

1. The subjects were asked to lay face-up with legs slightly apart and hands resting next to the body palms down and not touching any part of the body. The inner thighs were not in contact.
2. The subjects were also asked to remove the right shoe and the sock.
3. The electrode sites were cleaned with alcohol and the electrodes were attached as follows:
    - White-placed on an imaginary line bisecting the ulner head (bone on the little finger side of the right wrist).
    - Red- first joint of the middle finger, 3$^{rd}$ metatarsal head dorsum on the right hand.
    - Blue- placed on an imaginary line bisecting the medial mellealus (bone on the big toe side of the ankle).
    - Black-placed on the base of the second toe, 2$^{nd}$ metatarsal head dorsum on the right foot.
4. Leads were attached to the electrodes. The subject lay quiet and still during the entire test.
5. The required information was entered into the machine, and the result recorded.

### *3.5.2 Predictive equations using body measurements*

Percentage of body fat was estimated using the predictive equation developed by Baumgartner et al. (Baumgartner et al., 1998)

Percentage of body fat = 0.2034 (waist circumference)+0.2288 (hip circumference)+ 3.6827 (ln[triceps skinfold]) – 10.9814 (sex) – 14.3341,

Where sex 0 for women and 1 for men.

This equation was developed in a sample of 149 older subjects (60) of mixed racial and social background using DEXA as a criterion method. It was validated on a separate randomly selected group of 50 older subjects from the same study and 301 non-Hispanic white subjects aged 60 and older from a separate study and for whom DEXA measurements were available. Values from the predictive equation were highly correlated with estimates from DEXA (r=0.79-0.82 across the two validation groups) and were accurate to within ±4% of the DEXA value. Sex and ethnicity did not affect the accuracy of the predicted values for either group. Thus this equation was suitable for the elderly subjects aged over 60. The most recent study assessing the association between functional limitations and body composition of noninstitutionalized people (1,526 women and 1,391 men) aged 70 and older living in the United States also used this predictive equation to calculate the body fat of the subjects (Davison et al., 2002).

## 3.6 ASSESSMENT OF DIETARY INTAKE

The 24-hours dietary recall method was used in this study for the following reasons:

- Literacy of the respondent was not required.
- It was inexpensive and quick to administer and provided detailed information on specific foods (Block, 1989; Feskanich & Willett, 1993).
- There was relatively little burden on the respondents, so that compliance was high.
- In contrast to dietary records, dietary recalls occur after the food has been consumed, so there was less potential for the assessment method to interfere with dietary behavior.

However this method has limitations. These are described below:

- Accuracy depends on the subject's memory, their ability to convey accurate estimates of portion sizes consumed, their degree of motivation, and the persistence of the interviewer (Acheson et al., 1980).
- The flat slope syndrome may be a problem in the 24-hour recall method (Gersovitz et al., 1978). Here individuals appear to overestimate low intakes and underestimate high intakes.
- Even if several 24-hour recalls are collected from one person, it may be impossible to measure intake of infrequently eaten foods such as liver (Liu, 1992).

Nutritional status and health are influenced by usual or long-term dietary intake. For this reason, dietary assessment in this study should estimate usual intake. Day-to-day variation in food and nutrient intake by individuals is so large that one 24-hour diet recall cannot provide accurate information about an individual's usual intake (Bohlscheid-Thomas et al., 1997). Hence in the present study, three day 24-hour diet recalls have been collected from each subject. In order to represent the difference between weekday and weekend intakes, diets on two weekdays and one weekend day were recorded.

Respondents were asked to remember and report all the foods and beverages consumed during the preceding 24-hour period on each of three visits. The information was then recorded for later coding and analysis. In order to help the respondents remember all foods consumed throughout the day, the interview was structured with specific questions, such as how foods were prepared, what type of cooking oil was consumed, and what beverage and snacks were eaten. Natural serving sizes, such as the average weight of a piece of fruit, or a slice of bread were used. Food and drink measures such as cups, bowls, spoons and photographs were also used to help the respondent identify portion volumes, size and weight. Since the traditional Chinese eating pattern is to prepare and serve a limited number of complex dishes and have each individual place various amounts from each dish on his or her plate or bowl, group consumption from common plates increases the difficulty of obtaining accurate measurement of individual consumption. For the same reason Chinese are not accustomed to estimating portion sizes. Thus Chinese food items that are not included in the New Zealand Food

Composition database were calculated from raw materials. Cooking oil and seasonings were also added. Study subjects were encouraged to estimate the proportion of dishes they consumed. Because this method calculates items as purchased and not as cooked, some difference in nutrient content might result from the different state of the food. In this study, the subjects were asked to recall their diet during a 24-hour period going back from midnight of the previous day. After the interview, the information was checked for omissions and mistakes. If necessary, a respondent was contacted later by telephone or mail to clarify an entry or to obtain further information such as brand names, preparation methods, and serving sizes.

## 3.7 QUESTIONNAIRES

The questionnaires were written in English. The questions were asked in Chinese and the researcher recorded the answer in Chinese.

### *3.7.1 Preliminary testing*

To assess the usefulness of the questionnaire it was pre-tested on ten Chinese aged over 60 (five male, five female) who came from Mainland China. The subjects in this pilot trial were recruited in the same way as the test subjects. Their feedback was used to improve the clarity and layout of the questionnaire. Essentially the same questionnaire, with some modifications as a result of the pre-test, was administered to the test subjects. One significant modification was to ask the weight (grams per day) of cereal, fruit and vegetable eaten instead of serving size. Since the Chinese prepare and serve complex dishes and have various portions of each dish, serving size was not suitable for estimating food consumption of individual subjects. However, the study subjects or their family members normally knew the weight of raw material for every dish and could estimate how much they had consumed by estimating their consumption portion. The question on household income was also significantly modified. Subjects were asked about their household composition, how many people had an income and their income level, instead of asking for family income directly. The final questionnaires are included in Appendix 9 and 11.

### *3.7.2 First questionnaire*

The first questionnaire (See Appendix 9) covered the following topics:

- Dining habits
- Food preparation
- Diet and cooking preferences
- Food allergy
- Food preferences
- Variety of food consumed
- Sleeping habits
- Activity levels
- Transport preferences
- Sport participation.

### *3.7.3 Second questionnaire*

The second questionnaire (See Appendix 11) covered the following topics:

- Age
- Duration of residence
- Family incomes
- Education
- Occupation
- Household composition
- Life style and health

    Weight change after immigration

    Medical history

    Smoking habits

    Alcohol consumption

    Consumption of nutritional supplements

    Consumption of herbs.

## 3.8 DATA COLLECTION PROGRAM

Each subject required three visits by the researcher. The data collection programme is outlined below.

### *Visit one (about one hour)*

- The first questionnaire to determine food and activity patterns was administered.
- The first 24-hour recall interview on the subject's dietary intake was carried out.

### *Visit two (about one hour)*

- The second 24-hour recall of all food consumed in the last 24 hours was recorded.
- Body measures, blood pressure, BIA were measured and recorded.
- The researcher explained that the blood glucose measurements would be done two hours after meal in the third visit.

### *Visit three (about one hour)*

- The third 24-hour recall of all food consumed in the last 24 hours was recorded.
- The second questionnaire to determine demographic and medical details was administered.
- Blood glucose was measured.

## 3.9 DATA PROCESSING

All data were reviewed by the researcher at the end of each interview and checked with the subject if necessary.

- ***Questionnaire data coding***

Answers were coded using the predetermined code. There were several questions that allowed "write-in" responses. Codes were developed from the answers given at the end of the survey. The volunteer's birthday was used to determine decimal age by using the Conversion Table of Date to Decimal Years.

- ***Anthropometry data***

The average of the three records was calculated for each measurement. BMI, W/H ratio and percentage body fat from BIA and predictive equations were calculated.

- ***Dietary intake data***

Dietary intake data was entered in the FoodWorks (1999 Xyris Software Aus Pty Ltd) programme. As most of the Chinese food items were not available in FoodWorks, a database of Chinese food nutrients had to be set up before starting data entry. This study used the Chinese food database set up by KaiHong Tan for her study (Tan, 2001).

Before entering the dietary intake data, the weight of food consumed had to be converted to the weight of the edible portion, as most Chinese dishes contain bones, such as fried chicken, steamed whole fish, barbecue spare ribs, etc.

Mean nutrient intakes per day were calculated by averaging intakes for the three days.

In addition, for comparison with Mainland Chinese studies, foods were grouped into 19 categories; e.g. rice and its products; fruits; pork and its products etc.

The mean food intake per day in every food category was calculated by averaging intakes over the three days.

- ***Data entry***

All the coded questionnaire data, average anthropometric values were entered into Excel. The energy and nutrient intake data was also exported into Excel from FoodWorks.

- ***Data checking***

After finishing data entry, data of ten subjects (five men and five women) were chosen randomly and checked by supervisor KaiHong Tan. The difference between the two entries was minor.

## 3.10 STATISTICAL ANALYSIS

Means, standard deviations, minima, lower quartile, median, upper quartile and maxima were calculated as representative parameters. Calculations were performed on a

personal computer using the statistical analysis programs Excel and MINITAB (1998 release 12)

The two-tailed t-test was employed to detect possible significant differences between means of nutrient intakes and food patterns in male subjects and female subjects prior to making the nutrient intakes and food patterns table. The 0.05 level was chosen for statistical significance.

The Pearson product moment correlation was used to assess the relationships between nutrient intakes, anthropometric measurements and several socioeconomic factors. Some socioeconomic factors were ranked before assessing. The 0.05 level was chosen for statistical significance.

## 3.11 FEEDBACK TO PARTICIPANTS

Participates received a summary of the results of this study and a report in both English and Chinese on their body measurements and intake of important nutrients. They were able to compare the results with the recommendations provided. Important health information for the elderly was also included. Examples of the feedback are included in Appendix 12 and 13.

# CHAPTER 4. RESULTS

## 4.1 DEMOGRAPHIC DETAILS OF THE STUDY PARTICIPANTS

The study began in February 2002 and data was collected between September 2002 and November 2002. To recruit subjects, posters were placed in public places, such as churches, libraries, and community houses. Self-addressed envelopes were available from these places. Six subjects responded to the publicity and contacted the researcher directly. Most subjects were recruited by personal contact via friends or relatives. Before taking part in the study, all volunteers were asked about their health status. Subjects with diseases that might affect their dietary intake and physical activities were excluded from the study. A total of 50 elderly Chinese took part in this study, including 25 women and 25 men aged over 60 years old. The study population was representative of Auckland Chinese elderly; living in the east, west, north, south and central Auckland regions. All 50 volunteers completed the study. The response rate was 100%. Length of stay in Auckland ranged from one year to 18 years. Age distribution and length of residence in New Zealand is summarized in Table 4.1.

**Table 4.1 Age distribution of subjects and length of residence in New Zealand**

| | **Number of subjects and percentage of total** | | |
|---|---|---|---|
| | **Male** | **Female** | **All** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Age** | | | |
| Age>60, <65 | 11(44%) | 15(60%) | 26(52%) |
| Age>65, <70 | 13(52%) | 10(40%) | 24(48%) |
| Age>70 | 1(4%) | ~ | 1(2%) |
| Average age | 65.3 | 64.1 | 64.7 |
| | | | |
| **Months in NZ** | | | |
| <24months | 5(20%) | 5(20%) | 10(20%) |
| 24-48months | 9(36%) | 8(32%) | 17(34%) |
| >48months | 11(44%) | 12(48%) | 23(46%) |

The average age for men was 65.3 years, for women 64.1 years. Length of stay in New Zealand was divided into 3 groups. Twenty percent of the study subjects had lived in New Zealand less than 24 months, while nearly half had lived in New Zealand more than 48 months.

The socioeconomic characteristics of the study participants are described in Table 4.2.

**Table4.2: Socioeconomic status of study subjects**

| | Number of subjects and percentage of total | | |
|---|---|---|---|
| | **Male** | **Female** | **Total** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Education (general)** | | | |
| Primary school | ~ | 1(4%) | 1(2%) |
| Intermediate | 7(28%) | 6(24%) | 13(26%) |
| High school | 10(40%) | 9(36%) | 19(38%) |
| Tertiary | 8(32%) | 9(36%) | 17(34%) |
| | | | |
| **Education (Tertiary)** | | | |
| Certificate | ~ | 1(4%) | 1(2%) |
| Diploma | 5(20%) | 7(28%) | 12(24%) |
| Bachelor | 2(8%) | 1(4%) | 3(6%) |
| Master | 1(4%) | ~ | 1(2%) |
| | | | |
| **Total Income** | | | |
| Income<$15000 | ~ | 2(8%) | 2(4%) |
| Income>$15000, <$30000 | 6(24%) | 5(20%) | 11(22%) |
| Income >$30000, <$45000 | 9(36%) | 8(32%) | 17(34%) |
| Income> $45000, <$60000 | 6(24%) | 7(28%) | 13(26%) |
| Income>$60000 | 4(16%) | 3(12%) | 7(14%) |
| | | | |
| **Occupation** | | | |
| Legislators, senior officials, managers | ~ | 1(4%) | 1(2%) |
| Professionals | 3(12%) | ~ | 3(6%) |
| Technicians and associate professionals | 8(32%) | 12(48%) | 20(40%) |
| Clerks | 7(28%) | 4(16%) | 11(22%) |
| Service, shop, market | 6(24%) | 4(16%) | 10(20%) |
| Plant and machine operators, assemblers | 1(4%) | 2(8%) | 3(6%) |
| Elementary occupations (e.g.Labour) | ~ | 1(4%) | 1(2%) |

More than 70% of study subjects had a high school or tertiary education background. A diploma was the most common tertiary qualification. Eight percent of total study subjects had a bachelor or higher degree. Twenty-six percent of study subjects had a family income of under $NZ 30,000 per year. Sixty percent of study subjects had incomes in the $NZ 30,000-60,000 per year bracket and 14% of study subjects had a family income over $NZ 60,000. The ISO 800 Classification was used to group occupations in varied categories. Around 50% of study subjects' occupations were technicians and associate professionals or higher, showing that the study subjects had high social status in China.

Household composition is shown in Table 4.3. Most study subjects lived with their spouse. The percentage living with children and grand children were also very high. More than 85% of subjects had four or more family members in the household, indicating that most study subjects lived in extended family groups.

**Table 4.3: Household composition of study subjects**

| | **Number of subjects and percentage of total** | | |
|---|---|---|---|
| | **Male** | **Female** | **Total** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Live with spouse** | | | |
| Yes | 21(84%) | 19(76%) | 40(80%) |
| No | 4(16%) | 6(24%) | 10(20%) |
| Widower or widow | 3(12%) | 6(24%) | 9(18%) |
| | | | |
| **Live with children** | 19(76%) | 17(68%) | 36(72%) |
| | | | |
| **Live with grandchildren** | 14(56%) | 13(52%) | 27(54%) |
| | | | |
| **Live with others** | 8(32%) | 9(36%) | 17(34%) |
| | | | |
| **Household size (number of people)** | | | |
| 1 | ~ | 1(4%) | 1(2%) |
| 2 | ~ | 1(4%) | 1(2%) |
| 3 | 3(12%) | 2(8%) | 5(10%) |
| 4 | 2(8%) | 3(12%) | 5(10%) |
| 5 | 12(48%) | 11(44%) | 23(46%) |
| 6 | 7(28%) | 6(24%) | 13(26%) |
| More than 6 | 1(4%) | 1(4%) | 2(4%) |

Health status and life style behaviors of the study subjects are shown in Table 4.4, Table 4.5 and Table 4.6.

**Table 4.4: Health status of the study subjects –part one**

| | Number of subjects and percentage of total | | |
|---|---|---|---|
| | **Male** | **Female** | **Total** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Weight Change after immigration** | | | |
| No difference | 2(8%) | 6(24%) | 8(16%) |
| Increase<5kg | 5(20%) | 8(32%) | 13(26%) |
| Increase>5kg | 2(8%) | 4(16%) | 6(12%) |
| Increase, amount not known | 2(8%) | ~ | 2(4%) |
| Decrease<5kg | 13(52%) | 5(20%) | 18(36%) |
| Decrease>5kg | 1(4%) | 2(8%) | 3(6%) |
| | | | |
| **To see doctor in the last 12 months** | | | |
| Yes | 14(56%) | 14(56%) | 28(56%) |
| | | | |
| **Times to see a doctor last year** | | | |
| Never | 11(44%) | 11(44%) | 22(44%) |
| 1 time | 6(24%) | 6(24%) | 12(24%) |
| 2 times | 5(20%) | 2(8%) | 7(14%) |
| 3-5 times | 2(8%) | 2(8%) | 4(8%) |
| >6 times | 1(4%) | 4(16%) | 5(10%) |
| | | | |
| **Get flu** | | | |
| Never | 18(72%) | 13(52%) | 31(62%) |
| Once a year | 6(24%) | 7(28%) | 13(26%) |
| 2-3 times a year | ~ | 4(16%) | 4(8%) |
| More than 3 times a year | 1(4%) | 1(4%) | 2(4%) |

Eight percent of men and 24% of women reported no weight change after immigration. More men (56%) than women (28%) reported a decrease in weight after immigration. However more women (48%) than men (36%) reported an increase weight after immigration.

**Table 4.5: Life style behavior of the study subjects –part two**

| | Number of subjects and percentage of total | | |
|---|---|---|---|
| | **Male** | **Female** | **Total** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Present chronic disease** | 7(28%) | 16(64%) | 23(46%) |
| Periodically diagnosed as hypertensive | 3(12%) | 5(20%) | 8(16%) |
| Some early symptoms of cardiovascular disease | ~ | 1(4%) | 1(2%) |
| Hyperglycemic from occasional test | 2(8%) | 1(4) | 3(6%) |
| Lower back pain | 2(8%) | 6(24%) | 8(16%) |
| Low iron level | ~ | 1(4%) | 1(2%) |
| High blood lipid level | 2(8%) | 5(20%) | 7(14%) |
| **Treatment for the disease** | | | |
| Western medicine and therapy | 4(16%) | 9(36%) | 13(26%) |
| Chinese traditional medicine and therapy | ~ | 2(8%) | 2(4%) |
| Both western and Chinese traditional medicine and therapy | 1(4%) | 2(8%) | 3(6%) |
| Not taking any type of medicine | 20(80%) | 12(48%) | 32(64%) |

Around half of the total study subjects had visited their general practitioner last year. Eighteen percent of study subjects visited their general practitioner more than 3 times last year. Interestingly, over 60 percent of study subjects never got the flu after immigration. Only one man and one woman got flu more than 3 times a year. A total of 46% of study subjects had previously diagnosed chronic diseases. Hypertension (16%), lower back ache (16%), and high blood lipid level (14%) were common among the study subjects. Only one man and four women smoked, accounting for 10% of total study subjects.

To investigate drinking patterns, we used the AUDIT (Alcohol Use Disorders Identification Test) categories (Barbor & Grant, 1989). Those categories were also used

in the 1996/1997 New Zealand Health Survey. In this study, only two females and five males (14% of total) drank alcoholic beverages. (Table 4.6) They were all classified as light or safe drinkers.

**Table 4.6: Life style behavior of the study subjects**

| | Number of subjects and percentage of total | | |
|---|---|---|---|
| | **Male** | **Female** | **Total** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Subject smoked** | 4(16%) | 1(4%) | 5(10%) |
| | | | |
| **Subject drink** | 6(24%) | 2(8%) | 8(16%) |
| **Drinking category*** | | | |
| Light | 6(24%) | 2(8%) | 8(16%) |
| Moderate | ~ | ~ | ~ |
| | | | |
| **Supplements consumed** | 7(28%) | 16(64%) | 23(46%) |
| **Type of supplement** | | | |
| Vitamin and mineral supplements | 4(16%) | 13(52%) | 17(34%) |
| Fish oil supplements | 4(16%) | 7(28%) | 11(22%) |
| Active ingredients (such as garlic and colostrums) | 2(8%) | 4(16%) | 6(12%) |
| | | | |
| **Herbs used** | 5(20%) | 9(36%) | 14(28%) |
| **Methods of use herbs** | | | |
| In soup (for good health) | 4(16%) | 8(32%) | 12(24%) |
| Medical purpose | 1(4%) | 1 (4%) | 2(4%) |

* Category of subjects in alcohol consumption:

1. None; 2. Occasional (less than 1 unit per week); 3. Light (1-15 units per week); 4. Moderate (16-42 units per week); 5.Heavy (more than six units per day or 42 units per week

One unit of alcohol is equivalent to 300 ml of beer, a single measure of spirits or a glass of wine (Alcohol Advisory Council of New Zealand, 1995)

Dietary supplements use was investigated. Vitamin and mineral supplements were most frequently used (34% of all subjects), followed by fish oil supplements (22% of all subjects) and active ingredients, such as garlic and colostrums products (12% of all subjects). More women (64%) than men (28%) took supplements, accounting for 46%

of all study subjects. More females (36%) than males (20%) took herbs regularly. Most took them to improve health; only one in each group took them for medical purposes.

Food intake patterns are shown in Table 4.7, 4.8 and 4.9.

**Table 4.7: Food intake patterns of the study subjects –part one**

| | Number of subjects and percentage of total | | |
|---|---|---|---|
| | **Male** | **Female** | **Total** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Meals each day** | | | |
| 2 meals | ~ | 2(8%) | 2(4%) |
| 3 meals | 23(92%) | 21(84%) | 44(88%) |
| 4 meals | 2(8%) | 2(8%) | 4(8%) |
| | | | |
| **Dine out** | | | |
| Less than once a month | 14(56%) | 16(64%) | 30(60%) |
| 2-3 times a month | 6(24%) | 4(16%) | 10(20%) |
| Once a week | 5(20%) | 2(8%) | 7(14%) |
| 2-3 times a week | ~ | 2(8%) | 2(4%) |
| Once daily | ~ | 1(4%) | 1(2%) |
| | | | |
| **Eating alone** | | | |
| Nearly very meal | ~ | 2(8%) | 2(4%) |
| Once daily | 3(12%) | 1(4%) | 4(8%) |
| 2-3 times per week | 3(12%) | 1(4%) | 4(8%) |
| Seldom, less than once a week | 19(76%) | 21(84%) | 40(80%) |
| | | | |
| **Food preparation** | | | |
| Most of time myself | 7(28%) | 22(88%) | 29(58%) |
| Most of time my spouse | 14(56%) | 1(4%) | 15(30%) |
| Most of time my children or relatives | 4(16%) | 2(8%) | 6(12%) |
| | | | |
| **Eat Western takeaways** | | | |
| Never | 4(16%) | 10(40%) | 14(28%) |
| Less than once a month | 12(48%) | 10(40%) | 22(44%) |
| 2-3 times per month | 7(28%) | 5(20%) | 12(24%) |
| More than 2-3 times per week | 2(8%) | ~ | 2(4%) |
| | | | |
| **Reasons for choosing Western style takeaways** | | | |
| Convenient | 3(12%) | 3(12%) | 6(12%) |
| Other members in the family like it | 18(72%) | 12(48%) | 30(60%) |
| NA (don't eat at all) | 4(16%) | 10(40%) | 14(28%) |
| | | | |
| **Whether prefer Chinese cooking** | | | |
| Yes | 25(100%) | 25(100%) | 50(100%) |

**Table 4.8: Food intake patterns of the study subjects –part two**

| | Number of subjects and percentage of total | | |
|---|---|---|---|
| | **Male** | **Female** | **Total** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Milk drinking** | | | |
| Not drink | 7(28%) | 5(20%) | 12(24%) |
| 1-2 cups per week | 3(12%) | 5(20%) | 8(16%) |
| 1 cup per day | 15(60%) | 15(60%) | 30(60%) |
| | | | |
| **Cheese eating** | | | |
| No | 24(96%) | 23(92%) | 47(94%) |
| Less than once per week | 1(4%) | 2(8%) | 3(6%) |
| | | | |
| **Type of cooking oil** | | | |
| Mixed vegetable oil | 8(32%) | 13(52%) | 21(42%) |
| Animal fat | ~ | 1(4%) | 1(2%) |
| Peanut oil | 1(4%) | 1(4%) | 2(4%) |
| | | | |
| **Red meat consumption** | | | |
| No | 1(4%) | 2(8%) | 3(6%) |
| Less than once a week | 9(36%) | 14(56%) | 23(46%) |
| 2-3 times a week | 15(60%) | 9(36%) | 24(48%) |
| | | | |
| **Soy products** | | | |
| Not | ~ | 1(4%) | 1(2%) |
| Less than once a week | 10(40%) | 10(40%) | 20(40%) |
| 2-3 times a week | 15(60%) | 13(52%) | 28(56%) |
| More than once everyday | ~ | 1(4%) | 1(2%) |
| | | | |
| **Vegetable** | | | |
| 50-200 grams (per day) | 1(4%) | 6(24%) | 7(14%) |
| 200-400 grams (per day) | 12(48%) | 9(36%) | 21(42%) |
| 400-600 grams (per day) | 10(40%) | 9(36%) | 19(38%) |
| 600-800 grams (per day) | 1(4%) | ~ | 1(2%) |
| >800 grams (per day) | 1(4%) | ~ | 1(2%) |

Most of the study subjects had three meals a day. They usually ate with others, only two women reported eating nearly every meal alone. Eating Western takeaways and dining out were not common in this group. They ate Western takeaways because other members in the family ate them. Only two study subjects ate Western takeaways more than two to three times per week.

Dairy products are easily obtained in New Zealand. Over 60% of total study subjects drank milk, however most didn't eat cheese. Mixed vegetable oil and soy oil was the most common oil used in cooking. Red meat and soy product consumption pattern was

similar with around 50% of study subjects eating these less than once a week, and the remainder, two to three times per week. Vegetable and fruit consumption patterns were similar among men and women. However men seemed to consume more cereals than women. Fish consumption was high. Over 70% of study subjects ate fish two to three times per week. They consumed very little organ meat. Seventy two percent of subjects ate organ meats once a month or less. Food allergy was not common among study subjects. Most subjects didn't cut fat from meat when cooking.

**Table 4.9: Food intake patterns of the study subjects -part three**

| | Number of subjects and percentage of total | | |
|---|---|---|---|
| | **Male** | **Female** | **Total** |
| | **(n=25)** | **(n=25)** | **(n=50)** |
| **Fruit** | | | |
| Less than 50grams (per day) | 1(4%) | ~ | 1(2%) |
| 50-200 grams (per day) | 9(36%) | 10(40%) | 19(38%) |
| 200-400 grams (per day) | 12(48%) | 12(48%) | 24(48%) |
| 400-600 grams (per day) | 2(8%) | 3(12%) | 5(10%) |
| 600-800 grams (per day) | 1(4%) | ~ | 1(2%) |
| | | | |
| **Cereal food** | | | |
| 50-100 grams (per day) | ~ | 1(4%) | 1(2%) |
| 100-200 grams (per day) | 2(8%) | 10(40%) | 12(24%) |
| 200-300 grams (per day) | 7(28%) | 7(28%) | 14(28%) |
| 300-400 grams (per day) | 11(44%) | 7(28%) | 18(36%) |
| 400-500 grams (per day) | 4(16%) | ~ | 4(8%) |
| >500 grams (per day) | 1(4%) | ~ | 1(2%) |
| | | | |
| **Fish meal** | | | |
| Less than one time per week | 4(16%) | 6(24%) | 10(20%) |
| 2-3 times per week | 14(56%) | 12(48%) | 26(52%) |
| 4-5 times per week | 6(24%) | 6(24%) | 12(24%) |
| Nearly every meal | 1(4%) | 1(4%) | 2(4%) |
| | | | |
| **Animal organ products** | | | |
| No | 8(32%) | 10(40%) | 18(36%) |
| Less than one time per week | 8(32%) | 11(44%) | 19(38%) |
| 2-3 times per week | 9(36%) | 4(16%) | 13(26%) |
| | | | |
| **Food allergy** | 5(20%) | 5(20%) | 10(20%) |
| | | | |
| **Cut off fat from meat** | 4(16%) | 10(40%) | 14(28%) |

## 4.2 PARTICIPANTS ANTHROPOMETRIC MEASUREMENTS

Table 4.10 describes the male subjects' anthropometric measurements, and Table 4.11 the female.

**Table 4.10: Anthropometric characteristics and health measurements of the study subjects (male)**

| | Mean | SD | Min | LQ | Median | UQ | Max |
|---|---|---|---|---|---|---|---|
| Body weight (kg) | 68.2 | 7.48 | 52.4 | 63.5 | 70.6 | 73.8 | 80.3 |
| Height (cm) | 166.8 | 3.15 | 161 | 164.7 | 167 | 169.0 | 172.2 |
| BMI (kg/m²) | 24.5 | 2.49 | 18.9 | 23.18 | 24.8 | 25.95 | 28.47 |
| Triceps skinfold (mm) | 13.5 | 4.96 | 6.2 | 10.4 | 13.5 | 16.6 | 25.2 |
| Subscapular skinfold (mm) | 23.3 | 5.92 | 11.9 | 20 | 24.3 | 27.5 | 33 |
| Humerus width (cm) | 6.6 | 0.22 | 6.1 | 6.5 | 6.6 | 6.8 | 7.1 |
| Upper arm circumference (cm) | 27.3 | 2.86 | 19 | 25.6 | 28.2 | 29.6 | 30.5 |
| Waist circumference (cm) | 83.8 | 7.23 | 67.1 | 79.6 | 84.9 | 88.5 | 97.1 |
| Hip circumference (cm) | 96.3 | 4.08 | 88.8 | 95.0 | 97.1 | 99.0 | 102.4 |
| Waist/Hip ratio | 0.87 | 0.06 | 0.68 | 0.83 | 0.88 | 0.91 | 0.96 |
| Systolic blood pressure (mmHg) | 130.5 | 12.42 | 110 | 120 | 130 | 138 | 151 |
| Diastolic blood pressure (mmHg) | 83.8 | 6.88 | 70 | 80 | 85 | 88 | 100 |
| Blood glucose (mmol/l) | 6.0 | 0.82 | 4.2 | 5.6 | 5.9 | 6.6 | 7.8 |

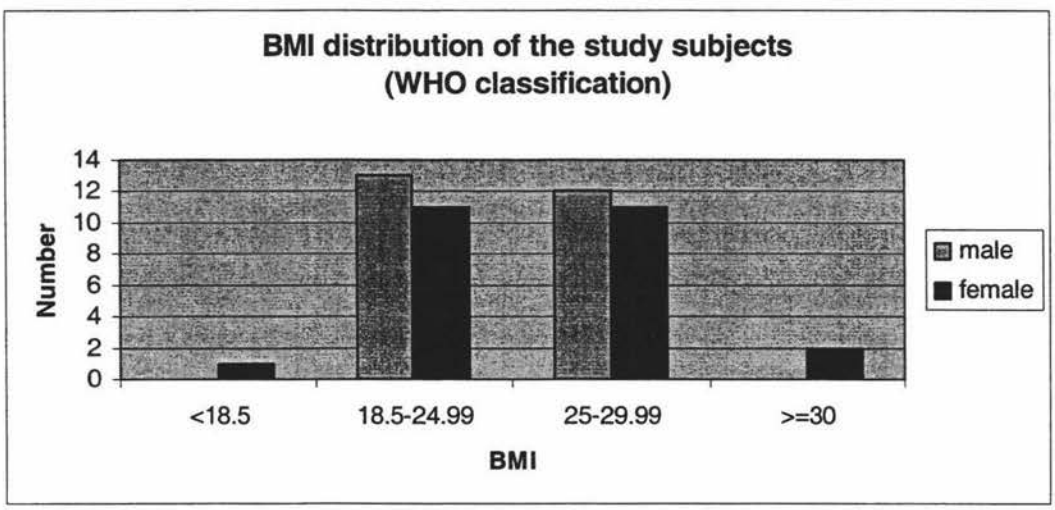
Men were taller and heavier than women ($p<0.05$). Mean BMI in men (24.5) was lower than that in women (24.8) ($p<0.05$). Women's skinfolds were much higher than the men's, especially tricep skinfolds (23.2mm vs. 13.5mm) ($p<0.05$). Men had larger humerus width values, upper arm circumferences and waist circumferences than women, but they had similar hip circumferences. Thus, men had a larger Waist/Hip ratio (0.87) than women (0.84) ($p<0.05$). Men and women had similar mean systolic and diastolic blood pressures (130.5mmHg, 83.8mmHg vs. 130.5mmHg, 80.5mmHg, $p>0.05$), however, men's mean blood glucose level was higher than women's (6.0mmol/l vs. 5.5mmol/l, $p<0.05$).

**Table 4.11: Anthropometric characteristics and health measurements of the study subjects (female)**

| | Mean | SD | Min | LQ | Median | UQ | Max |
|---|---|---|---|---|---|---|---|
| Body weight (kg) | 58.8 | 8.47 | 42.4 | 55.1 | 58 | 62.8 | 77 |
| Height (cm) | 153.8 | 5.01 | 145 | 150.1 | 153.7 | 155.5 | 162.6 |
| BMI (kg/m²) | 24.8 | 3.37 | 18.41 | 23.10 | 25.1 | 25.7 | 32.05 |
| Triceps skinfold (mm) | 23.2 | 7.83 | 11.3 | 19.6 | 22.3 | 28.5 | 40.2 |
| Subscapular skinfold (mm) | 26.0 | 9.01 | 12.1 | 17.6 | 27.3 | 33.0 | 42.2 |
| Humerus width (cm) | 6.1 | 0.30 | 5.6 | 6.0 | 6.1 | 6.3 | 6.7 |
| Upper arm circumference (cm) | 26.4 | 3.68 | 17.3 | 25.5 | 27 | 28.9 | 31.6 |
| Waist circumference (cm) | 81.6 | 10.16 | 65.2 | 74.0 | 81.3 | 88.0 | 98.3 |
| Hip circumference (cm) | 96.5 | 6.74 | 85.9 | 90.7 | 96.8 | 99.2 | 116 |
| Waist/Hip ratio | 0.84 | 0.07 | 0.73 | 0.80 | 0.83 | 0.90 | 0.96 |
| Systolic blood pressure (mmHg) | 130.5 | 16.2 | 94 | 120 | 130 | 143 | 160 |
| Diastolic pressure (mmHg) | 81.00 | 7.36 | 65 | 75 | 82 | 86 | 96 |
| Blood glucose (mmol/l) | 5.5 | 0.67 | 3.9 | 5.0 | 5.5 | 6.0 | 6.4 |

The distribution of BMI is shown in Figure 4.1.

**Figure 4.1: BMI distribution of the study subjects by sex (WHO classification)**



The WHO classification of normal BMI is 18.5-25. Overweight and obesity were classified as 25-30 and >=30 respectively (WHO, 2000). According to the WHO standard, 48% of male and 52% of female subjects in this study were considered overweight. Only one female but no males were considered underweight (Figure 4.3). Two females but no males were considered obese.

Increased waist circumference is independently associated with increased health risk. Table 4.12 shows the numbers and percentages of the study subjects in different waist categories.

**Table 4.12: Distribution of study subjects in different waist circumference categories**

| **Male waist circumference** | | **Female waist circumference** | |
|---|---|---|---|
| **(n=25)** | | **(n=25)** | |
| <=102cm | >102cm | <=88cm | >88cm |
| 25(100%) | 0 | 19(76%) | 6(24%) |

This ratio is considered an indicator of cardiovascular risk when the ratio exceeds 0.9 for males and 0.8 for females (National Cholesterol Education Program, 1994; Norgan, 1986). Both men and women's waist circumference were divided into two categories using these criteria. Detailed waist/hip ratio results are shown in Table 4.13

**Table 4.13: Distribution of study subjects in different waist/hip circumference ratio categories**

| **Male Waist/Hip ratio** | | **Female Waist/Hip ratio** | |
|---|---|---|---|
| **(n=25)** | | **(n=25)** | |
| <=0.9 | >0.9 | <=0.8 | >0.8 |
| 15(60%) | 10(40%) | 7(28%) | 18(72%) |

No male subjects had waist circumferences greater than 102cm. But 24% of female subjects had waist circumference greater than 88cm. Forty percent of men had waist/hip

ratios greater than 0.9 and 72% of women had waist/hip ratios greater than 0.8. These results indicate that more females than males were at risk.

## 4.3 HEALTH STATUS OF THE STUDY PARTICIPANTS

Blood pressure levels for males and females are shown in Table 4.14. Participants were deemed to be hypertensive in accordance with the World Health Organization (WHO) cut-off values, irrespective of whether they were taking hypertensive medication. Under these criteria, only one male and one female were deemed to be hypertensive.

**Table 4.14: Distribution of study subjects in different blood pressure categories**

| | **Male (n=25)** | **Female (n=25)** | **Total (n=50)** |
|---|---|---|---|
| **Systolic pressure (mmHg)** | | | |
| Normal BP<140 | 20(80%) | 17(68%) | 37(74%) |
| Borderline 140≤BP<160 | 5(20%) | 7(28%) | 12(24%) |
| Hypertension BP≥160 | ~ | 1(4%) | 1(2%) |
| **Diastolic pressure (mmHg)** | | | |
| Normal BP<90 | 21(84%) | 24(96%) | 45(90%) |
| Borderline 90≤BP<95 | 3(12%) | ~ | 3(6%) |
| Hypertension BP≥95 | 1(4%) | 1(4%) | 2(4%) |

Table 4.15: shows the blood glucose level distribution for males and females.

**Table 4.15: Distribution of study subjects in different blood glucose categories**

| | **Male** | **Female** | **Total** |
|---|---|---|---|
| Normal (<7.8mmol/l) | 24(96%) | 25(100%) | 49(98%) |
| Impaired glucose tolerance (≥7.8 and <11.1mmol/l) | 1(4%) | ~ | 1(2%) |

## 4.4 DIETARY STATUS OF THE STUDY PARTICIPANTS

### *4.4.1 Nutrient intake of the study participants*

Dietary energy sources and macronutrient intakes are shown in Table 4.16 and Table 4.17. Because there are some significant differences in intake between males and females, the results are presented in separate tables.

**Table 4.16: Dietary energy sources and macronutrient intake (male)**

| | Mean | SD | Min | LQ | Median | UQ | Max |
|---|---|---|---|---|---|---|---|
| Weight (g) | 1497 | 503 | 916 | 1252 | 1357 | 1621 | 3638 |
| Energy (kJ) | 8932 | 956 | 7563 | 8473 | 8868 | 9399 | 12078 |
| Protein (g) | 83.2 | 15.6 | 54.1 | 78.2 | 82.4 | 90.4 | 123.6 |
| Protein g/kg | 1.24 | 0.30 | 0.73 | 1.11 | 1.23 | 1.40 | 2.05 |
| Total fat (g) | 64.3 | 14.2 | 37.4 | 55.9 | 62.1 | 70.0 | 91.2 |
| Carbohydrate (g) | 307 | 49 | 205 | 283 | 295 | 328 | 478 |
| Alcohol (g) | 1.3 | 2.6 | 0 | 0 | 0 | 0.6 | 9.3 |
| Total sugars (g) | 56.2 | 25.6 | 18.4 | 38.0 | 49.5 | 74.3 | 105.1 |
| Starch (g) | 201 | 63 | 118 | 168 | 193 | 211 | 454 |
| Fibre (g) | 19.2 | 11.1 | 10.5 | 14.8 | 16.5 | 18.7 | 64.2 |
| Energy from protein % | 15.8 | 2.2 | 11.3 | 14.0 | 15.8 | 17.4 | 19.6 |
| Energy from fat % | 26.7 | 5.6 | 17.1 | 22.9 | 27.3 | 29.7 | 39.8 |
| Energy from carbohydrate % | 55.0 | 5.7 | 40.2 | 51.7 | 54.4 | 58.7 | 66.2 |
| Energy from sugar % | 10.6 | 4.6 | 2.5 | 7.8 | 9.8 | 13.9 | 18.9 |
| Energy from alcohol % | 0.4 | 0.8 | 0 | 0 | 0 | 0.2 | 3.0 |

The daily mean energy intake for males (8,932kJ) was significantly higher than for females (7,092kJ) ($p<0.05$). Although the daily mean protein intake for males was also higher than for females ($p<0.05$), the protein intake per kg body weight was similar for male and female ($p>0.5$). Protein contribution to energy intake was 15.8% and 17.2% respectively ($p<0.05$). Daily mean fat intake was 64.3g for males and 49.4g for females

($p<0.05$). Fat contribution to energy intake for males is 26.7% and for females is 25.8% ($p<0.05$). Carbohydrate intake for males was higher than for females, however, carbohydrate contribution to total energy intake was similar. The total sugar intakes for males and females were 56.2g and 51.7g respectively. Fibre intakes for study subjects were 19.2g and 18.2g. The alcohol intakes for both male and female were very low and only contributed between 0.4% and 0.2% to energy intake.

**Table 4.17: Dietary energy sources and macronutrient intake (female)**

| | Mean | SD | Min | LQ | Median | UQ | Max |
|---|---|---|---|---|---|---|---|
| Weight (g) | 1213 | 267 | 695 | 1101 | 1239 | 1318 | 1809 |
| Energy (kJ) | 7092 | 1234 | 5286 | 5933 | 7049 | 7566 | 10314 |
| Protein (g) | 70.7 | 12.5 | 41.4 | 66.8 | 69.8 | 76.6 | 92.9 |
| Protein g/kg | 1.21 | 0.20 | 0.82 | 1.10 | 1.19 | 1.28 | 1.62 |
| Total fat (g) | 49.4 | 14.0 | 24.7 | 42.4 | 45.6 | 56.7 | 84.5 |
| Carbohydrate (g) | 244 | 56 | 152 | 200 | 238 | 276 | 361 |
| Alcohol (g) | 0.5 | 1.6 | 0 | 0 | 0 | 0 | 5.9 |
| Total sugars (g) | 51.7 | 28.8 | 11.4 | 33.6 | 46.1 | 62.2 | 126.1 |
| Starch (g) | 160 | 48 | 88 | 126 | 147 | 200 | 260 |
| Fibre (g) | 18.2 | 12.4 | 10.4 | 12.6 | 15.4 | 18.4 | 74.0 |
| Energy from protein % | 17.2 | 2.9 | 11.4 | 15.2 | 16.5 | 19.4 | 22.7 |
| Energy from fat % | 25.8 | 5.7 | 11.7 | 22.4 | 24.6 | 30.0 | 36.5 |
| Energy from carbohydrate % | 54.7 | 6.0 | 45.4 | 50.5 | 55.6 | 57.6 | 70.6 |
| Energy from sugar % | 11.8 | 5.3 | 2.6 | 8.0 | 11.4 | 14.0 | 27.9 |
| Energy from alcohol % | 0.2 | 0.7 | 0 | 0 | 0 | 0 | 3.0 |

Vitamin and mineral intake are shown in Table 4.18 and Table 4.19. Male intakes of most vitamin and minerals tended to be lower than that of females except for B-Carotene and vitamin C.

## Table 4.18: Vitamin and mineral intake (male)

| | Mean | SD | Min | LQ | Median | UQ | Max |
|---|---|---|---|---|---|---|---|
| Thiamin (mg) | 1.2 | 0.3 | 0.7 | 1.0 | 1.2 | 1.3 | 1.7 |
| Riboflavin (mg) | 1.2 | 0.4 | 0.4 | 1.1 | 1.2 | 1.4 | 2.0 |
| Niacin (mg) | 16 | 3.9 | 10 | 14 | 16 | 18 | 24 |
| Niacin Eq (ug) | 30 | 7 | 16 | 26 | 29 | 33 | 45 |
| Retinol (ug) | 345 | 40 | 50 | 182 | 298 | 488 | 605 |
| B-Carotene Eq (ug) | 2614 | 483 | 633 | 1438 | 2444 | 4114 | 6878 |
| Total A Eq (ug) | 530 | 85 | 175 | 310 | 547 | 730 | 913 |
| Vitamin C (mg) | 126 | 73 | 53 | 84 | 127 | 165 | 261 |
| Vitamin D (ug) | 2.1 | 2.5 | 0 | 0.4 | 0.9 | 3.0 | 9.3 |
| Vitamin E (mg) | 11.5 | 5.9 | 4.7 | 7.6 | 10.4 | 12.3 | 29.1 |
| Vitamin B6 (mg) | 1.8 | 0.6 | 1.2 | 1.5 | 1.7 | 1.9 | 4.1 |
| Vitamin B12 (ug) | 2.6 | 1.6 | 0.8 | 1.7 | 2.5 | 3.0 | 8.4 |
| Total folate (ug) | 222 | 89 | 136 | 165 | 205 | 231 | 507 |
| Sodium (mg) | 2165 | 896 | 1323 | 1565 | 1943 | 2325 | 5286 |
| Potassium (mg) | 2950 | 380 | 1941 | 2268 | 2561 | 2874 | 4001 |
| Magnesium (mg) | 305 | 114 | 213 | 241 | 260 | 320 | 698 |
| Calcium (mg) | 615 | 87 | 180 | 440 | 550 | 720 | 1041 |
| Phosphorus (mg) | 1292 | 323 | 788 | 1116 | 1303 | 1434 | 2160 |
| Iron (mg) | 16 | 4.8 | 9 | 13 | 14 | 18 | 28 |
| Zinc (mg) | 8.9 | 1.8 | 5.5 | 7.7 | 8.8 | 10.1 | 13.1 |
| Manganese (ug) | 4719 | 530 | 3355 | 3920 | 4287 | 4690 | 5478 |
| Copper (mg) | 1.4 | 0.3 | 1.0 | 1.2 | 1.3 | 1.5 | 2.2 |
| Selenium (ug) | 59.5 | 23.1 | 25.3 | 47.1 | 54.2 | 65.0 | 127.9 |

## Table 4.19: Vitamin and mineral intake (female)

| | Mean | SD | Min | LQ | Median | UQ | Max |
|---|---|---|---|---|---|---|---|
| Thiamin (mg) | 1.1 | 0.3 | 0.7 | 0.8 | 1.0 | 1.2 | 2.0 |
| Riboflavin (mg) | 1.1 | 0.3 | 0.5 | 0.8 | 1.1 | 1.4 | 1.5 |
| Niacin (mg) | 14 | 6 | 6 | 11 | 13 | 15 | 41 |
| Niacin Eq (ug) | 27 | 8 | 9 | 23 | 26 | 30 | 54 |
| Retinol (ug) | 426 | 75 | 110 | 265 | 327 | 653 | 826 |
| B-Carotene Eq (ug) | 3206 | 526 | 511 | 1107 | 2894 | 5074 | 7139 |
| Total A Eq (ug) | 502 | 134 | 157 | 232 | 603 | 888 | 1093 |
| Vitamin C (mg) | 155 | 82 | 48 | 105 | 139 | 170 | 398 |
| Vitamin D (ug) | 3.3 | 2.8 | 0.04 | 1.0 | 2.8 | 4.4 | 9.4 |
| Vitamin E (mg) | 13.4 | 13.8 | 5.7 | 8.2 | 9.5 | 11.3 | 74.1 |
| Vitamin B6 (mg) | 1.6 | 0.5 | 0.7 | 1.2 | 1.5 | 1.7 | 2.9 |
| Vitamin B12 (ug) | 2.3 | 1.2 | 0.9 | 1.6 | 2.2 | 2.7 | 6.5 |
| Total folate (ug) | 198 | 102 | 88 | 124 | 174 | 231 | 559 |
| Sodium (mg) | 2146 | 822 | 906 | 1732 | 2023 | 2346 | 5244 |
| Potassium (mg) | 2478 | 747 | 1120 | 2213 | 2425 | 2721 | 4921 |
| Magnesium (mg) | 302 | 130 | 156 | 215 | 279 | 347 | 811 |
| Calcium (mg) | 574 | 194 | 260 | 432 | 587 | 687 | 1011 |
| Phosphorus (mg) | 1143 | 341 | 581 | 999 | 1124 | 1201 | 2432 |
| Iron (mg) | 13 | 3.2 | 9 | 10 | 12 | 14 | 24 |
| Zinc (mg) | 8.1 | 2.7 | 4.2 | 6.8 | 7.5 | 9.4 | 17.5 |
| Manganese (ug) | 4023 | 922 | 2350 | 2885 | 3833 | 4175 | 7512 |
| Copper (mg) | 1.3 | 0.4 | 0.8 | 1.0 | 1.3 | 1.4 | 2.5 |
| Selenium (ug) | 54.2 | 17.1 | 23.7 | 45.8 | 54.6 | 63.6 | 95.4 |

Lipid intakes are described in Table 4.20 and Table 4.21.

**Table 4.20: Lipid intakes of study subjects (male)**

| | Mean | SD | Min | LQ | Median | UQ | Max |
|---|---|---|---|---|---|---|---|
| Total fat (g) | 64 | 14.2 | 37 | 56 | 62 | 70 | 91 |
| SFA (g) | 23 | 5.6 | 9 | 21 | 23 | 27 | 36 |
| MUFA (g) | 28 | 6.7 | 12 | 24 | 28 | 32 | 42 |
| PUFA (g) | 18 | 5.0 | 11 | 15 | 18 | 22 | 33 |
| Cholesterol (mg) | 283 | 95.6 | 76 | 221 | 299 | 322 | 483 |
| Energy from MUFA % | 11.7 | 2.8 | 5.1 | 10.9 | 11.8 | 13.6 | 16.6 |
| Energy from PUFA % | 7.8 | 2.2 | 4.2 | 6.4 | 7.5 | 8.7 | 14.2 |
| Energy from SFA % | 10.1 | 2.5 | 4.3 | 9.0 | 10.7 | 11.3 | 15.8 |
| Fat as MUFA % | 39.6 | 4.1 | 33.0 | 36.3 | 38.8 | 42.5 | 46.6 |
| Fat as PUFA % | 26.5 | 5.1 | 19.0 | 24.6 | 26.4 | 28.2 | 38.4 |
| Fat as SFA % | 34.0 | 3.8 | 25.7 | 31.3 | 34.9 | 36.6 | 39.7 |

SFA=saturated fat; MUFA=monounsaturated fat; PUFA=polyunsaturated fat

**Table 4.21: Lipid intakes of study subjects (female)**

| | Mean | SD | Min | LQ | Median | UQ | Max |
|---|---|---|---|---|---|---|---|
| Total fat (g) | 49 | 14.0 | 25 | 42 | 46 | 57 | 85 |
| SFA (g) | 16 | 4.5 | 8 | 13 | 15 | 18 | 29 |
| MUFA (g) | 19 | 6.4 | 9 | 15 | 18 | 23 | 32 |
| PUFA (g) | 15 | 4.4 | 6 | 12 | 14 | 17 | 25 |
| Cholesterol (mg) | 257 | 79.2 | 89 | 185 | 249 | 326 | 383 |
| Energy from MUFA % | 10.2 | 3.0 | 5.3 | 8.3 | 10.0 | 12.1 | 16.0 |
| Energy from PUFA % | 7.9 | 2.0 | 4.2 | 6.9 | 8.0 | 9.3 | 11.5 |
| Energy from SFA % | 8.5 | 2.4 | 5.1 | 7.0 | 7.7 | 10.0 | 12.9 |
| Fat as MUFA % | 37.9 | 5.5 | 22.9 | 34.9 | 37.6 | 43.2 | 45.5 |
| Fat as PUFA % | 30.0 | 6.3 | 18.5 | 26.7 | 29.6 | 33.5 | 47.6 |
| Fat as SFA % | 32.1 | 4.4 | 22.0 | 30.7 | 32.2 | 34.4 | 41.4 |

SFA=saturated fat; MUFA=monounsaturated fat; PUFA=polyunsaturated fat

Mean fat intakes for male and female were 64g and 49g. Mean cholesterol intake for males was 283mg per day and for females was 257mg per day. Mean percentage of total energy from saturated fat for males and females were 10.1% and 8.5% respectively.

### *4.4.2 Food group consumption by study participants*

Foods consumed for comparison with Chinese studies were classified as belonging to one of 19 categories as shown in Table 4.22.

**Table 4.22: Food group consumption by study subjects (per day)**

| **Food items** | **Men** mean (g) | **Women** mean (g) |
|---|---|---|
| Rice/ products | 207 | 148 |
| Wheat/flour | 130 | 110 |
| Legume | 33 | 43 |
| Vegetable/tubers | 341 | 268 |
| Salted vegetable | 9.2 | 7.6 |
| Fruits | 207 | 223 |
| Pork | 40 | 31 |
| Other meats | 12 | 9 |
| Organ meats | 3 | 1 |
| Poultry/products | 68 | 44 |
| Egg | 23 | 25 |
| Fish/shellfish | 43 | 23 |
| Cooking oils/spead | 33 | 31 |
| Snack/sweet products | 22 | 23 |
| Dairy food | 175 | 161 |
| Fast food | 24 | 12 |
| Soft drink | 4 | 13 |
| Salt | 2.2 | 3.1 |
| Soy bean source | 0.7 | 0.35 |

## 4.5 PHYSICAL ACTIVITY LEVELS OF THE STUDY PARTICIPANTS

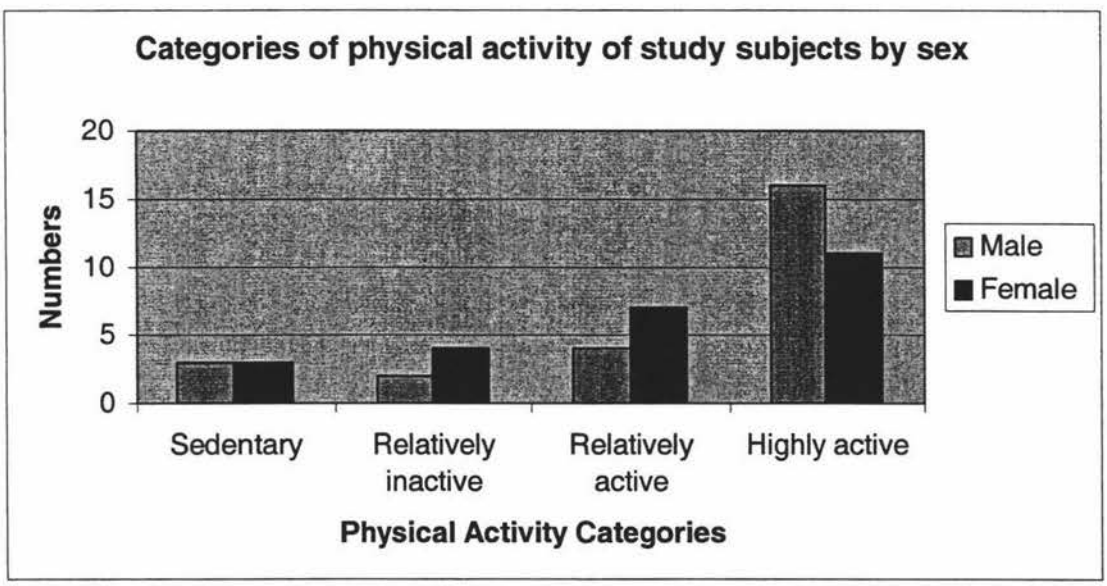
Physical activity levels were classified used the same categories as the 1996/1997 New Zealand Health Survey, shown below:

| | | |
|---|---|---|
| Physically inactive | Sedentary | No sports/activities in the previous seven days |
| | Relatively inactive | Took part in some leisure-time physical activity in the previous seven days, but less than 2.5 hours in total |
| Physically active | Relatively active | Took part in at least 2.5 hours, but less than five hours of leisure-time physical activity in the previous seven days |
| | Highly active | Took part in five hours or more of leisure-time physical activity in the previous seven days |

From Ministry of Health, 1999

Figure 4.2 showed the distribution of study subjects in the different physical activity categories

**Figure 4.2: Distribution of study subjects in different physical activity categories**




The numbers of sedentary and relatively inactive subjects in leisure time were relatively low. Sixty four percent of men and 44% of women were highly active in leisure time.

# CHAPTER 5. DISCUSSION

## 5.1 RECRUITMENT

Most subjects in this study were recruited personally via friends or relatives. Although at first some were embarrassed, unsure, or worried that volunteering may lead to unnecessary trouble, explanation and patience helped to persuade them to join the study. They were happy to introduce the study to their friends because of the strong sense of community and friendship between Chinese elderly. They were concerned about their own health, and were eager to learn. Most subjects admitted that the language barrier prevented them from getting adequate medical advice.

## 5.2 DEMOGRAPHIC DETAILS

### *5.2.1 Age*

For the purposes of this study 'elderly people' refer to those in the age range of 60 years and over. People at the age of 60 are recognized as 'elderly people' in China, compared to 65 in New Zealand. It is also the age at which people may be entitled to retirement benefits in China. This reflects the fact that many Chinese may face age-related disability and illnesses at a relatively younger age and have a shorter life expectancy than average New Zealanders.

According to Statistics New Zealand (1986, 1996), there were only 2,641 elderly Chinese immigrants aged 50 years and over in 1986, and this number increased to 7,089 in 1996. In this study, all subjects are in the 60-70age ranges except one man who is over 70. (Table 4.1)

### *5.2.2 Education level and occupation*

There is good evidence that a low level of education is associated with poor health status. Educational achievement is not just a function of an individual's abilities and aspirations, but is influenced strongly by socioeconomic circumstances (Benzeval et al.,

1995). People who do well in education are much more likely to make healthier choices in later life about the health-related habits of diet, alcohol consumption, smoking and exercise (Wadsworth, 1997). Income and education have been frequently linked with life satisfaction (Lohr et al., 1988; Osberg et al., 1987), but other studies were inconsistent (Kehn, 1995).

Chinese immigrants in New Zealand have higher average education background (Statistic New Zealand, 2001a). Friesen and Ip conducted a research in 1997 on the profile of New Chinese New Zealanders and found over 61% of the respondents had Bachelor's degrees. Only 0.6% did not have a secondary education (Friesen & Ip, 1997). Tan's study also observed a high tertiary qualification rate among the women subjects. (Tan, 2001). In Lu's study of Chinese children in New Zealand, over 80% of the parents had tertiary education (Lu, 2002). Because the young immigrants who were chosen by New Zealand for their qualifications, expertise, age, health and wealth were generally highly educated young urban dwellers, most had a good family background, which had the ability to give them a good education. Therefore most of their parents were likely to come from urban areas with higher education and wealth.

In the present study, over 30% of subjects had tertiary education. (Table 4.2) Obviously, this percentage is higher than in Mainland China. According to the 1992 Chinese National Nutrition Survey, only 3.7% of subjects over 60 years old had a tertiary education background nationwide. In urban areas, this increased to 8.4% (Ge et al., 1996).

In Western populations, high education and income correlate with a decrease in fat intake. The correlation of education and macro nutrient intakes will be discussed later.

### *5.2.3 Family income and family composition*

Income is the single most important modifiable determinant of health and is strongly related to health and well-being. Although previous studies have indicated that financial strain was consistently and negatively associated with life satisfaction (Krause, 1993), the link between poverty and ill health is clear. With few exceptions, the financially worst-off experience the highest rates of illness (Porirua Health Partnership, 1998). Higher socio-economic status is generally related to a greater variety of food

consumption (Marshall, 1995). A Canadian study that looked at health status measures in relation to income adequacy, education and occupation amongst older people living in the community, found that income adequacy was the most consistent predictor of health status (Cairney & Arnold, 1996). The 1992 Chinese National Nutrition Survey found that the nutrient intakes in higher income groups were always better than those in low income groups in all areas in China (Ge et al., 1996).

Family income (as opposed to individual income) was seen as the best indicator of income status (Ministry of Health, 1999). In this study, over 60% of study subjects had family incomes ranging from $NZ 30,000-60,000 per year, which can be considered a middle class income in New Zealand. Twenty six percent of total study subjects had low family incomes under $NZ 30,000 per year.

Social isolation and loneliness are issues of relevance to the health of older people (Tang et al., 1995). People who had close relationships with their family and friends had a lower rate of mortality (Rowe & Kahn, 1987). Strong family support affected the positive acculturation of elderly people (Selvarajah & Suppiah, 1994). The experience of the spouse played an important part in the immigrant acculturation process. A New Zealand study found that the spouse was identified as one of the key factors in successful acculturation (Sheehan, 1992). Also Thompson indicated that the family of an immigrant could play a key role in the success or failure of the immigrant (Thompson 1986). Mui's study of elderly Chinese immigrants in America showed that elderly who were satisfied with help received from family members were least likely to be depressed (Mui, 1996). Acculturation of the expatriate is then an aggregate process, which involves the total experience of the immigrant and his family (Selvarajah & Suppiah, 1994). The overall positive and negative experiences of the immigrants and their families may affect how the immigrant adjusts and reacts to the foreign environment.

Living in extended family groups is part of Chinese traditional culture. In the present study, only one study subject lived alone, 80% lived with their spouse, 72% lived with their children and 54% lived with their grandchildren (Table 4.3). In New Zealand, the household size of Asian ethnic groups is larger than that of Europeans (Statistic New Zealand, 2001a). In Chinese culture, the younger generation has the responsibility to care for their elderly parents, especially when they need support. The Chinese family is

responsible for the care of its aged, sick, unemployed and disabled members (Bowman & Hui, 2000). Most migrant Chinese elderly in New Zealand in this study were dependent because of the language barrier and financial reasons.

### *5.2.4 Lifestyle behaviours*

- **Smoking**

Smoking has been identified as the major cause of preventable death in developed countries. Smoking has been linked to increased rates of some cancers (lung, mouth, pharynx, oesophagus, larynx, pancreas and kidney), heart disease, stroke, and chronic respiratory diseases (Doll, 1998; WHO, 1997b). The results of the 1996/1997 Health Survey showed that around one quarter of all New Zealanders are current smokers. This includes 26.4% of men and 23.5% of women. Males were more likely to smoke than females. Twenty three point two percent of European adults, 27.7% of Pacific adults, 45.5% of Maori adults and 10.1% of people from the other ethnic groups reported that they were current smokers (Ministry of Health, 1999).

Only 10 percent of all study subjects smoked, which is similar to the rate observed in the New Zealand 1996/1997 Health Survey for people from the 'other' ethnic groups. (Table 4.6) This low rate of smoking may be attributed to the high education level of the study subjects. Tan's study also showed that Chinese women had a high education level and very low smoking rates (Tan, 2001). As well, high tobacco prices may limit consumption. One study in America found that smoking prevalence was lower among Chinese immigrants than local American and other immigrant groups (Klatsky et al., 1996). In Australia, a study found that a very high percentage (over 50%) of Chinese immigrants had given up smoking after migration (Hsu-Hage & Wahlqvist, 1993). However, the number of people giving up smoking after migration had not been calculated in the present study. This should be taken into account in subsequent studies.

- **Alcohol consumption**

Excessive alcohol consumption can produce detrimental effects. Long-term problems include irreparable damage to the brain, liver, intestines and pancreas. Alcohol is also a significant risk factor for some types of cancer, particularly breast cancer (World

Cancer Research Fund, 1997; The Committee on Medical Aspects, 1998), high blood pressure, haemorrhagic stroke, and cardiac conditions such as cardiomyopathy (Ministry of Health 1998).

Alcohol is one of the most commonly used drugs in New Zealand. In 2000, 88 percent of men and 83 percent of women were drinkers (Habgood et al., 2001). While most New Zealanders enjoy alcohol in moderation most of the time, there are negative health and social consequences associated with drinking. Seventy percent of adults have a pattern of drinking that puts them at risk of future physical or mental health effects from alcohol (Ministry of Health, 1999). According to the New Zealand Health Survey, older people tend to consume alcohol more regularly than do younger people, but tend to drink less on a single occasion (Ministry of Health, 1999).

Alcohol consumption by Chinese immigrants is very low by Western standards. In America, the rate of problem drinking in Asians is lower than the America national average. Chinese-Americans born in the U.S. consume more alcohol than immigrant Chinese-Americans (Huff & Kline, 1999). Flushing and other vasomotor symptoms (due to acetaldehyde dehydrogenase type I deficiency) that occur with ingestion of alcohol by people of Chinese descent could be partly responsible for lower rates of alcoholism in Chinese (Lassiter, 1995).

Drinking prevalence was shown to be related to socioeconomic status both in New Zealand and in China. People with lower family incomes, and lower levels of education were likely to drink. In China, the less educated consumed more alcohol (Siegrist et al, 1990), a similar pattern to that seen in New Zealand. In this study, only two females and five males (14% of the total) drank alcoholic beverages. (Table 4.6) They were all classified as light or safe drinkers. High education level and socioeconomic status may contribute to the low alcohol consumption rate in this study.

## 5.3 ANTHROPOMETRY CHARACTERISTICS

Ethnic differences in anthropometric values need to be taken into account when discussing the body measurements. A study of 990 men and 1021 women aged 70 and over in Hong Kong showed that all anthropometric values for Chinese elderly were lower than those for elderly Caucasians (Woo et al., 1988). Similar observations were

made in a study in Singapore which compared anthropometry data in a European and Asian population (Wang et al., 1994).

The anthropometry characteristics of Mainland Chinese, New Zealanders and migrant Chinese in this study were compared in Table 5.1 and Table 5.2. The data on Chinese were from Stookey's 1993 Chinese Elderly Health and Nutrition Survey, Side's Chinese elderly dietary survey, Thomas Chinese elderly survey in Hong Kong and the 1992 Chinese Nutritional Survey. Stookey's survey was conducted in eight provinces that vary substantially in geography, economic development, public resources and health indicators (GuangXi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Liaoning and Shandong). A multi-stage, random cluster process was used to draw the sample in each of the surveyed provinces. Counties in the eight provinces were stratified by income (low, middle, high) and a weighted sampling scheme was used to randomly select four counties in each province (one low income, two middle income and one high income). The survey investigated weight, height and body mass index of elderly Chinese aged 60 or over (Stookey et al., 2000). Side's survey was conducted in both urban and rural areas in Tianjin City in China. Anthropometric characteristics including weight, height, body circumference, skinfolds were investigated (Side et al., 1991). Thomas' study was conducted in Hong Kong China. Fifty eight men and 77 women aged between 60 and 65 without any history of significant renal, hepatic or cardiac disease were involved. The study investigated the weight, height, body circumference, skinfolds, blood pressure and blood glucose level of the subjects (Thomas et al, 2002). Although the lifestyle of Hong Kong Chinese seemed to resemble to the Western pattern, the elderly tended to eat a more traditional Chinese diet and their lifestyle was close to that in urban areas in Mainland China (Woo et al., 1999b). The 1992 Chinese National Nutrition Survey was conducted by the Chinese government in 1992, and involved urban and rural areas, males and females, more than 25,000 households, 100,000 people, and was therefore the largest in scale. Only weight and height of the study subjects were investigated.

New Zealand data was from the 1996/1997 New Zealand Nutrition Survey (NNS97).

## Table: 5.1 Mean anthropometric characteristics in different surveys (male)

| | Study subjects | New Zealand elderly[1] | 1993 China Health and Nutrition Survey [2] | Side's survey of Chinese elderly[3] (urban area) | Thomas' survey of Chinese elderly in Hong Kong[4] | 1992 Chinese National Survey[5] (urban area) |
|---|---|---|---|---|---|---|
| | n=25 | n=4,636 | n=688 | n=126 | n=58 | n=50,813 |
| | 60+ years | 65-75 years | 60+ years | 70+ years | 60-65 years | 60-80 years |
| | Mean | Mean | Mean | Mean | Mean | Mean |
| Weight (kg) | 68.2 | 78.6 | 57.5 | 65.9 | 64.6 | 56.3-63.9 |
| Height (cm) | 166.8 | 171.9 | 162.8 | 167 | 165 | 162.2-164.8 |
| BMI (kg/m2) | 24.5 | 26.6 | 21.6 | 23.2 | 23.8 | ~ |
| | | | | | | |
| **Skinfolds** | | | | | | |
| Triceps(mm) | 13.5 | 13.1 | ~ | 14.1 | 9.5 | ~ |
| Subscapular (mm) | 23.3 | 19.3 | ~ | ~ | 17.5 | ~ |
| | | | | | | |
| **Circumference** | | | | | | |
| Upper arm (cm) | 27.3 | 30.9 | ~ | 28.1 | | ~ |
| Waist (cm) | 83.8 | ~ | ~ | 88.3 | 86.6 | ~ |
| Hip (cm) | 96.3 | ~ | ~ | 99.9 | 95.5 | ~ |
| W/H ratio | 0.87 | 0.95 | ~ | 0.88 | 0.91 | ~ |
| | | | | | | |
| **Blood pressure** | | | | | | |
| Systolic (mmHg) | 130.5 | 155 | ~ | 141 | 142 | ~ |
| Diastolic (mmHg) | 83.8 | 86 | ~ | 82 | 82 | ~ |
| | | | | | | |
| Blood glucose (mmol/l) | 6.0 | ~ | ~ | ~ | 7.8 | ~ |

[1] Data from Russell et al., 1999

[2] Data from Stookey et al., 2000

[3] Data from Side et al., 1991

[4] Data from Thomas et al, 2002

[5] Data from Ge et al., 1996

## Table 5.2: Mean anthropometric characteristics in different surveys (female)

| | Study subjects | New Zealand elderly[1] | 1993 China Health and Nutrition Survey [2] | Side's survey of Chinese elderly[3] (urban area) | Thomas' survey of Chinese elderly in Hong Kong[4] | 1992 Chinese National Survey[5] (urban area) |
|---|---|---|---|---|---|---|
| | n=25 | n=4,636 | n=736 | n=134 | n=77 | n=49,388 |
| | 60+ years | 65-75 years | 60+ years | 70+ years | 60-65 years | 60-80 years |
| | Mean | Mean | Mean | Mean | Mean | Mean |
| Weight (kg) | 58.8 | 68.8 | 50.4 | 54.5 | 57.2 | 49.1-56.6 |
| Height (cm) | 153.8 | 159.0 | 151.2 | 154 | 1.51 | 150.3-152.8 |
| BMI (kg/m2) | 24.8 | 27.2 | 22.0 | 23.0 | 25 | ~ |
| | | | | | | |
| **Skinfolds** | | | | | | |
| Triceps(mm) | 23.2 | 24.5 | ~ | 16.7 | 14.7 | ~ |
| Subscapular (mm) | 26.0 | 23.5 | ~ | ~ | 20.0 | ~ |
| | | | | | | |
| **Circumference** | | | | | | |
| Upper arm (cm) | 26.4 | 30.7 | ~ | 26.3 | ~ | ~ |
| Waist (cm) | 81.6 | ~ | ~ | 84.9 | 83.7 | ~ |
| Hip (cm) | 96.5 | ~ | ~ | 98.4 | 95.4 | ~ |
| W/H ratio | 0.84 | 0.83 | ~ | 0.86 | 0.88 | ~ |
| | | | | | | |
| **Blood pressure** | | | | | | |
| Systolic (mmHg) | 130.5 | 152 | ~ | 145 | 141 | ~ |
| Diastolic (mmHg) | 81.00 | 79 | ~ | 82 | 81 | ~ |
| | | | | | | |
| Blood glucose (mmol/l) | 5.5 | ~ | ~ | ~ | 7.1 | ~ |

[1] Data from Russell et al., 1999

[2] Data from Stookey et al., 2000

[3] Data from Side et al., 1991

[4] Data from Thomas et al., 2002

[5] Data from Ge et al., 1996

### 5.3.1 Body weight and weight change after immigration

The Chinese elderly were lighter than their New Zealand counterparts. This was also observed in Tan's study of immigrant Chinese women in New Zealand (Tan, 2001). More men than women reported weight loss after immigration, while more women than men reported weight gain. The number of study subjects reporting a decrease or increase in weight were similar. However, body weight in the five Chinese male and female cohorts differs widely. Both male and female study subjects had the heaviest body weight in the Chinese elderly studies reported. Weight gain was more likely a problem than weight loss. Weight increase was also observed in Tan's study of middle-aged migrant Chinese women, where 95% of subjects reported a weight increase after immigration (Tan, 2001). Decreased physical activity and increased fat intake were probably the two main reasons for this. However a predominant cause for weight loss at old age is a reduction in food intake (Morley, 2001; Roberts, 2000).

### 5.3.2 Height

Height reduction is associated with aging. Average height loss is 2.9cm for men and 4.9cm for women (Chumlea et al., 1989). Most subjects measured height values were less than their former measurements.

The Chinese elderly were shorter than their New Zealand counterparts. Tan's Chinese women study in New Zealand observed the same results (Tan, 2001). Height patterns for both males and females were very similar in the five Chinese cohorts.

### 5.3.3 Body mass index

The WHO classification of normal BMI is 18.5-25. Overweight and obesity were classified as 25-30 and >=30 respectively (WHO, 2000). However, studies show that cut-off points for Asian people should be lower. Asians have smaller frames than Caucasians and therefore have higher levels of body fat at similar BMIs (Deurenberg, 1999; Deurenberg, 1998). Ko et al. found that the optimal BMI cutoff value for predicting hypertension in Hong Kong Chinese was 23.8, which is considerably lower than the cutoff value of 25 recommended for Caucasian populations (Ko, et al, 1999).

The BMI cut-off value for overweight and obesity recommended among Singaporeans is 23kgm² and 27kgm² respectively (Deurenberg et al., 2002), which is also lower than WHO classification. One American immigration study showed that Chinese had the lowest BMI between local American and other immigrant groups (Klatsky et al., 1996).

The Chinese BMI classification is similar to the WHO, except that obesity has been classified as > 27.0 instead of >30.0. The WHO, BMI for healthy weight adults up to age 70 is 18.0-25.0. Most authorities felt 22.0-27.0 to be more appropriate cut-off points, though this was not based on any universally recognized standard (Bartlett et al., 1998). The mean BMI reported in a study of 2011 non-diseased, non-cognitively impaired Chinese men and women, aged 70-90 years, ranged from 20.1 to 22.3 (Woo et al., 1995). Wang and Roe's study of 305 men and women in Beijing China reported the mean BMI as 25.2 for men and 25.0 for women (Wang & Roe, 1994). The mean BMI values of study subjects were 24.5 for male and 24.8 for female. These values are all higher than those of subjects in the Chinese studies but lower than their New Zealand counterparts. (Table 5.1 and Table 5.2)

Percentage of study subjects, Mainland Chinese elderly and New Zealand elderly in the various BMI categories are shown in Table 5.3. According to WHO standards, 48% of male and 52% of female subjects in the present study were considered overweight. Few study subjects were considered underweight or obese. However in this study the percentage of underweight was much lower than in Chinese health surveys on the elderly, where more than 15% of both male and female subjects were considered underweight. The percentage of overweight was about two fold higher than that in Chinese health surveys of the elderly.

This result is similar to other immigration studies. In a Melbourne study 1,474 adult Chinese (835 men and 638 women) were representatively sampled from Melbourne, Australia (271 men and 269 women), and three counties in Guangdong Province of the People's Republic of China. When age, education level and occupational status were adjusted the Melbourne Chinese had higher BMI than their Chinese counterparts. The data also indicated that Chinese women living in Melbourne had a relatively higher body fatness compared to their counterparts in China and that overweight is more prevalent in a population living in a relatively affluent society (Mai et al., 1996).

**Table 5.3: Percentage of study subjects, Mainland Chinese elderly and New Zealand elderly in the various BMI categories**

| | BMI prevalence (%) | | | | BMI prevalence (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Male | | | | Female | | | |
| | <18.5 | 18.5-25.0 | 25.0-30.0 | >30.0 | <18.5 | 18.5-25.0 | 25.0-30.0 | >30.0 |
| Study subjects | 0 | 52 | 48 | | 4 | 44 | 52 | |
| Elderly Mainland Chinese in 1993[1](60+yr) | 16.7 | 70.1 | 13.3 | | 15.9 | 64.9 | 19.2 | |
| New Zealand elderly (65-74yr) | 28.5 | | 57.6 | 13.9 | 30.5 | | 47.5 | 22 |

1. Data from Stookey et al., 2000
2. Data from Russell et al., 1999

### *5.3.4 Skinfold measurements*

Although the triceps skinfold thickness has been the site most frequently selected for a single, indirect measure of body fat, no single skinfold thickness measurement is regarded as adequate to assess body fat, especially for the elderly. Multiple skinfolds, rather than a single skinfold measurement, are particularly advisable for individuals undergoing rapid and pronounced weight gain. Changes in energy balance are known to alter the rate of fat accumulation differently between skinfold sites (Heymsfield et al., 1984).

The accuracy of elderly skinfold measurement is also affected by alterations in fat distribution, altered skin turgor and elasticity, and other characteristic changes of the aging skin. These changes make skinfold measurement difficult to interpret where the subject is aged 60 or over, unless comparisons are made with other elderly. However, tricep skinfolds can be used to provide some estimate of body composition and with a measure of midarm circumference, can be used to calculate midarm muscle circumference and midarm muscle area. Studies have confirmed the effectiveness of

using midarm muscle area to predict lean body mass (Blackburn et al., 1977; Gray and gray, 1979). Thus, it was still usefull to measure skinfolds in this study.

The values of skinfold measurements decrease with increasing age (Falciglia et. al., 1988). Suriah's study on 344 elderly aged 60-80 in Malaysia showed that the mean skinfold thickness of women age 60 to 69 was 13.3% greater than those age 70 to 79, whose skinfold thickness in turn was 9.8% greater than those age 80 to 89. The mean skinfold thickness of men age 60 to 69 was 10% greater than those age 70 to 79, whose skinfold thickness in turn was 3.2% greater than those age 80 to 89 (Suriah et al., 1998).

The mean tricep skinfold thickness of Chinese men in the present study is similar to that of New Zealand men and close to that in Side's study of Mainland Chinese elderly. However, women's mean tricep skinfold thickness in the present study was 1.3mm lower than New Zealand elderly women, and was higher than those in Side's study in Mainland Chinese and Thomas' study in Hong Kong. Both men and women's mean subscapular skin folds thickness in this study were higher than a comparable sample in New Zealand and much higher than those in Thomas Chinese elderly study in Hong Kong. (Table 5.1 and Table 5.2)

The ratio of the subscapular to triceps skinfold thickness is a measure of the distribution of subcutaneous fat between the peripheral and central regions. The study subjects had more central subcutaneous fat and less peripheral fat than New Zealanders. In a New Zealand study of 42 white and 40 Polynesian women, more central subcutaneous fat and less peripheral fat was found in the Polynesian group than the European group (Rush et al., 1997). Zillikens and Conway's study also suggested a difference in location of adipose tissue stores in a sample of America whites and blacks, specifically, that black women had greater upper-body obesity (Zillikens & Conway, 1990). It is suggested that there is an ethnic difference in subcutaneous-fat distribution.

### *5.3.5 Circumferences*

- **Arm circumference**

The arm contains subcutaneous fat and muscle; a decrease in mid-upper-arm circumference may therefore reflect either a reduction in muscle mass, a reduction in

subcutaneous tissue, or both. Mid-upper-arm muscle circumference (cm) and mid-upper-arm muscle area were calculated using the equation from Suriah 1998. Mid-upper-arm muscle circumference and mid-upper-arm muscle area can be used to assess total body muscle mass. Studies of adults and children showed high correlations between their measurements and the creatinine/height ratio (an index of body mass) (Trowbridge et al., 1982). Usually these two values decline with increasing age, because muscle mass decreases during aging (Suriah, 1998). Sarcopenia was defined as systematic and continuous losses of muscle mass with age. It together with increases in body fat up through the seventh decade are well recognized age-related changes in body composition (Muller et al., 1995; Borkan & Norris, 1977; Morley, 1997). Baumgartner and co-workers defined sarcopenia as values of 2 standard deviations or more below the mean for appendicular muscle mass of young healthy adults (Baumgartner et al., 1998). Sarcopenic individuals in this study were further differentiated into being sarcopenic-lean and sarcopenic-obese. Both types of sarcopenia were associated with functional impairment, disabilities, and falls independent of age, ethnicity, smoking, and comorbidity, but the relationships were strongest with sarcopenic obesity (Baumgartner et al., 1999).

In the present study, both men and women's upper arm circumferences were similar to those in the Mainland Chinese data, but smaller than their New Zealand counterparts. (Table 5.1 and Table 5.2). Because of little data on muscle mass of young Chinese adults, sarcopenia in this elderly population need further study.

- **Waist to hip circumference ratio**

The W/H ratio is a simple method for describing the distribution of both subcutaneous and intra-abdominal adipose tissue (Larsson et al., 1984; Jones et al., 1986). It is considered an indicator of cardiovascular risk when the ratio exceeds 0.9 for males and 0.8 for females (National Cholesterol Education Program, 1994; Norgan, 1986). A high W/H ratio indicates accumulation of excess fat in the abdominal regions, while a low ratio means more fat in the gluteal-femoral regions. The function of adipose tissue is different in different regions. The abdominal adipocytes have high responsiveness and sensitivity to catecholamines in the lipolytic system. An enlarged abdominal fat depot would then presumably be associated with an overflow of free fatty acids that can be transported into adipocytes and rehydrolyzed for storage. However, the rate of basal

lipolysis (free fatty acids released to the blood stream for energy use) is higher in gluteal-femoral fat tissue than abdominal tissue. (Norgan, 1986). Individuals with higher waist-to-hip ratios tend to have a more adverse metabolic profile and an increased risk for non-insulin-dependent diabetes and cardiovascular disease.

Changes of W/H ratio with age and excessive weight have not been characterised. Jones et al. measured W/H ratio in a semi-random, age-stratified sample of 4,349 British Caucasian men aged twenty to sixty-four years. They noted that the ratio and excessive weight increased with age (curvilinearly) both separately and in combination (Jones et al., 1986). Males usually have greater central body fat deposited than females (Thomas et al., 2002). In this study males had a greater W/H ratio than females. ($p<0.05$) Females in the present study had similar W/H ratios to their New Zealand counterparts, on average 0.84 compared to 0.83, while males had lower W/H ratios (average 0.87) compared to their New Zealand counterparts (average 0.95). Although an Australia immigration study of 1,474 adult Chinese in Melbourne showed that Melbourne Chinese men and women had a mean W/H ratio higher than that of their counterparts in Mainland China (Mai, 1996), this study observed an opposite results. Men and women in this study had the lowest mean W/H ratio when compared to their Chinese counterparts in Mainland China. (Table 5.1 and Table 5.2)

The percentage of study subjects and New Zealanders in different W/H ratio categories are shown in Table 5.4.

**Table 5.4: Percentage of study subjects and New Zealanders in different waist/hip circumference ratio categories**

| Subjects | Male (percentage) | | Female (percentage) | |
|---|---|---|---|---|
| | W/H ratio | | W/H ratio | |
| | <=0.9 | >0.9 | <=0.8 | >0.8 |
| Study subjects | 60 | 40 | 28 | 72 |
| New Zealanders (65-74yr)* | 22.9 | 77.1 | 31.9 | 68.1 |

*Russell et al., 1999

Table 5.4 shows that only 40% of male subjects had at risk W/H ratios compared to 77.1% of their New Zealand counterparts. The prevalence of at risk W/H ratio measurements in females in this study and in their New Zealand counterparts was similar i.e. 72% vs. 68.1%. Similar results were found in an Australian study, which showed that although Chinese immigrants in Melbourne had a lower prevalence of overweight measured by BMI (17.7 percent for men and 14.1 percent for women), they still had high mean W/H ratios (0.91 for men and 0.88 for women) (Hsu-Hage & Wahlqvist, 1993). This suggests that sites of body fat deposition should also be taken into account. Whether or not the W/H ratio in the elderly Chinese in this study had changed after immigration to New Zealand is not known. However an Australia study showed that Chinese immigrants had significantly greater waist circumferences and W/H ratios, but not hip circumferences, than their counterparts in Southern China (Hage et al., 1992).

### *5.3.6 Percentage of body fat from predictive equations and BIA*

Between the ages of 25 and 65 years, there is a substantial decrease in lean body mass (10% to 16%) because of losses in bone mass, skeletal muscle, and total body water with aging (Heymsfield et al., 1989; Kuczmarski, 1989). The relative mineral content of the fat free body mass decreases approximately one percent per year between 50-70 years of age (Adams et al., 1970; Smith et al., 1976). A study showed that elderly Chinese subjects' excessive body fat contributes to the development of cardiovascular risk factors, but the contribution is particularly strong when fat was centrally deposited (Thomas et al., 2002).

Percentage of body fat was estimated using the predictive equation developed by Baumgartner et al (Baumgartner et al., 1998) and was also read directly from the BIA machine.

- Percentage of body fat =0.2034 (waist circumference)+0.2288 (hip circumference)+ 3.6827 (ln[triceps skinfold]) – 10.9814 (sex) – 14.3341,

  Where sex 0 for women and 1 for men.

The results are shown in Table 5.5

**Table 5.5: Comparison of mean percentage of body fat from Baumgartner's equation and BIA**

| | Men<br>X±SD | Women<br>X±SD |
|---|---|---|
| % Body fat from equation[1] | 23.1±3.3 | 35.7±4.6* |
| % Body fat from BIA | 23.8±5.6 | 32.8±6.7* |

*$p<0.05$

[1] Equation from Baumgartner et al., 1998

The percentage of body fat for men was much lower than that for women. Women generally have a higher body fat than men regardless of age. One study of Chinese elderly conducted in Hong Kong showed that despite an 11% higher proportion of body fat in the females, no significant differences were identified in blood pressure, lipid profile, indices of insulin resistance or albumin-to-creatinine ratio (Woo et al., 1988).

Body fatness categories as recommended by Lohman (1992), are presented in Table 5.6

**Table 5.6: Body fat categories for men and women**

| | Men | Women |
|---|---|---|
| At risk* | ≤5% | ≤8% |
| Below average | 6-14% | 9-22% |
| Average | 15% | 23% |
| Above average | 16-24% | 24-31% |
| At risk° | ≥25% | ≥32% |

Data from Lohman, 1992

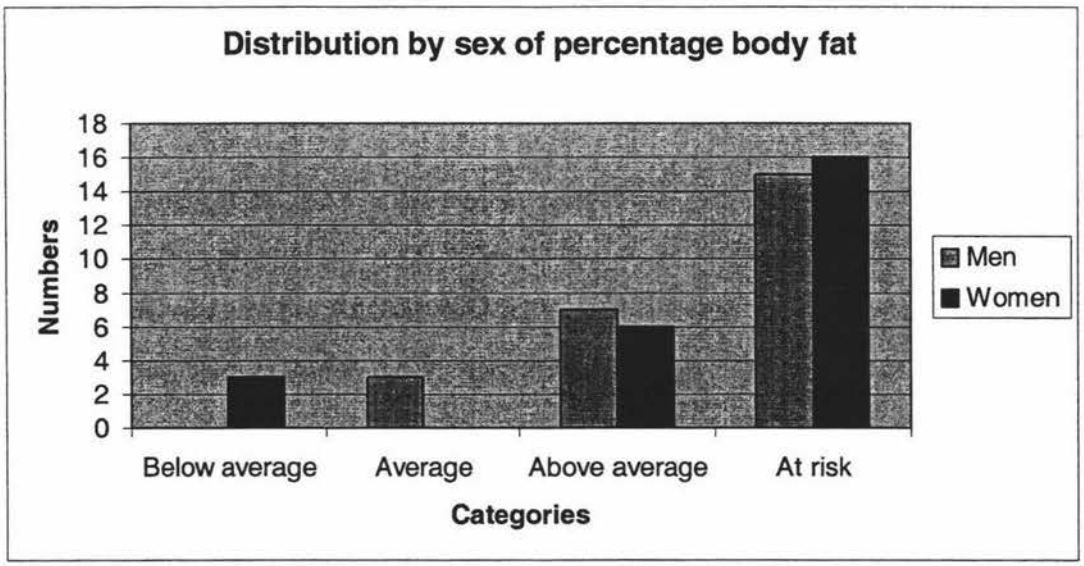
*At risk for diseases and disorders associated with malnutrition

°At risk for diseases associated with obesity

Distribution of percentage body fat determined by BIA by sex is shown in Figure 5.1. The category of obesity that places an individual at risk for disease is body fat in excess

of 25% for men and 32% for women (Lohman, 1992). In this study, 60% of men and 64% of women were at risk.

**Figure 5.1: Distribution by sex of percentage body fat determined by BIA**




*Percentage body fat was read from BIA machine

This result is coincident with that from BMI, where 48% of men and 52% of women had BMI's over the normal range. The high percentage at risk suggests that study subjects who have excess body fat should increase physical activity to decrease body weight. Increased BMI as well as body fat with aging are significantly associated with most age-related chronic disease, such as cardiovascular disease, hypertension and diabetes.

## 5.4 MEDICAL AND HEALTH MEASUREMENTS

### *5.4.1 General Practitioner Usage*

Age was a significant determinant of people's use of general practitioner services, with over 90% of people in the 65-74 and 75 plus age groups visiting a general practitioner at least once in the year, according to the NZ National Health survey (Ministry of Health, 1999). This reflects the fact that older adults are more likely to experience serious illnesses or persistent health complaints, and therefore are more likely to visit a general practitioner to obtain treatment for these health problems. The location, duration, and

appropriateness of the medical services contribute to successful outcomes of treatment (Richmond et al., 1995).

Many factors limit elderly Chinese immigrants use of medical services. These include the cost of medical services, lack of transport, difficulties in contacting a doctor and communication problems. Although in 1997 there were 3,119 general practitioners working either fulltime or part-time in New Zealand (New Zealand Health Information Service, 1999), few of them can speak Chinese. This limits the chance of Chinese elderly finding a suitable general practitioner. Even if the doctor can speak Chinese, they find it hard to explain some medical terms clearly to the Chinese elderly. Language is a big barrier (Ayonrinde, 2003). Only 56% of study subjects had visited a general practitioner at least once in the past year, much less than their New Zealand counterparts. (Table 4.4)

Migration leads to changes in almost all areas of life including health. But to what extent are health beliefs preserved, and how are they affected by the process of acculturation to the host society? One study found that the younger the immigrant arrived, the more positive their attitude towards modern medicine and the less use they made of traditional healing (Nakar et al., 2001). Use of Chinese therapies was common among first and second generation Chinese immigrants in America (Pearl et al., 1995). In this study, most study subjects with chronic diseases chose to be treated by Western medicine rather than traditional Chinese medicine.

### *5.4.2 Blood pressure*

In China, hypertension accounts for as much as half of the stroke mortality (He et al., 1995). Its prevalence has decreased in recent years in people over 45, but diastolic blood pressures have increased in young people (Yu et al., 1999). The age-adjusted prevalence of hypertension, in China is approximately 12% in men and 10% in women (Wu et al., 1995).

In the West, it has been estimated that a reduction in population blood pressures of around 5 mmHg would reduce the incidence of stroke by 26% and heart disease by 15% (WHO, 1997c; International Society of Hypertension, 1999). In the Asia–Pacific region, a population-wide reduction of 3 mmHg in diastolic pressure is likely to decrease the

number of strokes by about one-third (Eastern Stroke and Coronary Heart Disease Collaborative Research Group, 1998).

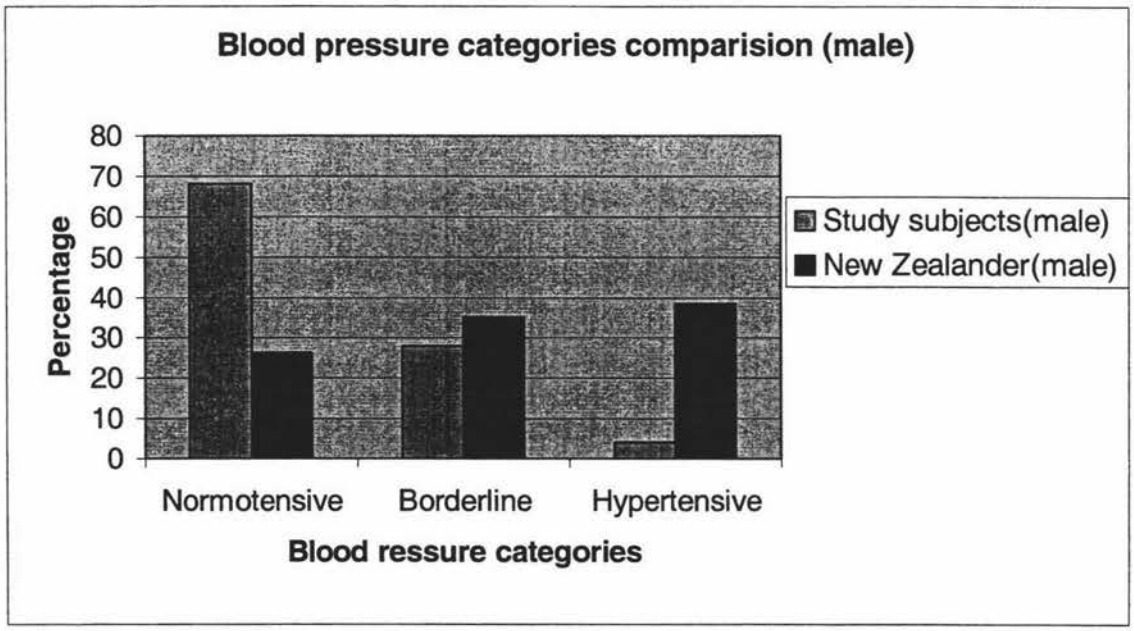
High blood pressure is common in New Zealand, affecting at least ten percent of all adults (Russell and Wilson, 1991; Trye et al 1996; Bullen et al., 1996).

In this study, mean blood pressure for both men and women was relatively low compared to the New Zealand national average (Table 5.1 & Table 5.2). Similar observations have been made in other studies where Chinese have been shown to have a lower mean blood pressure than Americans (Choi et al., 1990; Bell et al., 2002), Germans (Bernhardt et al., 1991), and their Malay and Indian counterparts in Singapore (Hughes et al., 1990). Additionally, it has been reported that hypertension is more prevalent in populations of Western culture than those of Asian culture (Choi et al., 1990). Klatsky et al. investigated cardiovascular risk in 13,031 Asian immigrants in America and found that U.S. born Chinese men had more hypertension than those born in other Asian countries (Klatsky et al., 1996).

Study participants were deemed to be hypertensive in accordance with the World Health Organization (WHO) cut-off values, irrespective of whether they were taking hypertensive medication. Under these criteria, only one male and one female were deemed to be hypertensive, representing only four percent of males and four percent of females. However in this age group in the New Zealand survey (Russell et al., 1999), the hypertension rate was 38.5% for males and 36.6% for females (Figure 5.2 and Figure 5.3).

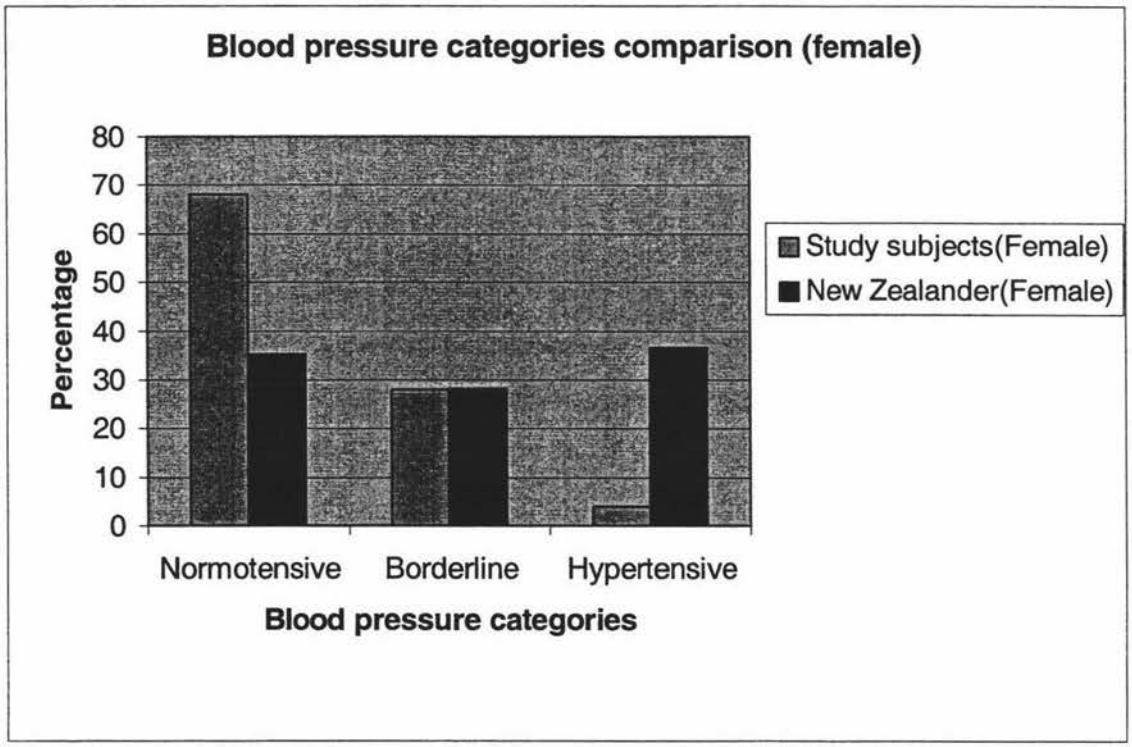
Mean diastolic blood pressures of both men and women in this study were similar to those found in Side's study and Thomas study, however mean systolic blood pressures were lower. It has been known for some time that the prevalence of hypertension varies according to socioeconomic criteria in some Western countries (Bell et al., 2002). For example, men in professional and clerical occupations tend to have lower blood pressures than those in manual or unskilled occupations. Subjects in this study had a higher socioeconomic background. This may influence their systolic blood pressure.

**Figure 5.2: Percentages of study subjects and New Zealand elderly in different blood pressure categories (male)**




Source NZ data: Russell et al., 1999

**Figure5.3: Percentage of study subjects and New Zealand elderly in different blood pressure categories (female)**




Source NZ data: Russell et al., 1999

### *5.4.3 Blood glucose level*

Diabetes mellitus is recognized as a major health problem that can result in a number of serious complications, including heart disease, eye disease, kidney diseases, nerve problems and limb amputations (Simmons, 1996). Type II diabetes makes up about 85-90% of all diabetes in developed countries, including New Zealand (WHO 1994). The change of lifestyle of Chinese people, along with the development of the national economy, has caused significant changes in disease patterns in China. Diabetes has also increased dramatically in the past years (Zhao & Chen, 2001).

Type II diabetes may be asymptomatic for many years and so it is possible for people to be unaware that they have it for long periods before diagnosis (Simmons, 1996). Increasing age is one of the major risks for Type II diabetes. Other major risks include obesity, physical inactivity and nutritional factors such as a high intake of saturated fats (Ministry of Health, 1997).

There are large differences in the prevalence of diabetes and impaired glucose tolerance between Chinese populations living in different parts of the world. For example, in Da Quing, an industrial city in the north west of China, the prevalence of diabetes in 1986 in both men and women aged 30-64 years was 1.6% (King et al., 1993). By contrast, in Chinese men and women of the same age in Mauritius, the prevalence of diabetes in 1987 was 16% and 10.1% respectively (Burrin & Price, 1985). Studies on Chinese people in the United Kingdom, Hong Kong and Singapore have found levels between those in China and Mauritius (Unwin et al, 1997; King et al., 1993; Dowse et al., 1990; Cockram et al., 1993).

In New Zealand, one in 27 (3.7%) of people aged 15 years or over were diagnosed with diabetes, according to the 1996/1997 National Nutrition Survey. The survey also showed that diabetes increased dramatically with age ($P<0.0001$). Of those aged 75 years or older, one in nine people said they had been diagnosed with diabetes (Ministry of Health, 1999).

In this study, only one man had impaired glucose tolerance, accounting for only 2% of total study subjects. No subjects were diagnosed as diabetics.

## 5.5 PHYSICAL ACTIVITIES

### *5.5.1 Physical activity level*

Sleep quality in later life is clearly influenced by more direct engagement in life and life satisfaction. Lack of sleep will cause changes in the normal physiology of the elderly, such as appetite, thus influence the health status of the elderly (Reynolds et al, 2001; Ohayon et al., 2001). In the present study, male and female subjects slept and napped over 8 hours a day, which met recommendations.

Regular sustained physical activity can substantially reduce the risk of developing or dying form heart disease, diabetes, colon cancer, and high blood pressure. Lack of physical activity has also been shown to be as important a risk factor for heart disease as smoking, high cholesterol levels and high blood pressure (US Department of Health and Human Service, 1996). Regular moderate physical activity is important to improve health and wellbeing (US Department of Health and Human Services, 1996; National Health Committee, 1998b). It has been estimated that up to one-third of the deaths from coronary heart disease, diabetes and cancer of the colon in New Zealand can be attributed to lack of physical activity (Galgali et al., 1998). Exercise is also important to prevent sarcopenia. Although sarcopenia is not completely reversed with exercise, physical inactivity leads to accelerate muscle loss. Even in very old individuals, exercise can increase muscle mass and strength (Fiatarone et al., 1994).

In New Zealand, overall 61% of adults in the 1996/1997 Health Survey could be described as "physically active"; that is, they took park in 2.5hour(150 minutes) or more of leisure-time physical activity in the previous week. A similar proportion of men and women of all ages up the age of 75 years fell in into the physically active category. This Survey also found that different ethnic groups might have different physical activity levels. Maori and people from the 'other' ethnic group in the New Zealand survey were more likely to be sedentary than European/Pakeha or Pacific people (Ministry of Health, 1999).

The percentage of study subjects and elderly subjects in the New Zealand Health Survey (age 65-74) in the different physical activity categories are shown in Table 5.7.

**Table 5.7: Comparison of physical activities levels of study subjects and New Zealand elderly**

| | Male | | Female | |
|---|---|---|---|---|
| | **Study subjects** | **New Zealander (65-74)*** | **Study subjects** | **New Zealander (65-74)*** |
| Sedentary | 12% | 12.9% | 12% | 12.9% |
| Relatively inactive | 8% | 18.9% | 16% | 19.1% |
| Relatively active | 16% | 14.4% | 28% | 14.2% |
| Highly active | 64% | 53.8% | 44% | 53.8% |

* Data from Ministry of Health, 1999

A similar proportion of subjects were sedentary in the present study and the New Zealand Health Survey. However, more male subjects were classed as highly active (64%) than their New Zealand counterparts (53.8%), while fewer female subjects were highly active (44%) than their New Zealand counterparts (53.8%). A population cohort study of 2,488 adults aged 20-45 in 1989-1997 in China examined weight change and its predictors and found low physical activity was a strong predictor of weigh gain. Compared to those whose weight remained stable (+/-2 kg/8 years), males and females who experienced large weight gain (>5 kg/8 years) were 3 and 1.8 times more likely to engage in light rather than heavy work-related physical activity (Bell et al., 2001). In Tan's study, most of the Chinese immigrant women reported activity decreases after immigration (Tan, 2001). In China, because of the extensive use of bicycles for transportation to and from work, physical activity, even in office workers, is performed more regularly than in New Zealand. In this study, most subjects reported increased physical activity because of lack of transportation and increased household work, such as gardening. Ninety-six percent of subjects didn't own a vehicle and they needed to walk long distances to the shop.

### *5.5.2 Vigorous activity*

A separate category was made up of those who took part in 'any' vigorous leisure-time physical activity in the previous seven days (defined as activity of sufficient intensity to

make the person breathe hard or sweat). Less study subjects (20%) took part in vigorous activity than their New Zealand counterparts (30%).

### *5.5.3 Most popular activities*

In this study, walking was by far the most popular form of physical activity, with 60% of males and 76% of females reporting that they had been walking for either enjoyment or exercise in the last seven days. This result is similar to the finding of the New Zealand Health Survey where 61.4% reported walking. A recent study of 61,200 post-menopausal women ages 40 to 77 found that post-menopausal women who walked at least four hours every week had a 41% lower risk of hip fracture than those who only walked one hour every week. Even standing more often, reduced the risk of hip fracture (Feskanich et al., 2002).

Gardening was the next most popular activity, with 36% of subjects reporting that they had been gardening in the last week. Other popular activities were exercising at home (10%) and cycling (10%). (Table 5.8)

**Table 5.8: Percentage of subjects participating in various exercises and average time spent per week on the exercise**

| | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | Subjects | Minutes per week | Subjects | Minutes per week | Subjects | Minutes per week |
| Walking | 15(60%) | 436 | 19(76%) | 265 | 34(68%) | 340 |
| Gardening | 13(52%) | 261 | 5(20%) | 588 | 18(36%) | 352 |
| Tai Chi | 6(24%) | 115 | 4(16%) | 450 | 10(20%) | 249 |
| Exercise at home | 2(8%) | 45 | 3(12%) | 108 | 5(10%) | 83 |
| Cycling | 5(20%) | 288 | ~ | ~ | 5(10%) | 288 |
| Aerobics | ~ | ~ | 1(4%) | 35 | 1(2%) | 35 |
| Qigong | 1(4%) | 80 | ~ | ~ | 1(2%) | 80 |
| Table tennis | 1(4%) | 210 | ~ | ~ | 1(2%) | 210 |

* Qigong is a traditional Chinese exercise and therapy. It relaxes the body and mind and strengthens organ functions through slow movement and respiration exercise.

To avoid overweight or obesity, active participation in moderate physical activities or sports, such as walking or "Tai Chi" is essential. However, the intensity of physical activities should be more moderate and should not exceed the tolerance of the circulatory system, especially in the elderly.

## 5.6 DIETARY INTAKE ANALYSIS

### *5.6.1 Consumption of dietary supplements*

Good nutrition primarily depends on appropriate food choices, and consuming a wide variety of foods in moderate amounts reduces the risk of both inadequate and excessive nutrient intakes (The American Dietetic Association 1996). Dietary supplements may be used to treat nutritional deficiency and also be indicated for therapeutic use. For those who do choose to use supplements, the American Dietetic Association recommends consuming supplements with low levels of nutrients, such that a daily dose does not exceed the recommended dietary allowance (The American Dietetic Association, 1996).

In New Zealand, about half the respondents (51%) used vitamin and/ or mineral supplements during the NNS97. They were used on a regular basis by 28 percent of the population, while 23 percent used them occasionally. More females (59 percent) than males (42 percent) reported taking vitamin and/ or mineral supplements (Ministry of Health 2002). In this study, the percentage of all subjects consuming supplements (46%) was similar to the New Zealand level (51%). Also more females (64%) than males (28%) took supplements (Table 4.4). In this study, vitamin and mineral supplements were taken by 34% of all subjects; fish oil supplements were taken by 22% and active ingredients, such as garlic and colostrums products, by 12%. This could be attributed to the high level at concern about their health.

### *5.6.2 Consumption of herbs*

Herb consumption is typically high in China. People believe that herbs not only can be used to heal disease, but also can be used to maintain good health. This is part of Chinese culture. Herbs are added to soup with meat and other ingredients for special purposes or are made into herb soup.

In Western medicine, the primary explanatory model of illness focuses on abnormalities in the structure and function of bodily organs and systems. Traditional Chinese medicine, on the other hand, views the body, soul and spirit as an integrated whole. Furthermore, because human beings are considered products of nature, humankind and the natural environment are seen to be inseparably and interdependently related; protecting the integrity of the human-nature dyad is thus fundamental to health.

The Chinese understanding of nature and the cosmos is expressed in 'Yin' and 'Yang' (complementary, interdependent opposites). 'Yin and Yang'is a dialectical concept that attempts to explain phenomena that appear to be simultaneously dependent on and in opposition to each other. All bodily functions are the result of the harmony of 'Yin' and 'Yang'; a mild imbalance implies a diseased state, and a total disruption of the harmony leads to death. Foods and herbs are divided into 'Yin-Yang' categories. For example, if an illness is believed to be caused by too much 'Yang', one way to compensate would be to eat foods or herbs that are considered 'Yin'.

Usually, elderly people in China have sufficient experience to decide what kind of herb soup they need to maintain their health. Sometimes using a doctor's prescription, they make herb soup to cure disease. However, in New Zealand, only very small amounts of herbs are used as seasoning in cooking or added as active ingredients to some nutrition supplements, contrary to the traditional Chinese practice.

Twenty-eight percent of all subjects used herbs in New Zealand. Only one man and one woman used herbs for medical purposes.

### *5.6.3 Dining habits of the study subjects*

Elderly Chinese have their traditional health beliefs (Chau et al., 1990). The dining habits and foods patterns of the elderly Chinese are considered healthy. Kim et al. found that their traditional food patterns were the healthiest when compared to other Asian populations (Kim et al., 1993).

- **High fish consumption**

Most of the study subjects reported that they consumed fish about 2-3 times a week. Although fish is rather expensive in New Zealand, the Chinese eat fish with bone rather than only fish fillets, therefore the cost of fish consumption for them is relatively low. On the other hand, one Mainland Chinese elderly study showed that fish consumption was positively associated with socioeconomic factors (Side et al., 1991). Most study subjects had a middle level income by New Zealand standards and also most of them had a higher educational background. Thus it was not surprising to find high fish consumption among the study subjects. High fish consumption has tended to be inversely associated with cognitive impairment and cognitive decline (Kalmijn et al., 1997). Fish intake is also associated with reduced cardiovascular disease. A study of 433 middle-aged Japanese men and women in Japan and 269 Japanese immigrants in Brazil found that decreased fish intake was associated with increased cardiovascular risk (Mizushima et al., 1997). High fish consumption is beneficial to the health of the elderly.

- **Dairy product consumption**

Although only three study subjects ate cheese, over 70% of total study subjects drank milk. The percentage of people drinking milk in this study was much higher than in China and similar to Satia's Chinese immigrant study in North America (78% drinking milk) (Satia et al., 2001). However, the percentage of people eating cheese in this study (12%) were much lower than Satia's study (78%) (Satia et al., 2001). Cheese and dairy products have never been highly acceptable in the traditional Chinese diet. Lactose intolerance is common among the Chinese (Davis & Bolin, 1967; Chung & McCil, 1968) and intestinal lactase deficiency due to genetic factors has been implicated in lactose intolerance (Chung & McCil, 1968; Bayless & Christopher, 1969). However, Chinese Americans had high mean consumption of dairy products, which suggest that lactase deficiency may be acquired (Wang et al., 1994). Indeed, a theory of adaptation has been proposed (Davis & Bolin, 1967; Cuatrecasas et al., 1965). Specifically, lactase deficiency could be acquired from a lack of challenge from the substrate (from diets low in lactose), resulting in a decrease in the enzyme. In a comparative study of Australian-born Asians with Asian students studying in Australia, the incidence of lactose

intolerance was found to be much lower in the Australian born (Bolin & Davies, 1970). Thus it is suggested that the process of acculturation has encouraged the consumption of dairy products. Conversely, without the motivational forces of acculturation, Chinese are less likely to adopt dairy products into their regular diet. A study of 98 Chinese Singaporeans, aged 1-42 years, showed a high prevalence of lactose intolerance due to lactase deficiency (Bolin et al., 1979).

### *5.6.4 Macronutrient intakes*

The subject's macronutrient intakes and sources of dietary energy were compared with the Chinese Recommended Daily Allowance (Chinese RDA) values, and the Australian Recommended Dietary Intake (RDI) values. The Australian Recommended Dietary Intakes (Truswell et al., 1990) have been adopted by New Zealand. Percentages of study subjects with intakes lower than these two recommendations were also included. (Table 5.9 and Table 5.10)

The ordinary Chinese diet is characterized by grains as the staples and inadequate consumption of animal foods. Because of the low intakes of dairy products and animal foods, calcium and heme iron is inadequate in the Chinese diet. The Chinese Recommended Daily Allowances (RDA), published in 1990 by the Chinese Nutrition Society (Chinese Nutrition Society, 1990), were worked out on the basis of these dietary characteristics. Thus the Mainland Chinese RDA for iron, zinc, vitamin D, E, C and thiamin is significantly higher than the Australian RDI for these nutrients. In China, nutrient intake was considered to be sufficient when the estimate was within 80 –120% of the corresponding RDA (Qu et al., 2000; Zhang et al., 1997).

The Chinese RDA and Australia RDI are defined as the amount of a nutrient that is sufficient for almost all individuals (97.5%). Dietary studies frequently define an adequate, nutritious diet as one that fulfills the RDA or RDI. The RDA/RDI specifies the levels of average intake of nutrients essential for maintaining normal body functioning for a healthy population. Diets under 100 percent of the RDA/RDI are associated with, but do not necessarily mean deficiency. Thus the RDA and RDI by definition exceed the requirement of most people and intakes above the recommended levels are almost certainly adequate. In this study, consumption of less than two-thirds

of the Chinese RDA and Australia RDI was used to indicate an inadequate intake of nutrients.

**Table 5.9: Comparison of mean energy sources and macronutrient intakes with Chinese and Australian Recommendations (male)**

| | Study subjects | Chinese RDA (60-80y) Sedentary [1] | % of subjects with intakes lower than Chinese RDAs | Australian RDIs (64+ yr)[2] | % of subjects with intakes lower than Austrilan RDI |
|---|---|---|---|---|---|
| Energy (kJ) | 8932 | 7500-8400 | 0 | 7400-11000 | 0 |
| Protein (g) | 83.2 | 65~70 | 16 | 55 | 4 |
| Protein/kg | 1.24 | ~ | ~ | 0.75 | 4 |
| Total Fat (g) | 64.3 | 40~56 | 8 | ~ | ~ |
| Fibre (g) | 19.2 | ~ | ~ | 25-30 | 92 |
| Energy from carbohydrate % | 55.0 | ~ | ~ | 50-55 | 20 |

[1] Chinese Recommended Dietary Allowance. Data from Zeng &Feng, 1991

[2] New Zealand Recommended Dietary Intakes adopted from Australia Recommended Dietary Intakes. Data from Ministry of Health, 2002

**Table 5.10: Comparison of mean energy sources and macronutrient intakes with Chinese and Australian Recommendations (female)**

| | Study subjects | Chinese RDA (60-80y) sedentary [1] | % of subjects with intakes lower than Chinese RDAs | RDIs (54+yr )[2] | % of subjects with intakes lower than Australian RDI |
|---|---|---|---|---|---|
| Energy (KJ) | 7092 | 6700-7100 | 28 | 6500-9300 | 28 |
| Protein (g) | 70.7 | 55-60 | 12 | 45 | 4 |
| Protein/kg | 1.21 | ~ | ~ | 0.75 | 0 |
| Total Fat (g) | 49.4 | 36-47 | 16 | ~ | ~ |
| Fibre (g) | 18.2 | | | 25-30 | 88 |
| Energy from carbohydrate % | 54.7 | | | 50-55 | 20 |

[1] Chinese Recommended Dietary Allowance. Data from Zeng &Feng, 1991

[2] New Zealand Recommended Dietary Intakes adopted from Australia Recommended Dietary Intakes. Data from Ministry of Health, 2002

Table 5.11 and Table 5.12 summarize the results from selected published studies of macronutrient intakes in the New Zealand elderly and in the Chinese population groups. Because the distribution of nutrient intakes may not be symmetric, the median is a better summary statistic than the mean. However because median values were not available in the reports of the two Chinese elderly surveys, only the mean values can be compared. Wang and Roe's study was conducted during October 1990 to February 1991 in China. The study examined the dietary intake of 305 elderly men and women (age>=55y) from two urban districts of BeiJing. The study examined the dietary intake, lifestyle, health behaviors and the differences in nutrient intakes and food patterns between smokers and non-smokers. Only non-smoker's data was used in this table (Wang & Roe, 1994).

**Table 5.11: Macronutrient intakes in different surveys (male)**

| | **Study Subjects** | **New Zealand elderly (>=65y)[1]** | **Wang's study of Chinese elderly (>=55y)[2]** | **Side's Dietary survey of Chinese elderly (>=70) (urban area) [3]** |
|---|---|---|---|---|
| | **Mean** | **Mean** | **Mean** | **Mean** |
| | n=25 | n=4,636 | n=71 | n=50 |
| Energy (kJ) | 8932 | 9274 | 9750 | 8060 |
| Protein (g) | 83.2 | 85 | 75.3 | 59 |
| Total fat (g) | 64.3 | 87 | 85.4 | 65 |
| Cholesterol (mg) | 283 | 288 | ~ | ~ |
| Carbohydrate (g) | 307 | 252 | 297 | 276 |
| Alcohol (g) | 1.3 | 11-13 | ~ | ~ |
| Total sugars (g) | 56.2 | 112 | ~ | ~ |
| Starch (g) | 201 | 140 | ~ | ~ |
| Fibre (g) | 19.2 | 22 | 10.9 | ~ |
| Energy from protein % | 15.8 | 16 | ~ | 12.3 |
| Energy from fat % | 26.7 | 34 | 33.1 | 30.3 |
| Energy from carbohydrate % | 55.0 | ~ | ~ | 57.1 |
| Energy from alcohol % | 0.4 | 4 | ~ | ~ |

[1]Russell et al., 1999
[2]Wang & Roe, 1994
[3]Side et al., 1991

**Table 5.12: Macronutrient intakes in different surveys (female)**

| | Study Subjects<br><br>Mean | New Zealand elderly (>=65y)[1]<br><br>Mean | Wang's study of Chinese elderly (>=55y)[2]<br><br>Mean | Side's Dietary survey of Chinese elderly (>=70) (urban area) [3]<br><br>Mean |
|---|---|---|---|---|
| | n=25 | n=4,636 | n=143 | n=50 |
| Energy (kJ) | 7092 | 6579 | 7645 | 7380 |
| Protein (g) | 70.7 | 64 | 60 | 54 |
| Total fat (g) | 49.4 | 60 | 72.5 | 57 |
| Cholesterol (mg) | 257 | 231 | ~ | ~ |
| Carbohydrate (g) | 244 | 189 | 232.3 | 250 |
| Alcohol (g) | 0.5 | 4-5 | ~ | ~ |
| Total sugars (g) | 51.7 | 87 | ~ | ~ |
| Starch (g) | 160 | 102 | ~ | ~ |
| Fibre (g) | 18.2 | 19 | 8.9 | ~ |
| Energy from protein % | 17.2 | 17 | ~ | 12.4 |
| Energy from fat % | 25.8 | 34 | 35.7 | 31.1 |
| Energy from carbohydrate % | 54.7 | ~ | ~ | 56.4 |
| Energy from alcohol % | 0.2 | 2 | ~ | ~ |

[1]Russell et al., 1999
[2]Wang & Roe, 1994
[3]Side et al., 1991

Mean fiber intakes for both male and female subjects were much lower than the Australia RDI. Ninety two percent of males and 88% of females had fiber intakes lower than the recommended levels. (Table 5.9 and Table 5.10) Thirteen males and sixteen females had fiber intakes lower than 2/3 Australia RDI.

### 5.6.4.1 Energy

Males and females in this study had adequate energy intakes when compared to the Chinese RDA and Australia RDI. Daily mean energy intakes of male subjects were higher than that of female subjects. ($p<0.05$) Because males on average have a greater

proportion of lean body mass and greater average body weight than females, they consume more food to maintain their bodies and meet their requirements for exercise.

Among the four surveys, males and females in Wang's study had the highest mean energy intake. Males in Side's study had the lowest energy intake, and females in the New Zealand survey had the lowest energy intake, followed by the females of the present study. Energy intakes for both male and female subjects in Wang's study were higher than those in Side's study. Although both studies were conducted at approximately the same period of time in the urban area of Mainland China, the subjects of Side's study were older than those of Wang's study. Energy intake decreases gradually with advancing age (Ministry of Health, 2002). Therefore, it was not surprising that mean energy intake in Side's study was lower than Wang's study.

Although it is commonly assumed that the more wealthy eat more in China (Ge et al., 1996), this is true perhaps only in developing societies where food scarcity is a problem. In developed countries, an inverse relationship between caloric intake and socio-economic status has been observed (Sobal & Stunkard, 1989; Rolland-Cachera & Bellisle, 1986). Generally, Chinese in China consume more energy than those in Western countries. A study of 2,488 healthy men and women in North America and China showed that Chinese in Mainland China consumed more energy than Chinese in North Amercia (Lee, 1994). Findings on 393 males and females in an America study showed that Chinese American females had a lower mean caloric intake than Singaporean Chinese (Wang et al., 1994). This may reflect a greater consciousness of dieting and the value of thinness in the Western society (Levenstein, 1993). Subjects in this study had lower energy intakes than those in Mainland China. The subjects were of high socio-economic status, which might partially explain their lower caloric intakes.

### 5.6.4.2 Protein

Low protein intakes had been observed in several immigration studies. A study compared dietary intakes in 29,458 adult Canadian and 7,158 adult immigrants in Canada and found that immigrants (particularly those from Asian countries) were at higher risk of inadequate intakes of protein (Pomerleau et al., 1998). Kim's study of nutritional status of residents in senior housing in Chicago found that more than 10% of

Asian Americans consumed less than 67% of the Recommended Dietary Allowance for protein (Kim et al., 1993).

In the present study 16% of males and 12% of females were observed with protein intake levels lower than the Chinese RDA, and four percent of males and four percent of females with protein intake lower than the Australia RDI. The Chinese RDA for protein was set at a higher level than the Australian RDI (See Table 5.9 and 5.10), presumably because the protein quality in the Chinese diet is relatively low, with the total proportion of protein coming from animals and legumes being only 37% (Ge et al., 1996). However, the principal sources of protein in the New Zealand diet are beef and veal, milk, poultry and fish/seafood, all foods with a high biological value for protein (University of Otago, 1999).

The protein requirement for adults was estimated by the 1985 Food and Agriculture Organization and World Health Organization Expert Consultation on Human Nutrition (FAO/WHO Expert Consultation) to be 0.6g/kg/day, and the safe level of intake was set at 0.75g/kg/day in order to cover the protein needs of 97.5 percent of the population (FAO et al., 1985). The RDIs for protein are based on the FAO safe level of protein intake (0.75g/kg/day). This equates to approximately 11-15 percent of energy being derived from protein (Jackson, 1998).

However, two recent studies on the elderly, conducted in America, suggested that the recommended protein intake level for the elderly should be increased to aid the maintenance of lean body mass (Baumgartner et al., 1999; Dvorak & Poehlman, 1998). This hypothesis is supported by several epidemiologic studies where healthy aging was associated with protein intakes near 1.2g /kg/day, whereas the present protein recommendations for the elderly are between 0.8 and 1g/kg/day (Blumberg, 1997). Young reviewed 73 studies and concluded that older people are also more likely to be affected by stressful stimuli which tend to increase protein needs, and the low energy intakes often found in older adults may reduce the efficiency of dietary protein utilization thus further increasing protein requirements (Young, 1992).

The daily mean protein intake for males was 83.2g and 70.7g for females and contributes on average 15.8% and 17.2%, respectively for male and female, of total energy. However the daily protein intake per kilo of body weight was similar for both

sexes (1.24g/kg/day for male and 1.21g/kg/day for female), both much higher than the recommendations, but close to the value suggested by Blumberg (Blumberg, 1997).

Men's protein intake in the present study (83.2g) was similar to New Zealand elderly men's protein intake (85g). However, women's protein intakes in the present study were higher than that intake in the New Zealand Survey. When the protein energy ratio was taken into account, the percentages of total energy intake from protein for both men and women were similar in the present study (15.8% for male, 17.2% for female) and the New Zealand Survey (16% for male, 17% for female). Both men and women's mean protein intakes in the present study were markedly higher than those reported in similar studies in China, especially Side's study. The subjects in Side's Chinese elderly study had the lowest percentage of total energy intake from protein (12.3% for male and 12.4% for female), which reflects the fact that inadequate protein intake is common among elderly Chinese in Mainland China (Ge et al.1996).

#### 5.6.4.3 Fat

An acceptable fat intake must meet the following three criteria. Intake most be sufficient to meet energy needs, supply an adequate quantity of essential fatty acids and other trace compounds, and provide adequate absorption of fat-soluble vitamins (Jéquier, 1999). For most adults, dietary fat should supply at least 15 percent of their energy intake. Mean fat intake for male subjects (64.3g) and for female subjects (49.3g) met the Chinese RDA requirement. Two male and four female subjects had fat intakes below the Chinese RDA, but above two-thirds of the Chinese RDA.

Not only total fat intake but also the proportions of different fats are important. The New Zealand Nutrition Taskforce recommends that the proportions of total energy supplied by different sources of fats should be:

- Total fat: 30-33 percent
- Saturated fatty acids plus trans fatty acids: no more than 12 percent
- Polyunsaturated fatty acids: approximately 6-10 percent
- Monounsaturated fatty acids: up to 20 percent (Department of Health, 1991).

The percentage of study subjects that met the 1991 New Zealand Nutrition Taskforce targets for energy from different fat sources has also been calculated and compared with

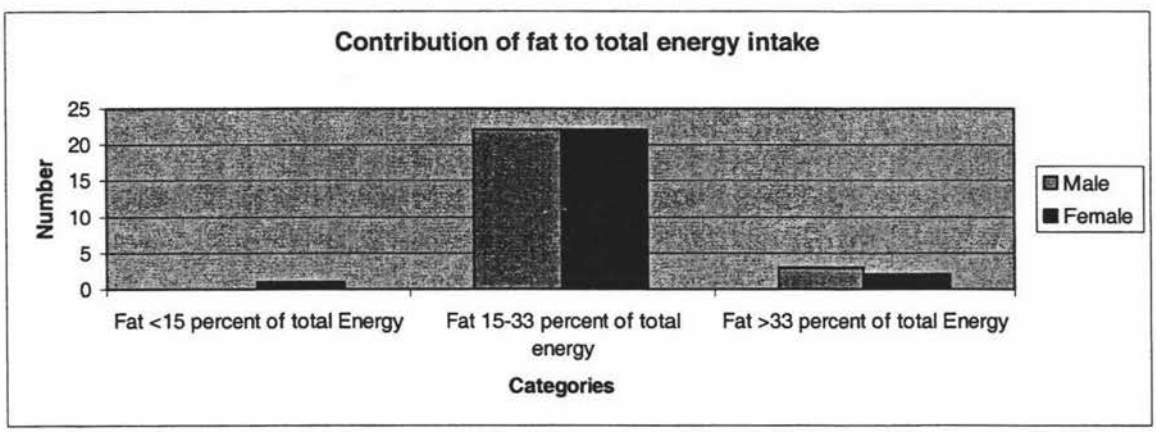
New Zealand NNS 97 values. (Table 5.13) The contribution of fat to total energy intake in the study subjects is shown in Figure 5.4

**Table 5.13: Comparison of the percentage of the study subjects and New Zealand elderly that met the 1991 New Zealand nutrition taskforce targets for fat intake**

| | Study subjects | | | Subjects from NZ 96/97 National Nutrition Survey* |
|---|---|---|---|---|
| | **Men (Percentage)** | **Women (Percentage)** | **Total (Percentage)** | **Man and woman combined (Percentage)** |
| Saturated fat <12% of total energy | 84 | 84 | 84 | 28 |
| Monounsaturated fat >10% of total energy (up to 20%) | 80 | 48 | 64 | 67 |
| Polyunsaturated fat 6-10% of total energy | 68 | 68 | 68 | 23 |

*Russell et al., 1999

**Figure 5.4: Contribution of fat to total energy intake in study subjects**




Only one woman in the study had a fat intake that contributed less than 15 percent of her total energy intake, while three men and two women had fat intakes that contributed

more than 33% of total energy, the New Zealand Nutrition Taskforce recommendation. Thus, 88% of men and 84% of women met this recommendation.

Mean fat consumption (64.3g in males and 49.4g in females) and mean percentage of total energy from fat (26.7% in males and 25.8% in females) in the present study were the lowest in the three studies for both men and women. These values were also lower than other Chinese surveys. Zhang studied 150 women in three cities in Mainland China and found the mean percentage of total energy from fat was 38%, and 73% of study women had fat intakes greater than 30% of total energy (Zhang et al., 1997) The Chinese National Nutrition Survey found 35% of total energy came from fat in men and women combined in urban areas (Ge et al., 1996). Although the traditional Chinese diet is considered to contain less fat than the Western diet, Chinese in Mainland China have increased their fat intake in recent years. Other Chinese immigrant studies also report a higher percentage energy from fat. Among 2,488 men and women in the United States, Canada, and China, the reported median percent energy from fat was 35% in North American Chinese (Whittemore et al., 1995). A study of 56 Chinese-American women aged 18 to 35 years in San Diego, California area reported consuming about 34% of energy from fat, mirroring the national average (Schultz et al., 1994).

Eight four percent of all subjects met the target for saturated fat (<12 percent), which is much higher than 28% in the New Zealand 96/97 National Nutrition Survey. A similar percentage met the target for monounsaturated fat. Sixty eight percent of all subjects met the target for polyunsaturated fat (6-10 percent), which is much higher than the 23% of New Zealanders in the 96/97 National Nutrition Survey. Thus study subjects had more ideal lipid intakes than New Zealand elderly. Both male and female subjects had similar cholesterol intakes to the New Zealand elderly. Their cholesterol intakes were lower than 300mg, which was considered below the risk level.

#### 5.6.4.4 Carbohydrate

The FAO/WHO Expert Consultation recommends that an optimum diet derive at least 55 percent of total energy from a variety of carbohydrate sources (WHO, 1997a). The New Zealand Nutrition Taskforce recommends that New Zealand adults obtain 50-55 percent of total energy from carbohydrate. Sucrose and other free sugars should be restricted to no more than 15 percent of total energy because of the potential problems

associated with excess energy intake and dental caries (Department of Health, 1991) The average percentage of total energy from carbohydrate in males and females in the present study is 55% and 54.7% respectively, which met the recommendation.

The mean carbohydrate intake for men in the present study (307g) was the highest among the four studies. It was much higher than the mean intake in the New Zealand National Nutrition Survey (252g). The carbohydrate intake for women in the present study (244g) was close to the mean intake for Wang's and Side's Chinese elderly survey (232.2g and 250g), which was also much higher than the mean intake in the New Zealand National Nutrition Survey (189g). The mean percentage of total energy from carbohydrate in both men and women were similar to that in Side's Chinese elderly survey. Mean starch intakes for both men and women in the present study were also much higher than other studies. On the other hand mean total sugar intakes for both men and women in this study were the lowest in all three studies.

Elderly people like to keep their traditional food habits even after immigration. Chinese usually eat three meals a day. Lunch and supper mostly consist of *fan* and a number of *tsai* (Denny, 1994). The main core of the meal (*fan*), is a grain-based food such as boiled or steamed rice, noodles (made from wheat), or steamed wheat buns. Fan was the main carbohydrate source for study subjects. Their high starch and low sugar intake pattern may benefit their cardiovascular health.

#### 5.6.4.5 Fibre

The RDI for dietary fibre in New Zealand is 25-30 g/day (Department of Health 1991). The mean fibre intakes are low at 19.2g for males and 18.2g for females. (Table 5.9 and Table 5.10) Only two men (eight percent) and two women (eight percent) met this New Zealand Recommendation. Intake of dietary fibre by the study subjects seemed inadequate. The elderly subjects in Wang's study in Mainland China observed the lowest fibre intake of 10.9g and 8.9g per day for men and women respectively. In a study of 150 adult women in Beijing, Shanghai and Naning city in Mainland China, fiber intakes were as low as 8.7 g per day. Although elderly Chinese immigrants in this study consumed adequate quantities of vegetable and fruit, they consumed mainly refined rice that is low in fibre, and less cereal that is high in fibre.

#### 5.6.4.6 Alcohol

Alcohol consumption of the study subjects was very low when compared to other studies. Mean alcohol intakes of male and females study subjects were only one tenth of that in New Zealand elderly.

### *5.6.5 Micronutrient intakes*

Vitamin and mineral intakes compared against the Chinese RDA and Australian RDI are shown in Table 5.14 and Table 5.15.

Mean intakes of calcium, zinc, vitamin A and vitamin D for males and females were far below the Chinese RDA and Australian RDI. Although mean selenium intakes for males and females reached the Chinese recommended level, they were lower than the Australian RDI.

The Lower Reference Nutrient Intake (LRNI) is defined as the amount of nutrient that is sufficient for only a few individuals (2.5%). Intakes below the LRNI by an individual will almost certainly be inadequate and are defined as intake at risk level.

Table 5.16 shows the numbers of male and female subjects consuming less than two-third of the Chinese RDA and Australian RDI. Table 5.17 shows the micronutrient intakes of study subjects with intake below the United Kingdom Lower Reference Nutrient Intake (LRNI). A large percentage of the elderly subjects had inadequate calcium intake. Twenty four percent of all subjects had inadequate calcium intakes and 20% of all subjects had calcium intakes below the LRNI. Zinc was another mineral with inadequate intakes among study subjects. When compared to the Australian RDI, which had a lower value than the Chinese RDA, 40% of males and 56% of females were still found with zinc intakes below 2/3 RDI. However, only one male subject had a zinc intake at risk level. More males (68%) than females (28%) had selenium intakes below 2/3 Australian RDI. Twelve percent of total study subjects had selenium intakes below the LRNI. Vitamin A intake was also inadequate among the study subjects. The vitamin intakes of most subjects were below the Chinese RDA and Australia RDI. Around 40% of males and females had inadequate vitamin A intake and 24% of total subjects had vitamin A intakes lower than the LRNI. Although 100% of all subjects had insufficient

dietary vitamin D intake, it is unknown what level was produced from exposure to the sun. Although mean vitamin E intake reached the recommended level, there were 32% of males and 8% of females with vitamin E intakes lower than two-third's of the Chinese RDA.

**Table 5.14: Vitamin and mineral intakes as a percentage of the RDA (male)**

| | Study subjects | Chinese RDA (60-80y) Sedentary [1] | % of subjects with intakes lower than Chinese RDAs | Australian RDIs (64+ yr)[2] | % of subjects with intakes lower RDI |
|---|---|---|---|---|---|
| Calcium (mg) | 615 | 800 | 80 | 800 | 80 |
| Iron (mg) | 16 | 12 | 16 | 7 | 0 |
| Sodium (mg) | 2165 | ~ | ~ | 920-2300 | ~ |
| Total Folate (ug) | 222 | | ~~ | 200 | 44 |
| Zinc (mg) | 8.9 | 15 | 100 | 12 | 80 |
| Selenium (ug) | 59.5 | 50 | 32 | 85* | 92 |
| Magnesium (mg) | 305 | ~ | ~ | 320 | 64 |
| Potassium (mg) | 2950 | ~ | ~ | 1950-5460 | 8 |
| Phosphorus (mg) | 1292 | ~ | ~ | 1000 | 20 |
| Vitamin A: retinol equivalents (ug) | 530 | 800 | 92 | 750 | 88 |
| VitminC (mg) | 126 | 60 | 8 | 40 | 0 |
| VitaminB 6 (ug) | 1.8 | ~ | ~ | 1.0-1.5 | 0 |
| Vitamin B12(ug) | 2.6 | ~ | ~ | 2.0 | 20 |
| Niacin equivalents (mg) | 30 | 12 | 0 | 14-17 | 0 |
| Riboflavin (mg) | 1.2 | 1.0-1.2 | 16 | 1.3 | 8 |
| Thiamin (mg) | 1.2 | 1.0-1.2 | 20 | 0.9 | 12 |
| Vitamin E (mg): α-tocopherol equivalents | 11.5 | 12 | 48 | 10.0 | 32 |
| Vitamin D (ug) | 2.1 | 10 | 100 | ~ | ~ |

[1] Chinese Recommended Dietary Allowance. Data from Zeng &Feng, 1991

[2] New Zealand Recommended Dietary Intakes adopted from Australia Recommended Dietary Intakes. Data from Ministry of Health, 2002

**Table 5.15: Vitamin and mineral intakes as a percentage of the RDA (female)**

| | Study subjects | Chinese RDA (60-80y) Sedentary [1] | % of subjects with intakes lower than Chinese RDAs | Australian RDIs (64+ yr)[2] | % of subjects with intakes lower than RDI |
|---|---|---|---|---|---|
| Calcium (mg) | 574 | 800 | 80 | 1000 | 92 |
| Iron (mg) | 13 | 12 | 44 | 5-7 | 0 |
| Sodium (mg) | 2146 | ~ | ~ | 920-2300 | 0 |
| Total folate (ug) | 198 | ~ | ~ | 200 | 64 |
| Zinc (mg) | 8.1 | 15 | 96 | 12 | 96 |
| Selenium (ug) | 54.2 | 50 | 28 | 70* | 84 |
| Magnesium (mg) | 302 | ~ | ~ | 270 | 44 |
| Potassium (mg) | 2478 | ~ | ~ | 1950-5460 | 12 |
| Phosphorus (mg) | 1143 | ~ | ~ | 1000 | 28 |
| Vitamin A: retinol equivalents (ug) | 502 | 800 | 72 | 750 | 80 |
| Vitamin C (mg) | 155 | 60 | 4 | 30 | 0 |
| Vitamin B6 (ug) | 1.6 | ~ | ~ | 0.8-1.1 | 4 |
| Vitamin B12 (ug) | 2.3 | ~ | ~ | 2.0 | 40 |
| Niacin equivalents (mg) | 27 | 12 | 8 | 11 | 4 |
| Riboflavin (mg) | 1.1 | 1.0-1.2 | 44 | 1.0 | 44 |
| Thiamin (mg) | 1.1 | 1.0-1.2 | 48 | 0.7 | 4 |
| Vitamin E (mg): α-tocopherol equivalents | 13.4 | 12 | 76 | 7.0 | 12 |
| Vitamin D (ug) | 3.3 | 10 | 100 | ~ | ~ |

[1] Chinese Recommended Dietary Allowance. Data from Zeng &Feng, 1991

[2] New Zealand Recommended Dietary Intakes adopted from Australia Recommended Dietary Intakes. Data from Ministry of Health, 2002

Table 5.18 and Table 5.19 show the vitamin and mineral intakes of the elderly from the present study, the New Zealand National Nutrition Survey, Wang's Chinese elderly study and Side's Chinese elderly study. Compared to the New Zealand National Nutrition Survey, study subjects had lower calcium, zinc, vitamin A, vitamin $B_{12}$, riboflavin intakes but higher selenium, vitamin C, vitamin $B_6$, vitamin E intakes.

However, when compared to elderly studies in Mainland China, study subjects had higher calcium, vitamin C, riboflavin intakes but lower iron intakes. Interestingly, although vitamin C intakes in all four studies seemed to be adequate, the study subjects had the highest mean vitamin C intakes, almost double the Chinese RDA and more than triple the Australia RDI. Wang's Chinese elderly study in Mainland China observed very low vitamin A intakes (197.1 for males and 227.1 for females). However, vitamin A intake in Side's study was similar to the present study. New Zealand elderly had almost double the vitamin A intake of subjects in this study.

**Table 5.16 Percentage of study subjects with nutrient intakes lower than 2/3 Chinese RDA and Australia RDI**

| | **Percentage of subjects with intakes lower than 2/3 Chinese RDA** | | **Percentage of subjects with intakes lower than 2/3 Australian RDI** | |
|---|---|---|---|---|
| | **Male** | **Female** | **Male** | **Female** |
| Calcium | 24 | 24 | 24 | 32 |
| Iron | 0 | 0 | 0 | 0 |
| Folate | ~ | ~ | 4 | 28 |
| Zinc | 68 | 88 | 40 | 56 |
| Magnesium | ~ | ~ | 0 | 4 |
| Potassium | ~ | ~ | 0 | 4 |
| Selenium | 12 | 8 | 68 | 28 |
| Phosphorus | ~ | ~ | 0 | 4 |
| Vitamin A | 36 | 44 | 40 | 40 |
| Vitamin $B_{12}$ | ~ | ~ | 8 | 12 |
| Niacin equivalents | ~ | ~ | 0 | 4 |
| Riboflavin | 8 | 8 | 12 | 8 |
| Vitamin E | 32 | 8 | 16 | 0 |
| Vitamin D | 92 | 92 | ~ | ~ |

**Table 5.17: Percentage of study subjects with micronutrient intakes below the United Kingdom Lower Reference Nutrient Intake (LRNI) for the relevant nutrients**

| Nutrients | United Kingdom LRNI* | Male | | Female | | Total | |
|---|---|---|---|---|---|---|---|
| | | (n=25) | % | (n=25) | % | (n=50) | % |
| Vitamin A (ug) | 300 (male) 250(female) | 6 | 24 | 6 | 24 | 12 | 24 |
| Riboflavin (mg/day) | 0.8 | 5 | 20 | 7 | 28 | 12 | 24 |
| Vitamin B12 (ug/day) | 1.0 | 1 | 4 | 1 | 4 | 2 | 4 |
| Folate (ug/day) | 100 | 0 | ~ | 2 | 8 | 2 | 4 |
| Calcium (mg/day) | 400 | 5 | 20 | 5 | 20 | 10 | 20 |
| Selenium (ug/day) | 40 | 2 | 8 | 4 | 16 | 6 | 12 |
| Zinc (mg/day) | 5.5 (male) 4.0 (female) | 1 | 4 | 0 | ~ | 1 | 2 |
| Potassium (mg/day) | 2000 | 1 | 4 | 3 | 12 | 4 | 8 |

*Data from Garrow, 2000

**Table 5.18: Vitamin and mineral intakes from different surveys (male)**

| | Study Subjects Mean | New Zealand elderly (>=65y) Mean | Wang's study of Chinese elderly (>=55y) Mean | Side's Dietary survey of Chinese elderly (>=70)[3] (urban area) Mean |
|---|---|---|---|---|
| | n=25 | n=4,636 | n=77 | n=50 |
| Calcium (mg) | 615 | 799 | 500.6 | 439 |
| Iron (mg) | 16 | 12.5 | 20.9 | 18 |
| Total folate(ug) | 222 | 262 | ~ | ~ |
| Zinc (mg) | 8.9 | 12.1 | ~ | ~ |
| Selenium (ug) | 59.5 | 46 | ~ | ~ |
| Magnesium (mg) | 305 | 309 | ~ | ~ |
| Phosphorus (mg) | 1292 | 1453 | ~ | ~ |
| Manganese (ug) | 4023 | 5231 | ~ | ~ |
| Copper (mg) | 1.3 | 1.4 | ~ | ~ |
| Vitamin A: retinol equivalents (ug) | 630 | 1279 | 197.1 | 648 |
| VitminC (mg) | 126 | 102 | 88.4 | 59 |
| VitaminB6 (ug) | 4.8 | 1.5 | ~ | ~ |
| Vitamin B12 (ug) | 2.6 | 4.5 | ~ | ~ |
| Niacin equivalents (mg) | 30 | 34 | 15.5 | 11.3 |
| Riboflavin (mg) | 1.2 | 1.8 | 1.0 | 0.8 |
| Thiamin (mg) | 1.2 | 1.5 | 1.3 | 1.3 |
| Vitamin E (mg): α-tocopherol equivalents | 11.5 | 10.8 | ~ | ~ |

[1]Russell et al., 1996; [2]Wang & Roe, 1994; [3]Side et al., 1991

**Table 5.19: Vitamin and mineral intakes from different surveys (female)**

| | Study Subjects<br><br>Mean | New Zealand elderly (>=65y)<br><br>Mean | Wang's study of Chinese elderly (>=55y)<br>Mean | Side's Dietary survey of Chinese elderly (>=70)[3] (urban area)<br>Mean |
|---|---|---|---|---|
| | n=25 | n=4,636 | n=143 | n=50 |
| Calcium (mg) | 574 | 670 | 449.8 | 370 |
| Iron (mg) | 13 | 9.6 | 15.7 | 16.3 |
| Total Folate (ug) | 198 | 227 | ~ | ~ |
| Zinc (mg) | 8.1 | 9.2 | ~ | ~ |
| Selenium (ug) | 54.2 | 38 | ~ | ~ |
| Magnesium (mg) | 302 | 251 | ~ | ~ |
| Phosphorus (mg) | 1143 | 1151 | ~ | ~ |
| Manganese (ug) | 4223 | 4563 | ~ | ~ |
| Copper (mg) | 1.3 | 1.2 | ~ | ~ |
| Vitamin A: retinol equivalents (ug) | 602 | 1149 | 221.7 | 617 |
| Vitamin C (mg) | 155 | 101 | 76.4 | 56 |
| Vitamin B6 (ug) | 1.6 | 1.2 | | ~ |
| Vitamin B12 (ug) | 2.3 | 3.9 | | ` |
| Niacin equivalents (mg) | 27 | 25 | 12.3 | 9.6 |
| Riboflavin (mg) | 1.1 | 1.5 | 0.8 | 0.7 |
| Thiamin (mg) | 1.1 | 1.2 | 1.0 | 1.2 |
| Vitamin E (mg): α-tocopherol equivalents | 13.4 | 8.5 | ~ | ~ |

[1]Russell et al., 1996; [2]Wang & Roe, 1994; [3]Side et al., 1991

### 5.6.5.1 Calcium

Some studies indicate that current calcium recommendations seem inadequate for the elderly. Reid et al, in a study of postmenopausal women in New Zealand, found that even in women with mean intakes of 750mg calcium per day an additional calcium supplement containing 1g/day (without added vitamin D) caused significantly less bone mineral loss over a two year period than in women taking a placebo (Reid et al., 1993). Heaney et al. found that estrogen-treated postmenopausal women need approximately 1,500mg calcium per day to achieve calcium balance (Heaney et al., 1995). A higher value for the elderly has been recommended in America. Based on US balance data, the National Academy of Sciences recommends a daily intake of 1,200mg/day for men and

women over age 50 (Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 1997).

Yet the average Chinese hardly reaches the recommended level. Low calcium intake has been observed in most studies in Mainland China. The 1992 Chinese National Nutrition Survey found a mean 457.9mg/day calcium intake in the urban population for men and women combined, while in rural areas the value was even lower. In a study of 150 women in urban areas of Mainland China calcium intake was 439mg/day. Pan's study on dietary intake of people in a fishing village found the mean calcium intake of men and women alike to be as low as 127.7mg/day (Pan et al., 1995). This mean value was far below the Lower Reference Nutrient Intake Recommendation (400mg for male and female).

In addition to studies in Mainland China, a Hong Kong study found that mean calcium intakes were 605mg/day for adult males and 570mg for adult females (Woo et al., 1999b). A study of 169 elderly Chinese Americans reported mean calcium intakes to be 734mg/day for males and 567mg for females (Kim et al., 1993). Another study which involved 2,488 healthy Chinese men and women residing in North America (and Canada) and in Mainland China reported that mean calcium intake was around 500mg/day for males and females in both North America and Mainland China (Lee et al., 1994).

Milk and dairy products are the main source of calcium. Typical Chinese meals do not include milk, cheese, yogurt or other dairy products. Thus, Chinese in Mainland China lack calcium in their diet. Although study subjects were living in New Zealand where dairy products are easily available, most of them are not used to a diet that includes sufficient dairy products. Milk was only consumed for breakfast by most of the study subjects and most of them (94%) never consumed cheese. Low dairy product consumption was also found among Chinese Australians (Hsu-Hage et al., 1995) and Chinese Americans (Lee et al., 1994; Kim et al., 1993).

Hu's study investigated associations between dietary calcium and bone status of 843 Chinese women aged 35-75 and indicated that dietary calcium, especially from dairy sources, increased bone mass in middle-aged and elderly women by facilitating optimal peak bone mass earlier in life (Hu et al., 1993). Recent studies (Heaney, 2000) suggest

that increased calcium and vitamin D intake may have a potentially protective effect against fractures. Since the percentage of study subjects with lower back ache was high (eight percent for males and 24% for females), study subjects, especially those with calcium intake lower than the LRNI, might consider taking a calcium supplement.

#### 5.6.5.2 Zinc

Zinc was one of the inadequate nutrients among the study subjects. Zinc intakes of most study subjects did not reach the recommended level. Around 50% of total study subjects had inadequate intakes. The mean intakes of zinc were also lower than those of the New Zealand elderly. However, a Hong Kong study observed mean zinc intakes of Hong Kong elderly aged 55 and over were 14mg and 11mg for men and women respectively, which were similar to those of Australians (13mg for men and 11mg for women). Zinc is high in lean meat. According to New Zealand studies, the principle sources of zinc for New Zealanders are beef and veal (19 percent), bread (10 percent), milk (8 percent), vegetables (6 percent) and bread-based dishes (5 percent) (University of Otago, 1999). However diets based on fish or vegetarian diets based on polished rice or roots and vegetables typically give a lower zinc intake (Garrow et al., 2000). This partly explains the low zinc intake of the study subjects.

#### 5.6.5.3 Selenium

Selenium, an essential trace nutrient found largely in grains, fish, and meats, enters the food chain through plants at geographically variable rates dependent on selenium concentrations in the soil. New Zealand has a low selenium soil level. The selenium intakes of New Zealanders have been considered lower than those of other Western countries (Robinson, 1989). Therefore, the selenium content of foods in the New Zealand food database has reflected the selenium level of New Zealand soil. However, in this study, the nutrient content of some Chinese vegetables came from the Chinese database, where the soil selenium level is much higher than that in New Zealand. The calculated selenium intake of study subjects may thus be higher than their actual intake. Although selenium intake of subjects may have been overestimated, there were still 68% of male and 28% of female study subjects with selenium intakes lower than two-third Australia RDI.

Wang and Side's Chinese elderly study in Mainland China had not studied the selenium intake among their study subjects. In the 1992 Chinese National Survey, the mean selenium intake for men and women combined in urban areas was 52.3ug/day, which was similar to that in this study. Mean selenium intakes of both males and females were higher than those of the New Zealand elderly.

#### 5.6.5.4 Iron

Intake of iron was adequate in this study. This result also was coincident with other immigration studies (Satia et al., 2001; Hus-Hage et al., 1995). Mean iron intakes for both men and women in the present study were higher than those in NNS97. However, these intakes were lower than their Chinese counterparts.

Soy and its products are also one of the common foods in the Chinese diet. Soy is high in iron. The iron content of tofu reaches to 10.5mg/100g (Hasler 1998), and is higher than the around 4mg/100g for beef. This could explain the high iron intake of the study subjects. Some high iron foods such as liver and animal blood that are part of Chinese diet, are not consumed in New Zealand. More than 75% of all subjects reported never consuming animal organs or consuming them less than once a week. (Table 4.9) However the consumption of animal organs was high in Mainland China, especially in rural areas (Ge et al., 1995). Thus the iron intake of study subjects was lower than their Chinese counterparts.

Although iron intake in Mainland China is surprisingly high, iron deficiency anemia is still common as iron in Chinese style food is poorly absorbed, with greater than 95% of the mean iron intake being in nonheme form (Chen et al, 1990; Campbell & Chen, 1994; Du et al, 2000) On the other hand, Chinese cooking methods also affect the absorption of iron. Vegetables are commonly stir-fried, and fruit juice or fresh fruits are seldom eaten with a meal. Therefore, although vitamin C enhances absorption of nonheme iron (Hallberg and Hulthen, 2000), the benefit of vitamin C is compromised by heat susceptibility and separate consumption. So, increasing both iron intake and iron bioavailability is necessary for the Chinese population.

Not all Chinese cooking methods have a negative impact on iron status. Studies showed that foods cooked in iron woks may have on increased iron content. Two studies investigated the iron content of Chinese foods cooked in woks and found available iron was higher in foods cooked in iron wok than in glass pots. These studies also compared the frequency of using an iron woks before and after immigration of Chinese Americans. Although Chinese American cooked less often after immigration, they did stir-frying more frequently and used their woks a lot. (Britton and Zhou, 1992; Zhou and Britton, 1994)

Further study is needed to reveal the dietary sources of iron and the iron status in this population.

#### 5.6.5.5 Sodium

According to the Chinese National Nutrition Survey, the mean sodium intake for adult men and women combined was 7,259mg/day in the urban area. Sodium intakes for both men and women in this study were much lower than this. This result differs from former findings that the elderly use salt or salty food rather than intrinsic food flavor, especially as taste and smell tend to decline with age (Schiffman & Warwick, 1993), thus sodium intake for the elderly might higher than the young. Chinese consume more salted vegetables and some processed meat, such as Lai Chang and Lai Rou. Compared to the Chinese National Survey, the study subjects had similar salted vegetable intakes. However the mean intake of 2,165mg sodium for men and 2,146 mg sodium for women may not be reliable and probably is an underestimation, because of the non-quantifiable use of salted seasonings, etc.

Sodium is often added during food processing, with up to 85 percent of the average daily sodium intake coming from processed and manufactured foods (Godlee, 1996; Engstrom et al., 1997). Bread and cereals are the major contributors of sodium in the New Zealand diet because of the quantities consumed (Ministry of Health, 2002). The Chinese consume mainly rice that doesn't need added salt. The sodium intake of New Zealand subjects was not been studied in NNS97.

A high-salt (sodium) intake has been linked to high blood pressure, which is an important risk factor for cardiovascular disease, especially stroke for the elderly

(National Heart Foundation's Nutrition Advisory Committee, 1999). In addition to its possible affects on blood pressure, evidence does suggest that perpetually high sodium intakes increase calcium loss, leading to the possibility of lone-term negative calcium balance (Cappuccio, 1996; Ginty et al., 1998).

#### 5.6.5.6 Vitamin D

The study subjects had insufficient vitamin D intake from food. People living in New Zealand with adequate outdoor activities probably get enough vitamin D from exposure to sunshine. However decreased mobility with old age causes decreased outdoor activities, and as a result reduced exposure to sunshine. Besides, with increasing age the capacity of the skin to synthesize pre-vitamin $D_3$ and the hydroxylation of 25-hydroxy-vitamin D by the kidney are both impaired. When healthy adults were exposed to the same amount of simulated sunlight, the maximum circulating concentration of vitamin D achieved in older subjects was only around one-quarter of that in young subjects (Holick et al, 1989). In addition, diminished vitamin D absorption because of fewer intestinal vitamin D receptors may also contribute to the low vitamin D level among the elderly (Ebeling et al., 1992). Thus the very low mean vitamin D intakes among the study subjects implies that study subjects with less outdoor activity may possibly have a vitamin D deficiency problem.

#### 5.6.5.7 Vitamin A

Low vitamin A intakes are common in this and other Chinese studies. Most Chinese studies observed mean vitamin A intakes within the range of 400 to 600ug/day. In Zhang's study on 150 women in urban China the mean vitamin A intake was 544ug (Zhang et al., 1997). A Singapore Chinese study reported the mean vitamin A intake to be 587ug for Chinese male and 575ug for female (Woo et al., 1999c). Kim's study on 169 elderly Chinese Americans found that about 25% of Chinese men and 28% of Chinese women consumed inadequate amount of vitamin A (less than two-thirds of Chinese RDA) (Kim et al., 1993). Netland and Brownstein also reported that a similar percentage of Asians in the San Francisco Bay area consumed less than 67% of the American RDA for vitamin A (Netland and Brownstein, 1984).

The need for vitamin A decreases among the elderly. Low serum vitamin A levels appear to be rare among older adults despite a high prevalence of dietary intakes below current recommended levels. Krasinske et al. studied elderly and young persons after feeding them a meal high in fat and vitamin A. Several hours after the meal, a unit of blood was taken and plasmaphoresis was done before reinfusing the plasma 24 to 48 hours later. In this study, it was found that elderly persons had diminished clearance ability with regard to vitamin A (Krasinski et al., 1989). So the present recommendations may be too high for older adults.

#### 5.6.5.8 Vitamin C

Both dietary studies of Chinese in Mainland China and those of immigrant Chinese in Western countries report adequate vitamin C intake. The mean vitamin C intake for urban men and women combined in the 1992 Chinese National Nutrition Survey was 95.6 mg/day (Ge et al., 1996).

The subjects in this study reported the highest vitamin C intake, when compared to the New Zealand Nutrition Survey and Chinese elderly studies. Increased intake of fruit and vegetables after immigration may contribute to the high vitamin C intake among the study subjects. There were several other explanations for this finding. For example, high socioeconomic status may provide more exposure to nutrition education messages (Satia et al., 2001). Subjects in this study had a high education level and they probably knew the benefits of fruit and vegetables. Another explanation may be that they incorporated "new" foods into their diets, such as fruit juices, while retaining some traditional food items, such as green leafy vegetables. . A study of 244 Chinese women in North America also reported that fruit and vegetable intake had increased and orange juice more heavily consumed since immigration (Satia et al., 2001). However other studies conducted in North America showed higher vegetable consumption in China than in North America, even among people of Chinese descent (Whittemore et al., 1995; Whittemore et al., 1990; Lee et al., 1994).

Vitamin C is found in many fruits and vegetables, but is unstable and is therefore easily destroyed (Athar et al., 1999). Estimates of vitamin C in foods vary according to the quality of transportation, shelf time prior to the consumer purchasing the food, and storage, preparation and cooking practices. Boiling vegetables can cause 50-80 percent

loss, but cooking vegetables with minimal water or in a microwave oven will decrease losses (Erdman and Klein, 1982;Vanderslice and Higgs, 1991). Chopping and dicing that exposes a large surface area to oxidation also results in loss of vitamin C. Chinese seldom eat raw vegetables. They usually fry them with a small amount of oil. But in this study, when we analyzed the nutrient composition of vegetables, the nutrient content of raw vegetables in the various recipes was calculated. Therefore, vitamin C may be overestimated in this study.

#### 5.6.5.9 Vitamin $B_6$, folate, vitamin $B_{12}$

Mean vitamin $B_6$, folate, and vitamin $B_{12}$ intakes for elderly in this study and in the New Zealand Nutrition Survey were higher than recommendations. (Only 2 subjects had folate intakes below the LRNI.) However, other elderly studies show the opposite result. Of more than 900 people aged 60 years and older in the Boston survey, over half had dietary vitamin $B_6$ intakes below two-thirds of the America RDA (Hartz, 1992). In Van der Wielen's study although mean folate intakes exceeded the recommendations in most of the larger dietary studies of older adults, a substantial proportion of older adults were found to have intakes below two-thirds of the country specific recommendations in several Western countries (van der Wielen et al, 1994). For the whole Western society, the prevalence of biochemical vitamin $B_6$ deficiency was around 23 percent (van der Wielen et al, 1994). A Christchurch study in New Zealand found low folate levels in older adults living in their own homes were uncommon, but low vitamin $B_{12}$ levels were a more frequent finding (7.3 percent prevalence rate) (Hanger et al, 1991).

In addition to maintaining serum and red blood cell folate levels in elderly persons, folate and vitamin $B_{12}$ are also needed for the conversion of homocysteine to methionine. Deficiency of either of these vitamins can give rise to high blood homocysteine levels that are strongly related to cardiovascular diseases. Recent studies suggested that higher intakes of folate from food or supplements, alone or in combination with vitamin $B_6$ were associated with substantially lower risk of coronary heart disease among elderly (Selhub et al., 1993; Boushey et al., 1995). Donovan's study found that people who were at lowest risk of cardiovascular disease were those who took both folate more than 400 ug and vitamin $B_6$ more than 3 mg each day. However the current America RDA for folate is 180ug and for vitamin $B_6$ 1.8mg,

Australia RDI for folate is 200ug and for vitamin $B_6$ 1.0-1.5mg/day. The result suggested that the current recommendations are too low to provide optimal protection against cardiovascular disease especially for the elderly population (Donovan, 1998). The benefit of folate, vitamin $B_{12}$ and Vitamin $B_6$ supplements for the elderly need to be further studied.

#### 5.6.5.10 Riboflavin

Twenty percent of males and 28% percent of females had riboflavin intakes lower than the LRNI. Mean riboflavin intake of study subjects was lower than that of their New Zealand counterparts, however higher than that of the Chinese elderly in China.

Riboflavin deficiency in the elderly is quite common. Russell and Suter found that 20% to 27% of older persons in America and Western European countries do not meet the 1989 America RDA (Russell & Suter, 1993). Low intakes of riboflavin are even more common in developing countries where dairy products are not regularly consumed. A study in Hong Kong compared dietary nutrient intakes between Hong Kong people and Australian and found that riboflavin intakes for Hong Kong males and females were 1.2mg and 1.0mg respectively, however riboflavin intakes for Australians were 2.4mg and 2.2mg respectively (Woo et al., 1999a). Furthermore, various surveys showed evidence of riboflavin deficiency among the elderly (as judged by an elevated erythrocyte glutathione reductase activity coefficient) that ranges between 5% to 16% in developed countries and 17% to 76% in developing countries (Russell & Suter, 1993).

### *5.6.6 Comparison of food consumption patterns*

In a sociocultural model, major determinants of food habits are the traditional food culture, food availability, and household economy (Axelson, 1986). Migrant populations are particularly sensitive to these determinants because of an inevitable pressure to change after migration.

Food consumption patterns in the study subjects compared firstly to the Chinese National Survey are shown in Table 5.20, and secondly to Side's Elderly Survey are shown in Table 5.21. There were sex differences in food consumption patterns. Men on average consumed more energy providing foods, such as cereals, than women. The diet

of study subjects was principally like that of the Chinese in Mainland China, using rice, pork, fish and vegetables. However they had greater intakes of wheat products, dairy products, fruits and legumes. Cereal, vegetable, salted vegetable, meat, cooking oil and snack consumption were similar for study subjects and the Mainland Chinese. (Table 5.20)

**Table 5.20: Comparison of food consumption pattern (Chinese National Nutrition Survey and the present study)**

| Food items | Men<br>Mean<br>g/day | Women<br>Mean<br>g/day | Chinese National Survey in 1992<br>(Urban Area)[1]<br>Men and Women Combined<br>Mean<br>g/day |
|---|---|---|---|
| | n=25 | n=25 | n=100,000 |
| Rice/ products | 207 | 148 | 223 |
| Wheat/flour | 130 | 110 | 165 |
| Legume | 33 | 43 | 13 |
| Vegetable | 341 | 268 | 365 |
| Salted vegetable | 9.2 | 7.6 | 8 |
| Fruits | 207 | 223 | 80 |
| Pork | 40 | 31 | 61 |
| Other meats | 12 | 9 | 17 |
| Organ meats | 3 | 1 | 6 |
| Poultry/products | 68 | 44 | 16 |
| Egg | 23 | 25 | 29 |
| Fish/shellfish | 43 | 23 | 44 |
| Cooking oils/spread | 33 | 31 | 37 |
| Snack/sweet products | 22 | 23 | 21 |
| Dairy food | 175 | 161 | 36 |

[1]Ge et al., 1996

However, when compared to Side's survey of the elderly in an urban area, the study subjects ate less bean products, eggs and salt. In contrast, vegetables, fruit and milk consumption was higher in the study subjects. (Table 5.21)

**Table 5.21: Comparison of food consumption pattern**

**(The present study and Side's elderly survey)**

| | Men | | Women | |
|---|---|---|---|---|
| **Food items** | **Present study** g/day | **Side's elderly survey (Urban Area 70+yr)' g/day** | **Present study** g/day | **Side's elderly survey (Urban Area 70+ yr) g/day** |
| | n=25 | n=50 | n=25 | n=50 |
| Cereals | 337 | 319 | 258 | 313 |
| Bean products | 33 | 168 | 43 | 203 |
| Vegetables | 341 | 192 | 268 | 171 |
| Meat (ME) | 123 | 42 | 85 | 32 |
| Eggs (EG) | 23 | 44 | 25 | 50 |
| Milk (MI) | 175 | 102 | 161 | 76 |
| Fish (FI) | 43 | 19 | 23 | 20 |
| ME+EG+MI+FI | 364 | 207 | 294 | 173 |
| Fruit | 207 | 90 | 223 | 105 |
| Oil | 33 | 23 | 31 | 25 |
| Salt | 3 | 12 | 4 | 11 |

'Side et al., 1991

It has been suggested that consumption of 400g/day or more of a variety of fruits and vegetables could, by itself, decrease overall cancer incidence by at least 20 percent (World Cancer Research Fund, 1997). An Australian study showed that the older Chinese and those who traveled to Australia at an older age tended to retain their traditional food intake patterns characterized by high intakes of fruits and vegetables (Hsu-Hage et al., 1995). Similar observations have been made of a group of female elderly Australians and American centenarians, who showed good compliance with the contemporary dietary guidelines in vegetable and fruit intakes (Crawford & Baghurst, 1990; Johnson et al, 1992). An immigration study of 244 Chinese women in North America reported an increase in fruit and vegetable intake after immigration (Satia et al., 2001). In this study, fruit intakes are higher than the other two Chinese studies, and vegetable intakes are significantly higher than the urban elderly in Side's study.

Study subjects had higher legume intakes than those in the Chinese National Survey. But bean product consumption of the study subjects was much lower than that of Side's elderly study. Elderly people in China like to eat bean products (Side et al., 1991). However, whether or not their consumption of bean products has changed is not known. Although the price of bean products in New Zealand was much higher than that in China, Chinese elderly in New Zealand still like to eat bean products. Similar results are found in other immigration studies. After adjustment for age, ethnicity and geographical area, intake of tofu was more than twice as high among Asian-American women born in Asia (62 times per year) compared to those born in the United States (30 times per year). Among migrants, intake of tofu decreased with years of residence in the United States (Wu et al., 1996). Different rates of soy consumption may lead to differing prevalence of some diseases. For example, breast cancer rates among Asian Americans are lower than those of the United States whites, but considerably higher than rates prevailing in Asia. It is suspected that migration to the United States brings about a change in endocrine function among Asian women, although reasons for this change remain obscure. More recently, soy consumption has also been shown to be antihypertensive (Teede et al., 2000).

In this study, dairy product intake significantly increased after immigration. The mean intake was four-five fold higher than that in the Chinese survey. Increased intakes of dairy products in migrant Chinese were also found in several other studies (Wang et al., 1994; Hsu-Hage et al., 1995; Woo et al, 1999c; Soh et al, 2000). The availability and cheap price of dairy products may contribute to their consumption.

Salt intake in China varied geographically, ranging from 13-17 g/day per person in the north to 11-15 g/day in the south (Chen, 1997). Salt intake by Chinese is very high by Western standards. Salt intakes among the study subjects were much lower than Side's study and other studies. However, study subjects may consume more processed food and fast food than the groups in China. The quantities of salt in processed food and fast food has not been calculated separately.

## 5.7 RELATIONSHIPS BETWEEN NUTRIENT INTAKE, BODY MEASUREMENTS AND OTHER FACTORS

### *5.7.1 Relationships between BMI and blood pressure, blood glucose level*

Table 5.22 presents the correlation coefficients between BMI, blood pressure and blood glucose level

**Table 5.22: Correlation between BMI, blood pressure and blood glucose level**

| | | Male | Female |
|---|---|---|---|
| | | R (n=25) | R (n=25) |
| BMI | Blood pressure (Systolic) | 0.51* | 0.31 |
| | Blood pressure (Diastolic) | 0.39* | 0.39* |
| | Blood glucose level | 0.60* | 0.14 |

* Significant correlation $p<0.05$

The systolic, diastolic blood pressure and blood glucose level for males and females were positively correlated with BMI. However, only diastolic blood pressure for males and females, systolic blood pressure and blood glucose level for males were significant. ($p<0.05$) This result was consistent with the studies of Pi-Sunyer in 1993 and Ko et al. in 1997, which suggested that body mass index was positively and independently associated with hypertension and type II diabetes mellitus (Pi-Sunyer, 1993; Ko et al., 1997). A study of 243 Chinese aged 55yr and over in Malaysia found that obesity was significantly associated with hypertension among the elderly aged 55-64 years (Teo & Idris et al., 1996). Obesity is a risk factor of diabetes (Ministry of Health, 1997). In this study, blood glucose level for men was significantly positively correlated with BMI.

### *5.7.2 Relationships between blood pressure and body measurements*

Correlation coefficients between systolic blood pressure and several anthropometric indices for study subjects are shown in Table 5.23.

**Table 5.23: Correlation coefficients between systolic blood pressure and several anthropometric indices**

| | | Men | Women |
|---|---|---|---|
| | | n=25 | n=25 |
| Blood pressure (Systolic) | Body-weight | 0.49* | 0.28 |
| | Waist circumference | 0.36* | 0.28 |
| | Hip circumference | 0.43* | 0.11 |
| | Waist to hip ratio | 0.19 | 0.33 |
| | Total body fat | 0.51* | 0.23 |
| | BMI | 0.51* | 0.31 |

*Significant correlation $p<0.05$

Body weight, waist circumference, hip circumference, waist to hip ratio and BMI for men are positively correlated with systolic blood pressure. ($p<0.05$) However, no significant correlation was observed for women subjects. The evidence to date from epidemiological studies suggests that this is likely as alcohol consumption (Nakanishi et al., 1998), smoking (Ueshima et al., 1987), high body mass indices (BMI)(Ko et al., 1997) and abdominal fat (waist-to-hip ratios) (Iso et al., 1991) have all been shown to positively predict the prevalence of hypertension.

A study on the relationship between blood pressure and body fat distribution among elderly Chinese found that blood pressure, especially systolic blood pressure was significantly positively correlated with weight, both waist and hip circumferences and body mass index (Ming et al., 1994). Jones has already stressed the importance of obesity as a risk factor for hypertension in Asian populations, even in very lean populations (Jones, 1995). Although Side et al. and Ming et al. showed that waist/hip ratio was more predictive of high blood pressure than body-weight (Side et al., 1991; Ming et al., 1994). This study has shown the opposite results.

### *5.7.3 Relationships between food intake, length of stay, education and family income*

The correlation coefficients between food intake and length of stay, education, and family income are shown in table 5.24

**Table 5.24: Relationships of food intake by length of stay, education and family income**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| **Food** | **Stay[1]** | **Education[2]** | **Family income[3]** | **Stay** | **Education** | **Family income** |
| Rice products | -0.10 | 0.38* | -0.10 | -0.12 | 0.39* | 0.11 |
| Wheat products | -0.03 | 0.12 | -0.30 | -0.04 | 0.15 | 0.10 |
| Legume products | 0.08 | -0.07 | -0.09 | 0.05 | 0.04 | -0.07 |
| Meat products | 0.05 | -0.39* | 0.41* | 0.13 | -0.42* | 0.43* |
| Vegetables | -0.13 | 0.001 | -0.24 | -0.12 | 0.008 | -0.12 |
| Salted vegetables | -0.17 | -0.40* | -0.20 | 0.11 | -0.35* | -0.25 |
| Fruits | 0.06 | -0.02 | -0.15 | 0.03 | 0.04 | -0.25 |
| Cooking oil | 0.08 | -0.20 | -0.05 | 0.09 | -0.34* | -0.21 |
| Dairy products | 0.14 | -0.05 | 0.11 | 0.16 | -0.07 | 0.22 |
| Salt | 0.13 | -0.35* | -0.14 | 0.18 | -0.46* | -0.16 |

[1] Calculated by months

[2] 1=Never attend school; 2=Primary School graduation; 3=Intermediate school graduation; 4=High school graduation; 5=Tertiary education

[3] 1=<15,000; 2=$15000<Income<$30000; 3=$30000<Income<$45000; 4=$45000<Income<$60000; 5= Income>$60000

*p<0.05

In this study, education level was significantly positively related to rice consumption and significantly negatively related to the meat intake, salted vegetable intake and salt intake for both men and women. ($p<0.05$) People with higher education were more concerned about their health and had more knowledge about healthy eating. Thus, it was

not surprising that they chose more healthy foods, eating more carbohydrate and less meat and salt. Family income was significantly positively related to meat consumption for both men and women. ($p<0.05$) People with higher family incomes can afford to consume more high quality meat products.

Education level and socioeconomic status have been shown to play a significant role in the food consumption patterns of population groups (Hus-Hage et al, 1995; Ge et al., 1996). The Chinese National Nutrition Survey (Ge et al., 1996) has already shown that dietary intake and nutritional status of Chinese adults differed with different socioeconomic level. The intake of animal protein and animal fat increased with the improvement in economic status.

### *5.7.4 Relationships between nutrient intakes by length of stay, education and family income*

A series of correlation analyses were undertaken to assess the relationship between nutrient intakes and socioeconomic factors. Several socioeconomic factors, such as income level, education level, length of stay were selected to examine the associations with fat, saturated fatty acid, monounsaturated fatty acid, cholesterol, sugar, fiber, vitamin A, vitamin C, calcium, iron and sodium intake. Table 5.25 shows the relationships between these parameters.

Education level was significantly positively related to fibre intake for male study subjects. ($p<0.05$) Education level was also significantly positively related to vitamin A intakes for both male and female study subjects. ($p<0.05$) A study of 352 elderly (65-95 years old) in Spain also found that women with low education level consumed less vitamin A (Lasheras et al., 2001). Education was found to be significantly negatively related to sodium intakes. ($p<0.05$) A Chinese population study in Mainland China also found that as education level increased, intakes of sodium decreased (Tian et al., 1996). Therefore, it was concluded that educational attainment and socioeconomic status play a significant role in the food consumption patterns of population groups.

High education and income of Chinese-American women has been found to correlate with an increase in fat intake (Schultz et al., 1994). These finding differ from what is typically seen in studies in Western populations, in which high education and income

correlate with a decrease in fat intake (Neuheuser et al., 1999; Erkkila et al., 1999). However, no relationship between fat intake and education and income was found in this study.

Data from 1,373 women and 193 men aged 60 and over from the U.S. Department of Agriculture's (USDA) 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) found that vitamin C, E and $B_6$, niacin, calcium, phosphorus and magnesium intakes of elderly individuals significantly positively related to formal education (Weimer, 1998). However, no such significant relationship was found in this study.

**Table 5.25: Relationships of nutrient intakes by length of stay, education and family income**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | **Stay[1]** | **Education[2]** | **Family income[3]** | **Stay** | **Education** | **Family income** |
| Fat | 0.14 | -0.14 | 0.11 | 0.12 | 0.02 | 0.09 |
| Sat. fatty acid | -0.11 | 0.03 | -0.12 | -0.04 | 0.01 | -0.10 |
| Mono. fatty acid | 0.04 | -0.24 | -0.12 | 0.05 | 0.02 | -0.17 |
| Cholesterol | 0.14 | -0.17 | 0.04 | 0.11 | -0.22 | 0.11 |
| Sugar | -0.32 | 0.26 | 0.17 | -0.18 | 0.28 | -0.02 |
| Fibre | -0.12 | 0.44* | 0.03 | 0.11 | 0.22 | 0.12 |
| Vitamin C | -0.04 | 0.20 | 0.13 | -0.03 | 0.14 | 0.15 |
| Vitamin A | -0.08 | 0.49* | 0.25 | -0.09 | 0.35* | 0.21 |
| Calcium | -0.15 | 0.32 | 0.09 | -0.16 | 0.21 | 0.02 |
| Iron | -0.24 | 0.29 | -0.22 | -0.11 | 0.11 | -0.31 |
| Sodium | -0.18 | -0.27 | 0.15 | -0.18 | -0.35* | -0.16 |

[1] Calculated by months

[2] 1=Never attend school; 2=Primary School graduation; 3=Intermediate school graduation; 4=High school graduation; 5=Tertiary education

[3] 1=<15,000; 2=$15000<Income<$30000; 3=$30000<Income<$45000; 4=$45000<Income<$60000; 5= Income>$60000

*p<0.05

### *5.7.5 Others*

- No significant associations were found between mid-upper-arm muscle circumference, mid-upper-arm muscle area and age.
- No significant associations were found between muscle mass and energy intake.

## 5.8 LIMITATION OF THE STUDY

- The major limitations of this study were the convenience samples and the smallness of the cohorts. Thus, caution should be used in extending the results to the population of elderly Chinese in New Zealand. Further, the recruitment of subjects was based on volunteering. It is possible that our cohort in New Zealand was highly selected on a basis which reflected higher socioeconomic background, and that the body measurements, nutrients intakes and food patterns were less variable than they would have been if the sample had been randomly selected.
- Another limitation of this study was the validity of the physical activity assessment methodologies used. Only leisure time physical activity questions were asked.
- The three-day dietary survey was carried out during the spring to summer period. Since the availability of many foods varies by season, it is recognized that these results may not be generalized to other seasons. In general, seasonal effects will probably be greater for food patterns rather than nutrient intakes (Gibson, 1990).
- Both a Chinese food composition table and a United Kingdom food composition database were used for calculation of the nutrient content of the Chinese foods not available in the New Zealand food composition database. The literature clearly indicates that nutrient contents in plants are influenced by many factors including the elements in the soil, soil pH, soil temperature, moisture levels and so on (Javis et al, 1976; Chaney & Hornick, 1977). Therefore, it is quite conceivable that the nutrient contents of vegetables, for example, will vary with the contents of the soil where they are grown for harvest. Thus, the nutrient value in the Chinese food composition table and the United Kingdom food composition database may not accurately reflect the true nutrient contents of the food bought by the Chinese elderly in New Zealand.
- Nutrient values for cooked food are not available in the Chinese Food Composition Table. All materials must be used as raw foods. However, it is well known that the nutrient content of food differs before and after a food being cooking, especially the soluble vitamin content of vegetables, which diminishes

after being cooked. Therefore, some nutrient intakes, such as soluble vitamins, may be overestimated in this study.

- This study only included Chinese elderly subjects. The data was compared to the Chinese National Survey, the NZ National Survey, and other studies. However, these surveys had a different sample frame and were conducted at different times and included different number of subjects. There was also some age range differences in these surveys. This means the conclusions from the study comparatives must be treated with caution.

# CHAPTER 6. CONCLUSION

The elderly study subjects were generally highly educated. Most of them lived with their children and grandchildren. Because of the language barrier, their rate of health service use, such as visiting a GP, was low.

Compared to the New Zealand elderly, they had a slightly better cardiovascular risk factor profile: lower mean BMI and Waist/Hip ratio, lower prevalence of obesity, lower blood pressure, lower blood glucose level and they smoked and drank less. Male subjects were more active than their New Zealand counterparts, however, females were less active. Compared to Mainland Chinese elderly living in urban China, the study subjects had higher BMI levels, a lower prevalence of underweight and a higher prevalence of overweight.

Study subjects had lower fat and higher carbohydrate intakes than their New Zealand counterparts. They also had better fatty acid intake profiles. Study subjects had lower fat sodium, zinc and vitamin E intakes, but higher calcium and vitamin C intakes than their Chinese counterparts; while calcium and vitamin A intakes of study subjects were much lower than their New Zealand counterparts. Inadequate intakes of calcium, zinc, vitamin A, vitamin D, selenium and fiber were the main nutritional problems in this group. Iron nutritional status in this population needs further study.

Consumption of dairy products, vegetables, fruit and poultry products in this study were higher than those in the Chinese National Survey, whereas, study subjects consumed less wheat/ flour and pork.

Further research is needed to address the following issues raised by the study:

1. Increased prevalence of chronic disease is one of the major factors affecting nutritional status in the elderly. The prevalence of some chronic diseases in these migrant Chinese elderly need further study.

2. This study highlights the difference in body fat distribution and composition between different ethnic groups. Thus, there is a need to develop consensus on

obesity indicators, such as the cut-off points for overweight and obesity based on BMI and waist/hip ratio cut-off value, that are appropriate for different races. On the other hand, the study also highlights the difference in these body measurements between the elderly and the young. The cut-off points suitable for Asian elderly also need to be developed.

3. Mainland Chinese had a relatively high incidence of iron deficiency anemia in the Chinese National Nutrition Survey. As dietary iron intakes of the study subjects were much less than those in the Chinese elderly survey and blood tests were not conducted in this study; iron status in this population needs further study.

4. It is necessary to monitor the relationship between changing dietary patterns, physical activity and the changing prevalence of chronic disease, such as coronary heart disease, hypertension, and diabetes in the immigrant Chinese elderly population in New Zealand.

5. Prevalence of some chronic disease, such as cardiovascular disease, hypertension, diabetes, increase with age. The age range in this study was narrow and does not represent all age groups in this elderly population. Health status with increasing age among the Chinese elderly population after immigration needs further study.

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# APPENDIX 1. HUMAN ETHICS APPLICATIONS

*Revised 3 July 2001)* **AKL/PN/WGTN Protocol**

**MASSEY UNIVERSITY HUMAN ETHICS COMMITTEE**

o: Secretary
Human Ethics Committee
Principal's Office
Albany, Auckland

OR Secretary
Human Ethics Committee
Old Main Building
Turitea, Palmerston North

OR Secretary
Human Ethics Committee
Block 5
Wellington

**Please send/deliver this original (1) application plus eleven (11) copies**

**APPLICATION FOR APPROVAL OF PROPOSED TEACHING/RESEARCH PROCEDURES INVOLVING HUMAN SUBJECTS**

**PPLICANT(S):**

**Name:** Patsy Watson for Wei Xei

**Department:** Institute of Food Nutrition and Human Health, Albany Campus

**Contact Email/Number:**p.watson@massey.ac.nz

**Status:** Programme Leader in Human Nutrition
*(e.g. lecturer, PhD/masterate student)*

**Name of Employer:** Massey University

**ROJECT:**

**Title:** Health status and dietary intakes of elderly Mainland Chinese in Auckland.

**Status:** Masterate
*(e.g. staff research, doctorate/masterate)*

**Funding Source:** Not applicable

**Clinical Trial Status:** yes ❑ no ❑***

**.TTACHMENTS:**
*:.g. Information Sheet(s), Consent Form(s), Questionnaire, etc)*

Information sheets, Consent forms, Data collection sheets,
Questionnaires, Feedback forms.

**UPERVISOR(S):**

**Name:** Patsy Watson, Kai Hong Tan

**Department:** Institute of Food Nutrition and Human Health, Albany Campus

**IGNATURE(S):**

**Applicant(s):** .....

**Supervisor(s):** P E Watson .....
*(required for all projects involving student research, implies satisfaction with application)*

**)ATE:** **12 June ,2002**

**)FFICE USE ONLY**

**Received:** **Decision:**

# Appendix 1

## HUMAN ETHICS APPLICATION

## 1. DESCRIPTION

### *1.1. Justification*

Men and woman over 60 often develop diet related degenerative diseases. The population of elderly Chinese immigrants in Auckland has increased dramatically in recent times. Food choices available to New Zealand Chinese are very different to food choices available to Chinese living in Mainland China. We hypothesise that the changes in food choice may influence the dietary patterns of elderly Chinese immigrants in New Zealand. Similarly activity patterns and lifestyle are often different. These dietary, lifestyle and activity changes may be reflected in a change in the body measurements, body fat levels, blood glucose levels and health of these elderly immigrants. If this hypothesis is confirmed the results of the study will be used to produce health messages to help immigrant Chinese elderly avoid dietary and lifestyle changes that may accelerate ageing and the incidence of some degenerative diseases.

### *1.2. Objectives*

- To assess dietary intake, activity levels, body composition, blood pressure, body fat distribution and blood glucose level in a sample of migrant Mainland Chinese men and women over 60 years that live in Auckland.
- To compare the data from this group with that from similar studies in New Zealand and China, and determine if there are any differences with respect to their overall nutritional status and health.
- To identify any nutritional patterns that may have a negative impact on the health of elderly migrant Chinese, and suggest dietary changes that may ameliorate these
- To identify any lifestyle and activity patterns that may have a negative impact on the health of elderly migrant Chinese, and suggest changes that may improve these.

### *1.3. Procedures for Recruiting Participants and Obtaining Informed Consent*

The study will be advertised in the Auckland Chinese Language newspapers, and through Auckland Chinese networks. Volunteer information sheets in English and Chinese (See pp.1-6) will also be available from the Auckland Chinese Community Centre, Chinese supermarkets, Chinese churches and from Chinese Medical Centres. People who are interested in volunteering will contact the researcher by phone, or return the "expression of interest" slips by post. The researcher will then send these people the detailed outline of the study (See pp. 4-10 for the English and Chinese version), and the consent form (See pp. 4-10 for the English and Chinese version), along with a stamped addressed envelope to return the "wish to volunteer" and "consent forms". People who wish to volunteer can either contact the researcher by

phone, or send back the "wish to volunteer" and "consent forms". People who contact the researcher by phone to volunteer, will have their signed consent forms collected by the researcher on her first visit. A non-random convenience sample of 25 men and 25 women who are over 60 years old will be recruited.

### *1.4. Procedures in which Research Participants will be involved*

There will be three visits to each subject. The procedures carried out in each visit are outlined below.

**Visit One (Around one hour required)**

- A general questionnaire to determine food and activity patterns will be administered. (See pp. for the English and Chinese version)
- A standard dietary recall of all food consumed in the last 24 hours will be recorded. (See pp. )

**Visit Two (Around one hour required**

- A standard dietary recall of all food consumed in the last 24 hours will be recorded. (See pp. ),
- The following body measurements will be taken

  Height

  Weight

  Triceps, biceps and subscapular skinfolds (made using a special calliper to measure the thickness of a fold of skin which produces a feeling of pressure but no pain.)

  Waist circumference (made using a tape measure around the waist.)
  Hip circumference- (made using a tape measure around the hips.)

  Blood pressure

  Measurement of body fat using a Bioelectrical Impedance Monitor (BIA). This measurement will be taken using a set of electrodes placed on the hands and feet. This measurement is not felt at all by the subject, as the current used is minute. New electrodes are used for each subject. Used electrodes will be collected in a special container and disposed of in an appropriate manner.
  (See pp. for the measurement sheet),

**Visit Three (Around one hour required**

- A standard dietary recall of all food consumed in the last 24 hours will be recorded. (See pp. )
- A general questionnaire to determine demographic and medical details will be administered. (See pp. for the English and Chinese version).

- Blood glucose will be measured by the standard finger pinprick method, test stix, and glucose monitor, used daily by many diabetics to monitor their blood glucose levels. The equipment used is recommended by Diabetes NZ. The subject will hold their hand under warm water for half a minute to increase blood flow, the chosen finger will be swabbed with alcohol, and a new sterile lancet will be used to prick the finger. (These devices control the depth of the prick, and the prick sensation is very slight). A test stix is used to collect a drop of blood, which is inserted in a Medisense Precision QID Monitor to obtain a blood glucose reading. A new finger prick device and test stick will be used for each subject and the used prick device and test sticks stored in a secure sharps container and disposed of in the appropriate way. (See pp. for the measurement sheet),

### *1.5. Procedures for handling information and material produced in the course of the research including raw data and final research reports*

The information will be collected, as hard copy. No audio or video records will be used.

All volunteers will be given a code number. A separate master file will be kept linking subject name and address to code number. This master file will be kept under lock and key and stored in a separate location to the data. Only the supervisor and researcher will have access to this list.

Data collection forms will be identified by code number only. When organising interviews the researcher will place removable name and address labels on each subject's data collection forms. These labels will be removed and destroyed once the interview is complete or the data collected. All data entered in the computer will be identified by code number only. Electronic data will be stored on the researcher's hard drive or personal H: drive on the network and will be accessible by password only, by the researcher or her supervisor. The password will be changed regularly to maintain security. All completed data collection forms will be stored in locked filing cabinets in the nutrition research rooms, which is locked and alarmed when no researcher is present.

No subject will be identified either by name or code number in the final research report, or in any conference presentations or scientific papers that may result form this work.

Each subject will receive a brief outline of findings of the study and individual health assessment if he required when complete

### *1.6. Procedures for sharing information with Research Participants*

At the completion of the study each subject will receive a summary of their personal results and all body measurements. (See pp. for Chinese and English versions.) A summary of results will also be published in the Chinese language newspapers.

### *1.7 Arrangements for storage and security, return, disposal or destruction of data*

The hard copy of all data will be kept in a locked data storage room, in a building fitted with a burglar alarm. Only authorized personnel have access to this room. The file connecting the subjects' name, address, and phone number will be kept in a separate file in a separate room and kept under lock and key by Patsy Watson, Programme Leader in Human Nutrition. The subject's identity will not be revealed in any results, thesis or research papers that result from this work. Original data will be destroyed after 10 years.

## 2. ETHICAL CONCERNS

### *2.1. Access to Participants*

The study will be publicised through the networks mentioned in 1.3. Initial contact will be made by the potential volunteer requesting further information from the researcher. On the basis of this information the potential volunteer will choose to enrol in the study or not. People who wish to volunteer can either contact the researcher by phone, or send back the "wish to volunteer" and "consent forms" (See pp. for the English and Chinese versions). People who contact the researcher by phone to volunteer, will have their signed consent forms collected by the researcher on her first visit. The researcher will then arrange a suitable time and place for the first visit. This visit will be at a location chosen by the volunteer e.g. home, workplace etc. Appointments will be made for the other two interviews, at time convenient to the subject.

### *2.2. Informed Consent*

All volunteers will be sent the information sheet describing the purpose of the study and what will be required of them. This form will be written in both English and Chinese. (See pp.) It explains the rights of the volunteers, including the right to decline to take part in all or any part of the study at any time. Assurance of confidentiality is clearly stated. Volunteers will have the opportunity to ask questions of the researcher or the supervisor at any time before they sign the consent form.

The consent form will be signed by the volunteer in the presence of a witness (other than the researcher), who will also sign the form. The consent form includes the name of the researcher and her supervisor. (See pp. for the English and Chinese version))

### *2.3. Anonymity and Confidentiality*

The measures taken in 1.5 and 1.7 will be used to ensure the anonymity and confidentiality of the volunteers.

### 2.4. Potential Harm to Participants

There is no possible harm to the volunteers for this study. The only time pain might be felt is momentarily when the finger is pricked for the blood test. When the blood pressures and skinfolds are taken, a little pressure will be felt. All participants have the right to decline to take part in any aspect of the study they feel uneasy with.

### 2.5. Potential Harm to Researcher(s)

The study methodology involves no harm to the researcher. In case of emergency the researcher will carry a mobile phone when she visits the subjects. If she feels threatened she will leave the premises immediately.

### 2.6. Potential Harm to the University

This study can bring no potential harm to the University. The strict anonymity, confidentiality and professional attitude during collection and handling of data should avoid any potential embarrassment to the University.

### 2.7. Participant's Right to Decline to Take Part

The information sheet and consent form clearly state that the volunteer can decline to take part in the study, can decline to take part in any section of the study e.g. body measurements, can decline to answer any question, or can withdraw from the study, at any time. This message will be repeated verbally during phone calls and home visits.

### 2.8. Uses of the Information

The information obtained from the study will be analysed and written up as a research report (thesis), presented as a conference paper, and if suitable written up as a paper for publication in a scientific journal. Each volunteer will receive a brief outline of his/her individual results and a summary of the results as a whole. The summary of results will also be sent to the Chinese language newspapers for dissemination to the Auckland Chinese Community.

### 2.9. Conflict of Interest/ Conflict of Roles

There is no conflict of interest for either the researcher or the supervisor involved in this study.

### *2.10. Other Ethical Concerns*

If during the study, the researcher encounters a serious social or family problem, after listening attentively she will suggest the volunteer contact the most appropriate of the following organisations: the Chinese Life Hot Line or the Women's Refuge. If she finds a volunteer has a serious financial problem she will refer them to Work and Income Support Services, and if she finds a health problem she will suggest the volunteers consult their General Practitioner.

## 3. LEGAL CONCERNS

### *3.1. Legislation*

**3.1.1 Intellectual Property legislation e.g. Copyright Act 1994**
Any scientific material will be appropriately referenced. The data collected will belong to Massey University.

**3.1.2 Human Rights Act 1993**
The questions and procedures involved in the study are carefully designed to contain no verbal or physical abuse, and contain no insulting or derogatory remarks directed at any section of the community.

**3.1.3. Privacy Act 1993**
The information required will be collected directly from the volunteer, and recorded as hard copy. No video or audio records will be used. Measures to ensure confidentiality for volunteers are detailed in Sections 1.5 and 1.7. These confidentiality measures will also cover those who choose to withdraw from the study at any stage.

The information collected will only be used for the purposes outlined in the information sheet. Publications will contain none of the participant's names or any information that may identify them. Massey University is clearly identified as the body responsible for this study.

**3.1.4. Health and Safety in Employment Act 1992**
No potential health hazards are foreseen.

**3.1.5. Accident Rehabilitation Compensation Insurance Act 1992**
The researcher will be covered by ACC in her car.

**3.1.6. Employment Contracts Act 1991**
Not applicable

### *3.2. Other legal issues*

Not applicable

## 4. CULTURAL CONCERNS

This research is being carried out on Mainland Chinese immigrant women, by a researcher who is herself from Mainland China, and has qualifications from a Chinese University. All study information, consent forms and questionnaires and record booklets have been translated into Chinese.

## 5. OTHER ETHICAL BODIES RELEVANT TO THIS RESEARCH

### 5.1. Ethics Committees

None

### 5.2. Professional Codes

Not applicable

## 6. OTHER RELEVANT ISSUES

None that we perceive at this time

# APPENDIX 2. HUMAN ETHICS APPROVAL

**Massey University**

**Office of the Principal**
Massey University
Albany Campus
Private Bag 102 904,
North Shore MSC,
Auckland, New Zealand
Principal: 64 9 443 9700 ext 9517
Regional Registrar: 64 9 443 9700 ext 9516
Facsimile: 64 9 414 0814

6 August 2002

Wei Xei
C/o Patsy Watson
Institute of Food Nutrition and Human Health
Massey University
Albany

**Dear** Wei Xei

**HUMAN ETHICS APPROVAL APPLICATION – MUAHEC 01/055**
**"Health Status and Dietary Intakes of Elderly Mainland Chinese in Auckland"**

Thank you for your application. It has been fully considered, and approved by the Massey University, Albany Campus, Human Ethics Committee.

If you make any significant departure from the Application as approved then you should return this project to the Human Ethics Committee, Albany Campus, for further consideration and approval.

Yours sincerely

Associate-Professor Kerry Chamberlain
**Chairperson,**
**Human Ethics Committee**
**Albany Campus**

CC Patsy Watson
Institute of Food Nutrition and Human Health,
Massey University, Albany

# APPENDIX 3. CONCISE OUTLINE OF THE STUDY OF VOLUNTEER REQUIRED (IN ENGLISH)

**Massey University**
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

## Volunteers Required for Study

*Volunteers Required for Study*
*On*
**Health Status and Dietary Intakes of Elderly Mainland Chinese in Auckland**

We are looking for **volunteers** to assist us in a study on nutritional status and dietary intake of **elderly Mainland Chinese in Auckland**. Our study will cover men and women **over 60**.

# Appendix 3

Men and women over 60 are often need extra medical attention. Environmental and cultural factors are known to have an important effect on dietary behaviour and health. The changed environment that elderly migrant Chinese experience in New Zealand may influence their dietary intakes, causing a nutritional imbalance. This study will evaluate the nutritional status, dietary intake and health of elderly Chinese. The results of this study will be converted into simple health education messages to improve the health and well being of elderly Chinese immigrants in New Zealand.

In this study, we are going to

- Record three days (two weekdays and one weekend) of food intakes by a 24-hour recall;
- Measure your height, weight, skin folds, circumference of upperarm, waist and hip and blood pressure;
- Test your blood glucose level.

All volunteers taking part will receive

- A brief analysis of their nutrient intakes and body measurements
- Their blood pressure and blood glucose level results

***This study has been approved by the Massey University committee on Human Ethics.***

If you would like to have more information and/or take part in this study, please fill in the attached form and return it to


Wei Xie c/o Patsy Watson
Massey University
Institute for Food, Nutrition and Human Health
Albany Campus
Private Bag 102-904
North Shore MSC
North Shore City


Or phone


Wei Xie (09) 021-1650280
KaiHong Tan (09) 4439700-9649
Patsy Watson (09) 4439755
Email: xieweiei@yahoo.com


***Please note: People with some diseases that will affect dietary intake and physical activities may not be suitable for our study. (Please contact us for more details)***

**Yes, I am interested in being part of the nutrition survey. Send me more information.**

**(Please fill the form below, then fold this piece of paper towards its back, first along line A, then along Line B to make a self addressed envelope)**

---

B_____

Wei Xie c/o Patsy Watson
Institute for food, Nutrition and Human Health
Massey University
Albany Campus

Private Bag 102-904
North Shore MSC
North Shore City

A_____

**Name:** _____

**Phone:** _____

**Address:** _____

_____

_____

# APPENDIX 4. CONCISE OUTLINE OF THE STUDY OF VOLUNTEER REQUIRED (IN CHINESE)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

## Volunteers Required for Study

## 我们征集志愿者参加

## 奥克兰的中国大陆老年人的健康状态和膳食摄入的研究

我们需要一些年龄在 60 岁以上的男性和女性自愿者协助我们进行居住奥克兰的中国大陆老年人的健康状态和膳食摄入的研究。

我们知道不管男性还是女性，到了 60 岁以上就可能需要更多的医疗上的协助。环境和文化是影响进食行为的重要因素，中国老年移民在移居纽西兰后，有可能因为环境的变化而使膳食摄入发生改变，从而导致营养失去平衡。为了研究居住奥克兰的中国大陆老年人的健康状态和膳食摄入，以及评价是否存在任何营养不平衡的因素，我们将对这个人群进行一次调查。调查的结果将作为健康宣传资料，以使移居纽西兰的中国大陆老年人更健康和幸福。

在这个研究中，我们将

- 通过 24 小时回顾法来记录您 3 天进食的食物。
- 我们还将测量身高，体重，皮褶厚度，腰围，臀围，血压,和身体脂肪的比例。
- 检验您血糖

所有参加的自愿者将会收到

- 一份关于他们自己的膳食模式和体格测量的分析报告
- 他们的血压和血糖值

此研究已经得到梅西大学人伦委员会确认。

如果您想得到更详尽的资料， 并希望参加该研究的话，请填好下表并寄回以下等地址

Wei Xie c/o Patsy Waston
Massey University
Institute for food, Nutrition and Human Health
Albany Campus
Private Bag 102-904
North Shore MSC
North Shore City

或致电
Wei Xie (09) 021-1650280
KaiHong Tan (09) 4439799-9649
Patsy Watson (09) 4439755

备注：如患有可能影响膳食摄入和活动的疾病，你可能不符合参加我们的研究的要求，具体请联络我们.

阅后回条

*我对此研究感兴趣，并希望参加该研究，请寄给我有关资料*

**(请填好以下的表格，沿 A，B 线折好以下的有地址的信封，寄回给我们)**

**B**

Wei Xie c/o Patsy Watson
Institute for food, Nutrition and Human Health
Massey University
Albany Campus

Private Bag 102-904
North Shore MSC
North Shore City

**A**

**Name:** _____

**Phone:** _____

**Address:** _____

_____

_____

# APPENDIX 5. CONSENT FORM (IN ENGLISH)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

## Health Status and Dietary Intakes Elderly Mainland Chinese in Auckland

## *Consent Form (In English)*

**This study has been approved by the Massey University Human Ethics Committee.**

If you would like to take part in this study, please complete this consent form and post it back to me or my supervisor, Patsy Watson.

Wei Xie
PO Box 45-164
Te Atatu North
Auckland
Phone: (09) 8389198
Fax: (09) 8389197
Email: xieweiei@yahoo.com

Patsy Watson (Supervisor)
Massey University
Institute for Food, Nutrition and Human Health
Albany Campus
Private Bag 102 904,
North Shore Mail Centre,
Auckland
Phone: (09) 443 9627
Facsimile: (09) 443 9640
E-mail: P.Watson@massey.ac.nz

# *Consent Form (In English)*

I, _____
(Full name, please print)

- I have heard and understood an explanation of the study I have been invited to take part in.
- I have been given, and I have read, a written explanation of what is asked of me.
- I have had the opportunity to ask questions and to have them answered, and I understand that I may ask any further question at any time.
- I understand I have the right to withdraw from the study at any time and have the right to decline to answer any particular questions.
- I agree to provide information to the researcher on the understanding that my name will not be used.
- I understand that my consent to take part does not alter my legal rights.
- I agree to take part as a subject in this study, under the conditions set out in the information sheet.

I consent to take part as a subject in this research, under the conditions set out in the Information Sheet.

Signed:

| _____ | _____ | _____ |
|---|---|---|
| *Subject (please print)* | *Signature* | *Date* |

*Thank you very much for your help!!*

# APPENDIX 6. CONSENT FORM (IN CHINESE)

## Consent Form (In Chinese)

# 奥克兰的中国大陆老年人的健康状况和膳食摄入的研究

## 自愿参加者意向书

此研究已经得到梅西大学人权委员会和北岸人权委员会的确认

如果您对此研究感兴趣，并希望参加该研究的话， 请填好意向书，并寄回以下等地址：

Wei Xie
PO Box 45-164
Te Atatu North
Auckland
Phone: (09) 8389198
Fax: (09) 8389197
Email: xieweiei@yahoo.com

Patsy Watson (Supervisor)
Massey University
Institute for Food, Nutrition and Human Health
Albany Campus
Private Bag 102 904,
North Shore Mail Centre,
Auckland
Phone: (09) 443 9627
Facsimile: (09) 443 9640
E-mail: P.Watson@massey.ac.nz

**谢谢您的参与和支持！**

# 意向书

**我，姓名** _____

- 已经明白对该研究课题的解释
- 我已经收到并阅读了有关需要我配合的资料
- 我有机会提出问题并已得到解答
- 我明白我有权利拒绝回答任何特殊问题
- 我明白我可以在资料收集完成，即验血完成前任何时间退出该研究
- 在未经我同意不能使用我的名字的前提下，我会给研究者提供我个人的资料
- 我明白我同意参加该研究并不改变我的法律权利

*我同意作为研究对象参加该研究，条件与前面关于该课题的解释相同*

**签名：** _____

**日期：** _____

# APPENDIX 7. PARTICIPANT INFORMATION SHEET (IN ENGLISH)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

## Health Status and Dietary Intakes of Elderly Mainland Chinese In Auckland

## *Participant Information Sheet*

*If you are over 60,*

- *You want to find out about potential risks to your health*
- *You want to know how to improve your diet*

***Volunteers Are Wanted** For A Study of*

*"Health Status and Dietary Intakes of Elderly Mainland Chinese In Auckland"*

***You Are Very Welcome to Join!***

# Researcher Background

This study will be conducted by Wei Xie, a Master's student at Massey University. She has a bachelor's degree of medicine from Sun Yat-Sen University of Medical Science, and worked as a dietician in GuangDong Province People's Hospital in Guangzhou for 2 years before immigrating to New Zealand. She is completing her Master's degree in Nutrition Science at Massey University. Her supervisors are Patsy Watson and KaiHong Tan. Patsy Watson is Programme Leader in Human Nutrition, Institute for Food, Nutrition and Human Health at Massey University. KaiHong Tan is an assistant lecturer at Massey University. They all specialise in human nutrition.

# Outline Of The Study

The Asian population is the fastest growing population in New Zealand and ethnic Chinese are the largest Asian subgroup in New Zealand. A large number of elderly Chinese have immigrated to New Zealand in the past ten years. These elderly Chinese are at the age when they need extra medical attention. The different culture, environment and food supplies in New Zealand may affect their dietary intakes, which may accelerate the progress of aging, causing health problems.

It is the objective of this study to provide baseline data on the food consumption, body measurements and blood glucose levels of elderly immigrants from Mainland China living in Auckland. The results will be compared with similar information on elderly people living in urban areas of China and their European New Zealand counterparts. Blood glucose levels and body measurements of these elderly Chinese will also be used to provide an individual report on their health status. The results of this study will be converted into simple health education messages to improve the health and well being of elderly Chinese in New Zealand.

# Human Ethics Approval

This project has been reviewed and approved by the Massey University Regional Human Ethics Committee, Albany Campus, Protocol MUAHEC 02/045. If you have any concerns about the conduct of this research, please contact Associate-Professor Kerry Chamberlain, Chair, Massey University Regional Human Ethics Committee, Albany, telephone 09 443 9799, email K.Chamberlain@massey.ac.nz <mailto:K.Chamberlain@massey.ac.nz>

# What Will You Need If You Want To Take Part In This Study?

You will need a home telephone or mobile number, which we can use to contact you.

# What Will You Be Asked To Do If You Volunteer?

- ***You will be visited three times.***

➢ ***First Visit (for around one hour)***

- A general questionnaire to determine food and activity patterns will be administered by the researcher. All the information asked is necessary and will be kept confidential

- The researcher will carry out a 24-hour recall interview on your dietary intake

➢ ***Second Visit (for around one hour)***

- A standard dietary recall of all food consumed in the last 24 hours will be recorded.

- The following body measurements will be taken

1. Height
2. Weight
3. Skinfolds
   - Triceps—Back of upper arm
   - Subscapular— Below the bottom tip of scapular
     a. -The researcher will use special calipers to measure the width of a fold of skin.
     b. -This produces a feeling of slight pressure, but no pain.

c. -The measurements will be taken on the right side of your body

4. Upper arm, waist and hip circumferences

5. Your elbow breath

6. Your blood pressure
   Blood pressure will be measured twice during the visit

7. Bioelecrical Impedance Analysis (BIA)
BIA is used to measure body fat percentage. In practice, a minute current is passed between electrodes spanning your body and the voltage drop between electrodes provides a measure of impedance, which can be used to calculate the body fat percentage. You will feel nothing and is will not harm your body.

**Note: We suggest you wear a short T-shirt and pants for the body measurement.**

➢ ***Third Visit (for around one hour)***

- A standard dietary recall of all food consumed in the last 24 hours will be recorded.

- A general questionnaire to determine demographic and medical details will be administered.

- A drop of blood will be taken from your fingertip, as a sample for testing the glucose level in your blood. You will feel a prick at your fingertip. The process will be brief, and will not be harmful for your health. This test will help to exam your blood glucose level, which helps to assess your risk of diabetes.

# What Will You Get For Participating?

Each volunteer will receive a summary of the study results as well as a brief analysis of their nutrient intakes, body composition results, blood pressure result, blood glucose result and individual health assessment.

# Rights Of The Volunteers

- Any one receiving this information sheet may decline to take part in the study.
- Any volunteer may refuse to answer any question or have any body measurement taken if they wish.
- All volunteers can withdraw from the study at any time up to completion of data collection or blood test.
- Once all data collection is completed, volunteers will not be able to withdraw their data from the study.
- All volunteers have the right to ask questions about the study at any time during the study
- All volunteers provide information on the understanding that their name will remain confidential
- All volunteers will receive a summary of findings of the study and their individual health assessment upon completion of the study

If you have any queries or concerns regarding your rights as a participant in this research, you may contact the Health Advocates Trust, Phone (09) 6389638.

# Confidentiality

The results of this study will be strictly CONFIDENTIAL. Anything a volunteer tells the researchers will be anonymous and remain confidential. Each volunteer will be identified by code number only, not by name, in the collection and analysis of all information. All data collected will be filed in a locked cabinet in a locked and alarmed room. The analysis of the information will focus on the results for the group as a whole, not the individual.

# Publication Of Results

Results of this study will be included in a thesis, presented at nutrition conference and as a scientific paper. A summary of the results will be published in Chinese language newspapers.

If you have any questions at any time please contact us:

Ph: (021) 1650280 (Wei Xie)
(09) 4439700-9649 (KaiHong Tan)
(09) 4439755 (Patsy Watson)

***If you are interested in taking part in this study (and we hope you will be), please contact the researcher by phone or email or complete the attached form and send it to:***

Wei Xie
PO Box 45-164
Te Atatu North
Auckland
Email: xieweiei@yahoo.com

Patsy Watson
Programme Leader in Human Nutrition
Massey University
Institute for food, Nutrition and Human Health
Albany Campus
Private Bag 102-904
North Shore MSC
North Shore City
Email: P.Watson@massey.ac.nz

# *Contact Details*

Yes, I am interested in taking part in this study and here are my contact details!

- Date Today: _____
- Name: _____
- Phone Number: (Day) _____

  (Night) _____
- Mobile Number: _____
- E-Mail Address: _____
- Facsimile: _____
- Home Address: _____

  _____

  _____

# APPENDIX 8. PARTICIPANT INFORMATION SHEET (IN CHINESE)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

## 奥克兰的中国大陆老年人的健康状况和膳食摄入的研究

## *Participant Information Sheet*

如果你超过 60 岁，

- 你渴望了解你身体的情况
- 你渴望得到健康生活的信息，提高生活的质量

*我们需要自愿者参加*

*“奥克兰的中国大陆老年人的健康状况和膳食摄入的研究”*

非常欢迎您的参与！！

# 参加研究的人员

此研究由正在梅西大学攻读营养硕士学位课程的谢玮具体进行。她曾在中国广州的中山医科大学取得医学学士学位，并在广东省人民医院担任营养医师 2 年。她的导师是梅西大学食物与人类健康学院的主管，营养学家—Patsy Watson。还有助教谭凯虹。

# 关于研究的概要说明

亚洲人群特别是中国人的人数近年在纽西兰增长很快。过去的十年里大批的老年移民随家人移居纽西兰。他们需要更多的关注和医疗的投入。纽西兰在饮食文化和食物提供上与中国存在很大的差别，这差别可能影响到中国移民的食物选择。这些变化可能导致老年人营养的不平衡，从而导致疾病和加快衰老。

本研究的目的在于收集有关居住在纽西兰奥克兰的中国大陆老年男性和女性的膳食模式，体格，和血脂的基本资料。研究的结果将与中国的同类人群作比较，并且会对该人群存在的任何营养不平衡因素作出评价。调查的结果将作为健康宣传资料，以使移居纽西兰的中国大陆老年人更健康和幸福。

# 人伦委员会通过

这个研究已经被梅西大学人伦委员会备案和通过，编号是 MUEHEC 02/045。如果你对这个研究有任何的问题，请联络梅西大学 Albany 人伦委员会副教授 Kerry Chamberlain, Chair， 电话是 09 443 9799, 可发电子邮件到 K.Chamberlain@massey.ac.nz 或 <mailto:K.Chamberlain@massey.ac.nz>

# 参加这个研究，你需要准备什么？

你只需要有一个家庭电话或手机，使我们可以联系到你就可以了。

# 作为自愿者，你要做些什么？

*您会接受三次访问*

➢ **第一次访问(大约一个小时)**

- 首先，访问者会和您作一个有关您的饮食和日常活动有关的问卷调查，这些资料对于本研究是必须的，所有资料都遵循保密的原则

- 其次，访问者将会跟您做一个 24 小时回顾性的膳食调查

➢ **第二次访问(大约一个小时)**

- 访问者将会跟您做一个 24 小时回顾性的膳食调查
- 访问者还会跟您做以下的身体测量

1) 身高

2) 体重

3) 皮褶厚度:我们将使用皮褶计来测量。在测量中您只会有轻微的压迫感，不会感到疼痛。
   a. 三头肌皮褶厚度：上臂后部
   b. 二头肌皮褶厚度：上臂前部
   c. 肩胛下角皮褶厚度：背部肩胛下角
   d. 腰围和臀围

4) 血压

5) 身体脂肪比例。

*备注：请穿宽松的衣物参加身体测量*

➢ **第三次访问(大约一个小时)**

- 访问者将会跟您做一个 24 小时回顾性的膳食调查
- 访问者会和您作一个有关您的综合背景和医疗情况有关的问卷调查
- 血糖的测量。使用血糖仪。需要从指尖取一滴血。你可能会感到指尖有少许的疼痛，但我们的操作会迅速，而且不会对你的身体有任何的危害

# 如果你参加，你会得到什么

你除了可以得到我们这个研究的简要的研究结果，还可以得到一份你自己膳食摄入，身体测量，血液检查的报告和分析。

# 志愿者的权利

- 任何收到这份说明的人，可以拒绝参加研究
- 志愿者可以拒绝回答某些问题和拒绝接受某些身体测量
- 在资料收集完成前的任何时间，志愿者可以在任何时候退出研究
- 当资料收集完成，志愿者不可以退出研究
- 志愿者可以在任何时间询问有关研究的问题
- 所有的志愿者都应该清楚了解他们的名字不会被出版
- 研究完成后，所有志愿者都会收到这个研究的简要的研究结果，还可以得到一份自身膳食摄入，身体测量，血液检查的报告和分析。

如果你有任何有关你参加这个研究的权利的问题，你可以联络健康推广基金，电话是 (09) 6389638。

# 保密性

研究的结果严格遵守保密的原则。所有有关志愿者的资料是匿名和保密的。收集和分析资料的时候只会出现志愿者的代码，而非姓名。所有收集到的资料将会封存于一间有防盗报警装置的房间的橱柜中。研究的重点时群体而非个体，研究的地点将不会发表的结果中注明。

# 结果的发表

研究的结果将会写成论文，发表在营养学方面的资料上，同时，亦会寄给中文报刊登载。

如有任何疑问，请电：
Ph: (021) 1650280 (谢玮)
(09) 4439700-9649 (谭凯虹)
(09) 4439755 (Patsy Watson)

# Appendix 8

如对此研究感兴趣，并希望参加该研究的话，请给我们电话或填好附上的表格，寄回以下地址：

Wei Xie
PO Box 45-164
Te Atatu North
Auckland
Email: xieweiei@yahoo.com

Patsy Watson
Programme Leader in Human Nutrition
Massey University
Institute for food, Nutrition and Human Health
Albany Campus
Private Bag 102-904
North Shore MSC
North Shore City
Email: P.Watson@massey.ac.nz

# APPENDIX. 9 FIRST VISIT INFORMATION SHEET (INCLUDING QUESTIONNAIRE ONE AND 24 HOURS DIETARY RECALL)


Institute for Food, Nutrition and Human Health
Albany Campus

## Health Status and Dietary Intakes of Elderly Mainland Chinese In Auckland

## First Visit

***Questionnaire One***

Food And Activity Pattern

***24-Hour Dietary Recall***

Code Number of Subject: _____

Sex of Subject: _____

Time of Interview: _____

Date of Interview: _____

Interviewer (Initials) _____

Venue of Interview: _____

---

Coding: ☐ ☐ ☐ ☐

Date: ☐ ☐ ☐ ☐ ☐ ☐

# Appendix 9

Where Necessary Circle The Letter Next To The Appropriate Answer

1. How many meals do you have every day?

   a. 2 meals
   b. 3 meals
   c. 4 meals
   d. More than 4 meals

1.Meals per day

1=a
2=b
3=c
4=d
88=NA
99=Don't know

2. How often do you dine out?

   a. Less than once a month
   b. 2-3 times a month
   c. Once a week
   d. 2-3 times a week
   e. Once daily
   f. Nearly very meal

2.Eat away home

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

3. How often do you eat alone?

   a. Nearly every meal
   b. Once daily
   c. 2-3 times per week
   d. Seldom, less than once a week

3.Eat alone

1=a
2=b
3=c
4=d
88=NA
99=Don't know

4. In New Zealand, who prepares your meal at home?

   a. Most of time myself
   b. Most of time my spouse
   c. Most of time my children or relatives
   d. Volunteers
   e. Friends

4.Food preparation

1=a
2=b
3=c
4=d
5=e
88=NA
99=Don't know

5. How often do you eat western style takeaways (such as KFC, fish and chips etc)?

   a. Never
   b. Less than once a month
   c. 2-3 times per month
   d. 2-3 times per week
   e. Once daily
   f. Nearly very meal

5.Western takeaways

1=a
2=b
3=c
4=d
5=e
6=f
99=Don't know

6. If you eat western style takeaway, why do you take western style takeaways? (Choose as many as you like)

   a. Convenient
   b. Cheap
   c. Delicious
   d. High nutrition value
   e. Other members in my family also like to eat these
   f. The only food I can buy near to my house

6.Reason for choose western style takeaways

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

7. Do you prefer Chinese cooking in New Zealand?

   a. Yes
   b. No

7..Chinese cooking

1=a
2=b
99=Don't know

8. If no, please specify why _____

8.Cooking preference

1=Inconvenient
2=I don't know the Chinese cooking method
3=Waste time
4=Other cooking method is more healthy
5=Other members in my family cook for me
6=I usually buy western food materials
7=The cooking utility in my house is for western cooking only
8=I just don't like Chinese cooking
88=NA
99=Don't know

9. Do you have any food allergy?

   a. Yes
   b. No

9.Food allergy

1=a
2=b
99=Don't know

10.If you choose yes to question 9, please specify what they are

_____

10.Specify food allergy

1=Seafood
2=Milk
3=Gluten
4=Peanut
5=Legume
6=Meats
7=Some vegetables
8=Some fruit
9=others
99=Don't know

11.How often do you drink milk?

   a. I don't drink milk
   b. 1-2 cups per week
   c. 1 cups per day
   d. 2 or more cups per day

11.Milk

1=a
2=b
3=c
4=d
99=Don't know

12.How often do you eat cheese?

   a. I don't eat cheese
   b. Less than once per week
   c. 1-2 times per week
   d. 3-5 times per week
   e. Nearly daily

12.Cheese
1=a
2=b
3=c
4=d
5=e
99=Don't know

13.What kind of cooking oil do you usually use?

   a. Mixed vegetable oil
   b. Animal fat
   c. Peanut oil
   d. Olive oil
   e. Soy oil
   f. Corn oil
   g. Other

13.Cooking oil

1=a
2=b
3=c
4=d
5=e
6=g
88=NA
99=Don't know

14. How often do you eat red meat, such as beef?

a. I don't eat it at all
b. Less than once a week
c. 2-3 times a week
d. Nearly once everyday
e. Nearly every meal

14.Red meat

1=a
2=b
3=c
4=d
5=e
99=Don't know

15. How often do you eat soy food and products, such as bean, soymilk, Tofu etc.?

a. I don't eat them at all
b. Less than once a week
c. 2-3 times a week
d. Nearly once everyday
e. Nearly every meal

15.Soy products

1=a
2=b
3=c
4=d
5=e
88=NA
99=Don't know

16. About how many grams of vegetable do you eat per day? For example, lettuce, spinach, cauliflower, cucumber, etc.

_____

16.Vegetable

1=less than 50grans
2=50-200 grams
3=200-400 grams
4=400-600 grams
5=600-800 grams
6=800-1000 grams
7=>1000 grams
88=NA
99=Don't know

17. About how many grams of starch vegetable do you eat per day? For example, potatoes, kumara, etc.

_____

17.Starch vegetable

1=less than 50grans
2=50-200 grams
3=200-400 grams
4=400-600 grams
5=600-800 grams
6=800-1000 grams
7=>1000 grams
99=Don't know

18. About how many grams of fruit do you eat per day? For example, apples, pears, bananas, kiwifruits, etc.

_____

18.fruit

☐☐

1=less than 50grans
2=50-200 grams
3=200-400 grams
4=400-600 grams
5=600-800 grams
6=800-1000 grams
7=>1000 grams
99=Don't know

19. About how many grams of cereal food do you eat per day? For example, rice, bread, etc

_____

19.Cereal

☐☐

1=less than 50grans
2=50-100 grams
3=100-200 grams
4=200-300 grams
5=300-400 grams
6=400-500 grams
7=>500 grams
99=Don't know

20. How often do you eat fish?

a. I don't eat it at all
b. Less than one time per week
c. 2-3 times per week
d. 4-5 times per week
e. Nearly every day
f. Nearly every meal

20.Fish meal

☐☐

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

21. How often do you eat animal organ products?

a. I don't eat it at all
b. Less than one time per week
c. 2-3 times per week
d. 4-5 times per week
e. Nearly every day
f. Nearly every meal

21.Animal organ products

☐☐

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

22.Do you usually cut off fat from meat when you prepare your meal?

a. Yes
b. No

22.Cut off fat

1=a
2=b
88=NA
99=Don't know

23.How long do you usually sleep at night?

☐☐ (Hours)

☐☐ (Minutes)

23.Spleeping

☐☐☐ Minutes

88=NA
99=Don't know

24.How long do you usually nap each day? (Do not include regular night sleep.)

☐☐ **(Hours)**

☐☐ **(Minutes)**

24.Napping

☐☐☐ Minutes

88=NA
99=Don't know

25.On an average day, how much time do you usually spend on light activities?

☐☐ **(Hours)**

☐☐ **(Minutes)**

25.Light activities

☐☐☐ minutes

88=NA
99=Don't know

Light activities include:

- Standing still
- General office work (typing, writing)
- Occasional short distance walking
- Driving a car, van
- Light cleaning – ironing, cooking, doing dishes, dusting
- Knitting, sewing

26. On an average day, how much time do you usually spend on moderate activities?

☐☐ **(Hours)**

☐☐ **(Minutes)**

Moderate activities include:

- Carrying light loads – carrying baby
- Continuous walking – shopping
- Heavy cleaning – mopping, sweeping, vacuuming, laundry, cleaning windows
- Gardening – planting, weeding
- Car washing
- Painting

26.Moderate activities

☐☐☐ Minutes

88=NA
99=Don't know

27. On an average day, how much time do you usually spend on heavy activities?

☐☐ **(Hours)**

☐☐ **(Minutes)**

Heavy activities include:

- Carrying moderate to heavy loads (more than 10 kg)
- Gardening–digging, mowing raking
- Chopping, sawing wood

*27.Heavy activities*

☐☐☐ Minutes

88=NA
99=Don't know

28. How much time do you spend driving each day?

☐☐ **(Hours)**

☐☐ **(Minutes)**

28.Driving (transport)

☐☐☐ Minutes

88=NA
99=Don't know

29. How much time do you spend walking to and from work, school, visiting or shopping each day? (Do not include walking for sport, exercise or pleasure.)

☐☐ **(Hours)**

☐☐ **(Minutes)**

29.Walking (transport)

☐☐☐ Minutes

88=NA
99=Don't know

## 30. Sports, please fill in the following form

| In the last 7 days, which of these have you done for enjoyment or exercise? | If yes, please tick | How many times in the last 7 days did you do this? | In total for the last 7 days, how much time did you spend on this? (Minutes) | In the last 7 days, did this make breathe hard or sweat? If yes, please tick |
|---|---|---|---|---|
| a. Walking | ◯ | ☐☐ | ☐☐☐ | ☐ |
| b. Gardening | ◯ | ☐☐ | ☐☐☐ | ☐ |
| c. Cycling | ◯ | ☐☐ | ☐☐☐ | ☐ |
| d. Play TaiChi | ◯ | ☐☐ | ☐☐☐ | ☐ |
| e. Aerobics | ◯ | ☐☐ | ☐☐☐ | ☐ |
| f. Swimming | ◯ | ☐☐ | ☐☐☐ | ☐ |
| g. Golf | ◯ | ☐☐ | ☐☐☐ | ☐ |
| h. Exercising at home | ◯ | ☐☐ | ☐☐☐ | ☐ |
| i. Gym exercises or weight training | ◯ | ☐☐ | ☐☐☐ | ☐ |
| **other** | | | | |
| j. _____ | ◯ | ☐☐ | ☐☐☐ | ☐ |
| k. _____ | ◯ | ☐☐ | ☐☐☐ | ☐ |
| l. _____ | ◯ | ☐☐ | ☐☐☐ | ☐ |

# 24 Hours Dietary Recalls (Visit One)

**Date:** ___ /___ /_____ **weekday or weekend** **Page No.** _____ _____

| Eating Time | Meal | Food, Name, Brand, Receipt and Preparation Method | Amount of Volume Consumed |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
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| | | | |

# APPENDIX. 10 SECOND VISIT INFORMATION SHEET (INCLUDING BODY MEASUREMENTS AND 24 HOURS DIETARY RECALL)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

## Health Status And Dietary Intakes Of Elderly Mainland Chinese In Auckland

## Second Visit

*24-Hour Dietary Recall*
*Body Measurements*

Code Number of Subject: _____

Sex of Subject: _____

Time of Interview: _____

Date of Interview: _____

Interviewer (Initials) _____

Venue of Interview: _____

---

Coding: ☐ ☐ ☐ ☐

Date: ☐ ☐ ☐ ☐ ☐ ☐

# 24 Hours Dietary Recalls (Visit Two)

**Date:** ___ /___ /_____ **weekday or weekend** _____ **Page No.** _____

| Eating Time | Meal | Food, Name, Brand, Receipt and Preparation Method | Amount of Volume Consumed |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# Body Measurement

| | | 1st Measurement | 2nd Measurement | 3rd Measurement | Mean Value |
|---|---|---|---|---|---|
| Body Weight (kg) | | | | | |
| Body Height (cm) | | | | | |
| Skinfolds (mm) | *Triceps | | | | |
| | *Subscapular | | | | |
| Humerus width (cm) | | | | | |
| Circumferences (cm) | Upperarm | | | | |
| | Waist | | | | |
| | Hip | | | | |

** The measurements are made on the right side of the body*

- **Blood pressure:**

| | 1st Measurement | 2nd Measurement | 3rd Measurement | Mean Value |
|---|---|---|---|---|
| Systolic (mmHg) | | | | |
| Diastolic (mmHg) | | | | |

- **BIA (Bioelectrical Impendence Analysis)**

  - Fat Mass _____ ; %Fat _____
  - FFM(Fat Free Mass) _____ ; %FFM _____

_____

# APPENDIX 11. THIRD VISIT INFORMATION SHEET (INCLUDING QUESTIONNAIRE TWO AND 24 HOURS DIETARY RECALL)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

## Health Status and Dietary Intakes of Elderly Mainland Chinese In Auckland

### *Third Visit*

***24 Hours Dietary Recalls***

***Questionnaire Two***

Demographic and medical details

Code Number of Subject: _____

Sex of Subject: _____

Time of Interview: _____

Date of Interview: _____

Interviewer (Initials) _____

Venue of Interview: _____

---

Coding: ☐ ☐ ☐ ☐

Date: ☐ ☐ ☐ ☐ ☐ ☐

# 24 Hours Dietary Recalls (Visit Three)

**Date:** ___ /___ /_____ **weekday or weekend**_____ **Page No.** _____

| Eating Time | Meal | Food, Name, Brand, Receipt and Preparation Method | Amount of Volume Consumed |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

*Where Necessary Circle The Letter Next To The Appropriate Answer*

1. Your date of birth:

Please write down _____ /_____ /_____

1.Decimal age

☐ ☐ ☐ ☐ ☐ ☐

Today's decimal date

_____

Date of birth decimal date

_____

Decimal age

_____

2. How long have you been in New Zealand?

Please write down _____

2.Months in NZ

☐ ☐ ☐

3. What's your highest education qualification?

a. Never attend school
b. Primary school graduation
c. Intermediate school graduation
d. High school graduation
e. Tertiary education

3.General qualification

☐ ☐

1=a
2=b
3=c
4=d
5=e
88=NA
99=Don't know

4. What's your highest tertiary education achievement?

a. Certificate
b. Diploma
c. Bachelor degree
d. Master degree
e. PhD
f. Not applicable

4.Tertiary education

☐ ☐

1=a
2=b
3=c
4=d
5=e
6=f
99=Don't know

5. What was the total income that you and your family got in the last 12 months? (NZ dollars)

a. Income<$15000
b. $15000 <Income<$30000
c. $30000 <Income<$45000
d. $45000 <Income<$60000
e. Income>$60000

5.Family income

☐ ☐

1=a
2=b
3=c
4=d
5=e
88=NA
99=Don't know

6. Who Lives with you in your home, please write down

| | | |
|---|---|---|
| Spouse | a. Yes | b. No |
| Children | a. Yes | b. No |
| Grandchildren | a. Yes | b. No |
| Others | Specify | _____ |

6. Family members

1=a
2=b
88=NA
99=Don't know

6a.Live with spouse ☐☐

6b.Live with children ☐☐

6c.Live with grandchildren ☐☐

6d.
11=Relatives
12=Friends
13=Care giver
14=Flatmate
15=Parents
16=Great-grandchildren
17=Other

7. Which is the best description of your employment status in NZ?

a. A full time job
b. A part-time job
c. Not in paid work but on benefit
d. Neither in paid work nor on benefit
e. Retired
f. Others

7.Employment in NZ ☐☐

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

8. If you live with your spouse, what is his/her employment status in NZ?

a. A full time job
b. A part-time job
c. Not in paid work but on benefit
d. Neither in paid work nor on benefit
e. Retired
f. Others

8.Spouse employment in NZ ☐☐

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

9. Which is your occupation in NZ?

Please write down _____

9.Occupation in NZ

☐☐

1=Legislators, senior officials, managers
2=professionals
3=Technicians and Associate professionals
4=Clerks
5=Service, shop, market
6=Skilled Ag and fish
7=Craft and related trades
8=Plant and Machine operators, assemblers
9=Elementary occupations (e.g. Labour)
10=Not specified
88=NA
99=Don't know

10.Which was your occupation in China?

Please write down _____

10.Occupation in China

☐☐

1=Legislators, senior officials, managers
2=professionals
3=Technicians and Associate professionals
4=Clerks
5=Service, shop, market
6=Skilled Ag and fish
7=Craft and related trades
8=Plant and Machine operators, assemblers
9=Elementary occupations (e.g. Labour)
10=Not specified
88=NA
99=Don't know

11. Is there any change in your body weight since you came to New Zealand?

a. No difference
b. Increase<5kg
c. Increase>5kg
d. Increase, but I don't know the amount
e. Decrease<5kg
f. Decrease>5kg
g. Decrease, but I don't know the amount

11.Weight change

☐☐

1=a
2=b
3=c
4=d
5=e
6=f
7=g
88=NA
99=Don't know

12. In the last 12 months, have you seen a doctor or been visited by a doctor about your own health? By 'doctor' I mean any GP or family doctor, but not a specialist.

a. Yes
b. No

12. To see doctor

☐☐

1=a
2=b
88=NA
99=Don't know

13. How many times did you see a doctor last year?

a. Never
b. 1 time
c. 2 times
d. 3-5 times
e. 6-11 times
f. >12 times

13.Times doctor visiting

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

☐☐

14. In the past two years, how often did you get the flu?

a. Never
b. About once a year
c. About 2-3 times a year
d. More than 3 times a year

14.Flu

☐☐

1=a
2=b
3=c
4=d
88=NA
99=Don't know

15. Have you ever been told by a doctor that you have the following diseases? Choose as many as applicable.

a. Hypertension
b. Cardiovascular disease (heart disease)
c. Diabetes
d. Osteoporosis (Back ache)
e. Hyperthyroid
f. Low iron level
g. High blood lipid level

15.Disease

1=Yes
2=No

a. ☐
b. ☐
c. ☐
d. ☐
e. ☐
f. ☐
g. ☐

16. If you have any of diseases mentioned above, which treatment are you receiving?

a. Western medicine and therapy
b. Chinese traditional medicine and therapy
c. Both western and Chinese traditional medicine and therapy

16.Treatment of disease

☐☐

1=a
2=b
3=c
88=NA
99=Don't know

17. Do you smoke?

a. Yes
b. No

17.Smoking

☐☐

1=a
2=b
88=NA
99=Don't know

18. How many cigarettes do you smoke on average every day?

a. 0
b. 1-10
c. 11-20
d. 21-30
e. 31 or more
f. Don't know

18.Cigerette consumption

☐☐

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

19. Do you consume alcohol drinks regularly?

a. Yes
b. No

19.Drinking ☐☐

1=a
2=b
88=NA
99=Don't know

20. What kind of alcohol drinks do you usually drink?

a. Beer
b. Wine
c. Spirit
d. Chinese traditional medicine alcohol drink

20.Kind of drink

1=Yes
2=No
99=Don't know

a. ☐☐
b. ☐☐
c. ☐☐
d. ☐☐

21. Please specify how much you usually drink per week?

*Beer* _____

Wine _____

Spirit _____

Chinese traditional medicine alcohol drink _____

21.Volume of drink (ml)

Beer ☐☐☐☐
Wine ☐☐☐☐
Spirit ☐☐☐☐

Chinese medicine alcohol ☐☐☐☐

88=NA ☐☐

99=Don't know

22. Do you take any nutritional supplements including Chinese medicine supplement regularly?

a. If Yes, please specify

b. No

22aType of supplements

1=a
2=b
99=Don't know

22b.
1=Vitamin supplements
2=Mineral supplements
3=fibre supplements
4=Chinese medicine supplements
5=Active ingredients supplements such as garlic)
6=Others

| Name | Dose | Number taken | How often |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

23. Do you take any herbs (including use in food and soup) regularly?

a. Yes
b. No

23.Herb usage

1=a
2=b
99=Don't know

24. If yes, how often do you take the herbs?

a. Less than once a month
b. 2-3 times a month
c. Once a week
d. Daily
e. 2 times or more daily

24.Times of herb usage

1=a
2=b
3=c
4=d
5=e
99=Don't know

25. What herbs do you take? Please write down

_____

_____

_____

25.Herbs

26. Why do you take these herbs?

a. For good health
b. Prevent some diseases
c. For the therapy of diseases
d. I just love the taste
e. Against aging
f. Others

26.Reason for taking herbs

1=a
2=b
3=c
4=d
5=e
6=f
88=NA
99=Don't know

☐☐

*Blood glucose level* _____

# APPENDIX 12. FEEDBACK FORM (IN ENGLISH)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

## Health Status And Dietary Intakes Of Elderly Mainland Chinese In Auckland

## *Feedback Form*

*Dear* _____

Thank you very much indeed for taking part in our study of the health status and dietary intake of elderly Chinese from Mainland China in Auckland. Your assistance and co-operation in the data collection is greatly appreciated, as without this the study would have failed.

A report of your individual results is enclosed. This includes a summary of your nutrient intake, which has been calculated from the 24-hour recalls taken at the three visits. Your intake of these nutrients is compared with dietary recommendations that are commonly used for New Zealanders and Chinese. Your blood glucose level is also enclosed and abnormal results will be indicated. The results of your body measurements and explanations of the normal range of each are also provided.

If there is no result reported it is because you did not complete that part of the study.

If you have any queries or wish to discuss your results further please do not hesitate to contact us at Ph: 4439700-9649 or 021-1650280

Thanks again for your help. We have enjoyed working with you.

Regards

Wei Xie
KaiHong Tan (Supervisor)

**CODE: _____ YOUR INDIVIDUAL RESULTS**

# YOUR NUTRIENT INTAKE

*1.* **Energy Intake (Kcal)_____**

- **Percentage of energy comes from fat _____**
  - Percentage of energy comes from saturated fat _____
  - Dietary cholesterol (mg)_____
- **Percentage of energy comes from protein _____**
- **Percentage of energy comes from carbohydrate _____**

**Comment:**

- The current RDA (Recommended Dietary Allowance) of energy is 2300kcal for males and 1900 for females who are over 51+. Energy needs decline with advancing age. Accordingly, the energy RDA for adults decreases slightly after age 50. Energy intakes typically decline in parallel with needs. Still, many older adults are over weight, indicating that their food intakes do not decline enough to compensate for reduced energy expenditure. There is a 10% reduction of caloric need between ages 51-75 with an additional 10-15% reduction after age 75 depending on individual activity.
- It is suggested that for older adults fat and oils supply fewer than 30% of total energy in diet. Cutting fat may help retard the development of cancer, atherosclerosis, and other degenerative diseases. Only 10% of calories should come from saturated fat. Dietary cholesterol should be limited to 300 mg or less per day.
- It is suggested that 12-15% of total energy should come from protein in New Zealand. The protein needs of older adults seem to be about the same as, or even greater than, those of younger people. Because energy needs decrease, however, the protein must be obtained from low-kcalorie sources of high-quality protein, such as lean meats, poultry, fish, and eggs; nonfat and low-fat milk products; and legumes
- Carbohydrates are also one of the principal sources of energy in the daily diet. For the elderly, it is desirable that between 55-60% total energy should come from carbohydrates, mainly starchy foods like rice, noodles, cereals, potatoes kumara etc. High sugar intakes should be avoided.

## 2. Fiber Intake (g) ————

**Comment:**

Recommendation of dietary intake (RDI) is 25-30g/day. Many studies have confirmed the importance of fibre in preventing cardiovascular disease, cancers, diabetes, and other gastrointestinal diseases. High fibre intakes also prevent constipation.

## 3. Vitamin and Mineral Intake

| Vitamins & Minerals | Your Intake | RDI* | Comment |
|---|---|---|---|
| Vitamin A (ugRE/day) | | 750 | Needs decrease; avoid supplements containing vitamin A. |
| Vitamin D (ug/day) | | 10 | Needs increase; get exposure to sunlight and include vitamin D-rich foods, such as fish in the diet. |
| Vitamin B6 (mg/day) | | 1.0-1.5(Men) 0.8-1.1(Women) | Needs increase. VitB6 deficiency impairs immune system. |
| Vitamin B12 (mg/day) | | 2.0 | Needs increase; eat vitamin B12-rich foods, such as lean red meat, chicken, and skim milk |
| Folate (ug/day) | | 200 | Needs decrease; no recommended changes |
| Iron (mg/day) | | 7 (Men) 5-7 (Women) | Vitamin C and red meat increase absorption. |
| Zinc (mg/day) | | 12 | Needs increase; eat foods rich in zinc, such as lean red meat, oysters, wheat germ and whole grains |
| Calcium (mg/day) | | 800 (Men) 1000 (Women) | Needs increase: eat foods rich in calcium, such as milk |

*Recommended Dietary Intakes (RDIs) are the levels of intake of essential nutrients considered, in the judgement of Australia the National Health and Medical Research Council, on the basis of available scientific knowledge to be adequate to meet the known nutritional needs of practically all healthy people. These RDIs are also used in New Zealand. The values above are chosen from the age group men>64 yr and women>54yr.

## Food Guide For The Elderly

- Cereal group — six or more servings per day
- Vegetable Group — three or more servings per day
- Fruit group — two or more servings per day
- Dairy products — three servings per day
- Meat and other protein rich foods — two or more servings per day

**4. Sodium Intake _____**

**Comment**:

Chronic excess intake of sodium has been shown to play a role in the development of hypertension. Reduction of sodium intake is effective to lowering blood pressure in some people. Salt is the main source of sodium in the diet. But sodium is not only present in table salt, but in other forms—such as flavorings, including monosodium glutamate (WeiJing), oyster oil, soy sauce etc;, processed food, including salted vegetable (XianCai), salted fish(XianYu), bacon, ham, Chinese sausage (NaChang), Chinese Winterized Pork meat (LaRou), century egg (PiDan), etc; and preservative. In New Zealand, it is recommended to reduce sodium intake to 120mmol to 140mmol per day. In China, salt intake is recommended to be less than 5g/day. The average daily intake of salt in developed countries is 10-12g (4 g sodium).

**5. Water Intake ————**

Total body water decreases as people age. Dehydration is a risk for older adults, who may not notice or pay attention to their thirst. An intake of 6 to 8 glasses of water a day is recommended.

**From your dietary analysis, we have found that your intake of**

☐ All nutrients are very good.

☐ Your intake of some nutrients is not balanced; here are our suggestions for you.

_____

_____

_____

# Your Body Measures

## 1. Height, Weight and BMI

| Body Measure | Your Values | Ideal Values | Comment |
|---|---|---|---|
| Height (cm) | | | |
| Weight (cm) | | | |
| BMI | | | |

Note: BMI is calculated by dividing the individual's weight (kg) by the square of her height (m).
In New Zealand, Less than 20, Thin; 20-24, Desirable range; 25-29, Overweight; Over 30 Obese.
In China, Less than 18.5, Thin, 18.5-25 Desirable range; 25-30, Overweight; Over 30 Obese.
Elderly who are at high risk of cardiovascular disease should have BMI 27 or under.

## 2. Skinfolds and Circumference

| | | Your Value | Normal Range |
|---|---|---|---|
| Skinfolds (mm) | Triceps | | |
| | Subscapular | | |
| Circumference (cm) | Upperarm | | |
| | Waist | | |
| | Hip | | |
| Waist to hip ratio = Waist (cm)/ Hip (cm) | | | |

Note: Waist to hip ratio has been used as a measure of fat distribution. Recent studies provide evidence that increased waist-to-hip circumference ratio (greater than 0.8) represents high cardiovascular disease risks. A waist circumference of 102cm or more in men and 88cm or more in woman is associated with significantly increased disease risk.

## 3. Body Percentage Fat _____

**Comment**:

The normal range for men is approximate 10-20, for woman is approximate 15-30.

**4. Blood Pressure (mmHg)*** _____ Normal ☐
Abnormal ☐

**Comment**:
Normal range is 60-90 / 90-120 mmHg. If your blood pressure is greater than the normal range, we suggest you consult your doctor.

**5. Blood Glucose Level (mmol/l)*** _____ Normal ☐
Abnormal ☐

**Comment:**
A normal blood glucose is 3.5-7.0mmol/l. If your blood glucose level is greater than the normal range, it may indicate impairment in glucose tolerance. We suggest you consult your doctor.

***Note: If the results of 4,5 are abnormal, please refer to the separate instrution.**

From your above results, here is our suggestion for you

_____

_____

_____

*We wish you happiness in New Zealand!*

**Thank you very much for joining our study. If you have any further questions about this report or our study, please don't feel hesitate to contact us at any time!**

Wei Xie c/o Patsy Watson
Massey University
Institute for food, Nutrition and Human Health
Albany Campus
Private Bag 102-904
North Shore MSC
Email: xieweiei@yahoo.com

*Thank you for taking part in our study*

**"Health Status And Dietary Intakes Of Elderly Mainland Chinese In Auckland"**

**Your test has shown the following abnormal results.**

_____

_____

_____

Please take this sheet to your family doctor for further advice!!

If you and your doctor have any question of this result, you can contact us

Wei xie: **021-647913**
**KaiHong Tan: (09) 4439700-9649**
**Patsy Watson: (09) 4439755**
Email: xieweiei@yahoo.com

# APPENDIX 13. FEEDBACK FORM (IN CHINESE)

Massey University

Institute for Food, Nutrition and Human Health
Albany Campus

## Health Status And Dietary Intakes Of Elderly Mainland Chinese In Auckland

## Feedback Form

---

非常感谢您参加我们居住奥克兰中国大陆老年人的健康状态和膳食摄入的研究。如果没有您积极的参与和配合，我们将不能成功的完成研究。

以下是有关您健康的报告。这个报告包括有关您营养摄入的总结，这是从您 3 天的 24 小时饮食回顾中总结出来的。 您的营养素摄入量会和新西兰和中国的推荐量相比较。您的血糖测定结果和身体测量值也会包括在内，我们会告诉您正常值的范围。

如果您没有完成某部分，将没有测量值显示。

如果您有有关您个人报告的任何问题，请联络我们。我们的电话是：4439755 或 021-1650280

再次感谢您的帮助和协助

祝好

谢玮
谭凯虹

CODE: _____ 您的营养报告

# 您的营养素摄入：

*1.* 热量摄入（千卡）_____

- **脂肪提供的热量百分比** _____
  - 饱和脂肪酸提供的热量百分比 _____
  - 胆固醇摄入量（毫克）_____
- **蛋白质提供的热量百分比** _____
- **碳水化合物提供的热量百分比** _____

- 51 岁以上老年人推荐的热量摄入量是男性 2300 千卡，女性 1900 千卡。随着年龄的增长，热量的需要量会减少。所以推荐量也有一定的减少。热量的摄入是应该随着需要量的减少而减少的。许多的老年人超重，这显示他们没有应需要的减少而减少摄入。一般来说，51~75 岁应该在以上的推荐量减少 10%，75 岁以上还应按活动的减少，相应减少 10-15%。
- 脂肪和油应该提供少于 30%的总热量。减少脂肪的摄入可以减缓癌症，心血管疾病和退行性疾病的发生。饱和脂肪应提供少于 10%的总热量。每日的胆固醇的摄入应少于 300 毫克。
- 按新西兰的推荐量，12~15%的总热量应该来自蛋白质。老年人的蛋白质需要量和年轻人一样，甚至高于年轻人。但是，蛋白质应该从含低热量，高质量的食物中摄取，例如瘦肉类，禽畜，鱼，蛋，脱脂和半脱脂奶制品，和豆类。
- 碳水化合物是重要的热量来源。理想的摄入量是 55~66%热量应来自碳水化合物，而且主要是来自淀粉类食物，例如面包，谷类，土豆，地瓜等。应避免摄入过多的纯糖。

2. 纤维素（克）_____

推荐的纤维素摄入量是 25-30 克每天. 许多的研究已经证实纤维素在防治心血管疾病，癌症，糖尿病和胃肠道疾病方面的重要性。足够的纤维素摄入可以防治便秘，因此，可以有效的防止结肠癌。

### 3. 维生素和微量元素

| 维生素和微量元素 | 摄入量 | RDI* | 评 价 |
|---|---|---|---|
| 维生素 A<br>(微克单位/每天) | | 750 | 需要量减少。避免添加维生素 A 的营养药品。然而，素食者可能有维生素 A 的缺乏。 |
| 维生素 D<br>(微克/每天) | | 10 | 需要量增加。尽量多接触阳光，多食含维生素 D 丰富的食物，包括鱼，添加维生素 D 的脱脂奶粉等。 |
| 维生素 B6<br>(毫克/每天) | | 1.0-1.5(男性)<br>0.8-1.1(女性) | 需要量增加。维生素 B6 缺乏可以损害免疫系统。 |
| 维生素 B12<br>(毫克/每天) | | 2.0 | 需要量增加，多食含维生素 B12 丰富的食物，例如瘦的红肉，鸡，脱脂奶。 |
| 叶酸<br>(微克/每天) | | 200 | 需要量减少。 |
| 铁<br>(毫克/每天) | | 7 (男性)<br>5-7 (女性) | 维生素 C 和肉类一起食用可以提高铁的吸收 |
| 锌<br>(毫克/每天) | | 12 | 需要量增加，多食含锌丰富的食物，例如瘦的红肉，蚵，小麦等杂粮。 |
| 钙<br>(毫克/每天) | | 800 (男性)<br>1000 (女性) | 摄入通常不足够。骨质疏松常见 |

*Recommended Dietary Intakes (RDIs) 是由澳洲健康和药物研究会制定的，里面规定的必需营养素的摄入标准是在大量科学研究的基础上制定的满足大部分健康人需要的摄入量。新西兰也是使用这个标准。上面的量是按照男性》64 岁，女性》55 岁制定。

### 4. 钠的摄入

过量摄入钠可能引起高血压。减少钠的摄入有利于降低血压。在日常饮食中，盐是主要的钠的来源。不过，钠不单单存在在盐中，还存在例如调味料中，例如味精，蚝油，酱油等。还有经加工的食物，例如咸菜，咸鱼，烟肉，火腿，腊肉，腊肠，皮蛋等，还有防腐剂。在新西兰，建议钠的摄入应该降低到 120 毫摩尔到 140 毫摩尔每天。在中国，盐的摄入建议在每天 5 克以下。然而，在大部分的发展国家，盐的摄入在 10-12 克(4 克钠)。

### 5. 水的摄入

身体总的水分是随年龄的增加尔减少。老年人因为对渴的感受性降低，所以脱水对他们来说是非常危险的。老年人每天应该喝 6-8 杯水。

从你的饮食分析来看，

☐ 所有的营养素摄入都理想

☐ 一些营养素摄入不理想，我们给您的建议是

_____

_____

_____

# 你身体测量的指标

1. 身高，体重和 BMI

| 身体测量 | 你的值 | 理想值 | 评价 |
|---|---|---|---|
| 身高(厘米) | | | |
| 体重(公斤) | | | |
| BMI | | | |

备注：BMI 是有体重(公斤)除以身高(厘米)的平方计算出来的。在新西兰，少于 20，偏瘦；20-24，理想；25-29，超重；超过 30，肥胖。在中国，少于 18.5 偏瘦，18.5-20 理想，25-30 超重，超过 30，肥胖。老年人 BMI 大于 27 易患心血管疾病。

2. 皮褶厚度和周长

| | | 您的值 | 理想值 |
|---|---|---|---|
| 皮褶厚度 (毫米) | 三角肌皮褶厚度 | | |
| | 肩胛下角皮褶厚度 | | |
| 周长 (厘米) | 上臂围 | | |
| | 腰围 | | |
| | 臀围 | | |
| 腰臀比 = 腰围(厘米)除以臀围(厘米) | | | |

备注：腰臀比用于测量脂肪的分布。近来的研究表面，腰臀比大于 0.8 易患心血管疾病。男性腰围大于 102 厘米，女性大于 88 厘米，也易患病。

3. 身体脂肪比例

_____

大部分的脂肪分布在皮下，皮褶厚度可以用来衡量皮褶脂肪。男性的脂肪大约占身体 10-20%，女性占 15-30%。

4. 血压(毫米汞柱) _____

正常的血压值是 60~90/90~120 毫米汞柱。如果你的血压高于正常，我们建议你咨询你的医生。

5. 血糖浓度 (毫摩尔每升)_____

正常的血糖值是 3.5 到 7.0 毫摩尔每升, 如果你的血糖高于正常，显示你的糖耐量受到损害。我们建议你咨询你的医生。

**注意：如果 4，5 项的值不在正常范围，请带上我们的附表去咨询你的医生。**

从上面的结果，我们建议您

_____

_____

_____

## 希望您在新西兰健康，快乐!!

感谢您参加我们的研究。如果您有任何问题，请联络我们。

*Wei Xie c/o Patsy Watson*
*Massey University*
*Institute for food, Nutrition and Human Health*
*Albany Campus*
*Private Bag 102-904*
*North Shore MSC*
*Email: xieweiei@yahoo.com*

*请将此表格带给你的医生！*

*Thank you for taking part in our study*

**"Health Status And Dietary Intakes Of Elderly Mainland Chinese In Auckland"**

**Your test has shown the following abnormal results.**

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Please take this sheet to your family doctor for further advice!!

If you and your doctor have any question of this result, you can contact us

Wei xie: **021-647913**
**KaiHong Tan: (09) 4439700-9649**
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