DIETARY INTAKE AND NUTRITIONAL STATUS OF KOREAN MIGRANTS IN NEW ZEALAND

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ABSTRACT

Migration to a new country presents many lifestyle challenges that may influence future health outcomes. In particular, eating patterns may be altered due to the expense or lack of availability of foods typical of the immigrant's usual diet and the relative abundance of unfamiliar, locally produced foods. Studies of migrants carried out in host countries have shown that the change of living environment is associated with changes in food choices, activity patterns and other lifestyle factors. This may then be reflected by changes in health indicators: e.g., body measurements, and consequently morbidity and mortality. The latest census indicates that Koreans are the fastest growing ethnic group and the third largest Asian ethnic group in New Zealand after Chinese and Indians. Nonetheless, to date no studies have examined the nutritional outcomes resulting from the migration of Koreans to New Zealand. Hence, a study is needed to determine the dietary habits and the possible impact of the diet on risk factors for health and disease among Korean migrants.

As a pilot study, the purpose of this study was to assess dietary intake and other health related measures in a sample of 50 middle-aged (40-55 years) Korean females who have lived in New Zealand for at least 5 years. The study assessed sociodemographic characteristics, activity level, dietary intake, factors related to the dietary intake and anthropometric and biochemical measurements by questionnaires, 24-hour dietary recall and appropriate body measurements. The body measurements included weight, height, triceps and subscapular skinfolds, waist, hip, and upper arm circumference, elbow breadth, body fat using Bioelectrical Impedance Analysis, blood pressure and blood glucose level.

The nutrient intakes of subjects were found to be generally adequate and the proportions of energy derived from macronutrients (Carbohydrate:Protein:Fat = 55:17:26) were also considered to be in the adequate range. However, low intakes of calcium (596mg) and zinc (8mg) and high intake of sodium (3749mg) were identified as the main nutritional problems in this population. The nutrient intakes of Korean immigrants to New Zealand with longer residences (≥8.8 years) did not differ from those with shorter residences (<8.8 years). This suggests that the dietary acculturation of migrant Koreans may have taken place during the early years of residence in New Zealand (<5 years). The findings from this study further indicate that Korean migrants have not changed their traditional dietary habit to any great extent and that rice and *kimchi* still hold a prominent place in their diet. While the intakes of the study

participants were generally similar to reported intakes from Korean and New Zealand national surveys, the intakes of some nutrients were intermediate in the study participants (Korean immigrants) between those of native Koreans and New Zealanders; intakes of calcium in migrant Koreans were lower than those of New Zealand women, but higher than native Koreans because of a significantly greater intake of dairy products.

The risk associated with BMI is difficult to evaluate in this population group because of differences between Korean and New Zealand standards. The subjects had a much lower prevalence of obesity, measured by the BMI, according to the New Zealand (2%) compared to the Korean classification (24%) (P=0.005). Similarly, the subjects had a lower prevalence of increased disease risk, measured by waist circumference, according to the global classification (8%) compared to the Asian classification (24%) (P=0.029). However, almost half of all subjects fell into the 'at risk' group for WHR, suggesting that subjects may have more body fat in the upper body in relation to their body size. These findings suggest that appropriate ethnic-specific obesity indicators need to be developed to monitor anthropometric changes in migrant populations. The majority of subjects fell into the normal blood pressure range with only two hypertensive women in the study group.

The findings from this study identified the areas of concern in nutrition and indicated the need for further research into this population. Furthermore, these results may be used to develop culturally appropriate nutrition education materials and programmes.

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BIA	Bioelectrical Impedance Analysis
BMI	Body Mass Index
CFU	Colony Forming Units
CHD	Coronary Heart Disease
CVD	Cardiovascular Disease
FM	Fat Mass
FFM	Fat-Free Mass
HRT	Hormone Replacement Therapy
LAB	Lactic Acid Bacteria
NTD	Neural Tube Defects
PUFA	Polyunsaturated Fatty Acid
RDA	Recommended Dietary Allowances
RDI	Recommended Dietary Intake
RTE BF	Ready-to-eat Breakfast
TG	Triglyceride
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist to Hip Ratio

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CHAPTER 1. INTRODUCTION

1.1 Geographical and Historical Influences on the Korean Diet

Korea is a peninsular country that has been a single ethnic nation since ancient times. It is located in Eastern Asia between China and Japan in the border of the Yellow sea and the Sea of East. Koreans have lived under the same culture for 5,000 years as an independent nation. This has led Koreans to develop a strong cultural identity as a homogenous ethnic group with their own language and customs, including unique dietary patterns. However, it is believed that the traditional Korean dietary pattern was not established until the *Chosun* dynasty (1392-1909 AD) (Kang & Lee, 1985).

The typical traditional Korean diet is not only different from Western diets, but also from diets of other nearby Asian countries, such as China or Japan. As in many cultures around the world, the traditional Korean dietary pattern developed from a geographical context, including the environmental factors of the land and behavioural practices of the native people. The Korean peninsula is surrounded on three sides by ocean. This has allowed Koreans to incorporate abundant seafood, including marine vegetables such as laver and kelp, to their diet. In addition, many mountainous areas in the land have led Koreans to include various wild vegetables in their diet. Broad coastal plains in the southwest of the country were adequate for agriculture. This in turn has led grains to become the staples of Korean diet. The practices of Buddhism and Confucianism that have governed the country for a very long time have also influenced food and health beliefs in Korea. Koreans believe in the five blessings of life; longevity, wealth, health, virtue and peaceful death, and that good eating habits are essential to maintaining good health. Diet, therefore, is traditionally considered an important influence on health and wellbeing in Korean culture. These closely interwoven external and internal factors have shaped the modern dietary habits of Koreans.

1.2 Foodstuffs and Meal Patterns in Korea

This section will discuss the foodstuffs that commonly comprise the Korean diet

including a few important traditional Korean foods, and the meal patterns of Koreans.

1.2.1 Rice

The major energy sources for Koreans are starch foods, particularly rice. Rice is the primary staple and also the most important single constituent of the Korean diet in terms of bulk and nutritional value. In Korean culture 'cooked rice' means 'meal'. In fact, "Have you eaten rice yet?" is a common greeting for Koreans. This is roughly equivalent to the English "How are you?" (Kim & Oh, 1996) and signifies the strong importance of rice in Korean culture. Rice has been, and still is, the primary element of Korean diet (South Korean Ministry of Health and Welfare, 2002).

Traditionally, rice was also a main source of protein for Koreans, with consumption of soy products that enhance the overall quality of the protein. Short grain rice is used in Korea, while long grain rice is hardly used. Nowadays, short grain rice cooked with other grains such as brown rice, barley and millet is gaining popularity as health food.

1.2.2 Vegetables

Having a number of vegetable dishes at every meal is one of the prominent features of the Korean diet. Furthermore, the types of vegetables that are commonly used in Korea are very diverse. They include wild edible greens, such as bracken; field-grown greens, such as wild garlic; and cultivated vegetables, such as eggplant, squash and cucumber (Lee, Popkin, & Kim, 2002). It is reported that there are approximately 280 different edible vegetables available in the Korean diet, with over 300 types of vegetables eaten in rural areas (Kim, Lee, & Park, 1993).

The indigenous Korean vegetables, which are mostly wild vegetables, are rich in vitamins and minerals. Vitamin A and vitamin C contents are high in these vegetables, as well as high calcium/phosphorus (Ca:P) ratio. It has been reported that the Ca:P ratios of Korean indigenous vegetables (e.g., sow thistle; 2.24, red pepper leaves; 10.23) are much higher than those of animal foods such as beef (0.08) and mackerel (0.11) (Rural Nutrition Institute, 1991). Widely consumed Korean indigenous vegetables include mugwort, Shepherd's purse, sow thistle and red pepper leaves.

Vegetables are cooked in a variety of ways. They are usually boiled, steamed, stir-fried, or pan-fried and also eaten fresh/raw, but seldom deep-fried. However, boiled and steamed are often the most common methods of cooking vegetables. Fermentation is another common method of processing vegetables and other foodstuffs in Korea, especially in preparing *kimchi*, a traditional Korean food. This is discussed separately in the section 1.2.3.1.

In Korea, food and medicine were traditionally considered to have the same roots (Yoon, 1980), and some vegetables and herbs are used as both food and medicine. This recalls the words of Hippocrates, the Father of Modern Medicine in the West: "Let food be thy medicine and medicine be thy food" (413 BC). This concept is thought to be the basis of functional foods development that is currently gaining worldwide popularity. Such vegetables and/or herbs include jujube, garlic, ginger, mugwort, and ginseng.

1.2.3 Fermented foods

Fermented foods hold a unique place in the Korean diet because of the many indigenous Korean foods that are preserved by fermentation. The following are the reasons for employing fermentation to process foods in Korea. The Korean climate can be characterised by four distinct seasons with a long hot summer. Hence, a preservation method able to withstand the long hot summer days was needed to prevent deterioration of foods. Furthermore, due to the plain taste of the staple, rice, a food processing method able to compensate for this was also needed (Kim & Oh, 1996).

Cheese and yoghurt are the most ancient and some of the most common fermented foods found in the West. While these are fermented from milk, raw ingredients from plants are used for fermentation in Korea. The fermentation process selectively cultivates those microorganisms beneficial to humans, but suppresses less desirable or detrimental organisms. The main fermented foods that are commonly eaten by Koreans are described below.

1.2.3.1 *Kimchi*

Kimchi in the Korean diet

Kimchi is a pungent mixture of pickled and fermented vegetable products that has a long tradition in Korea. It is comprised of many different ingredients, which may also

include some animal products such as seafood. *Kimchi* has a sour, sweet and carbonated taste and is the main side dish of the Korean diet. It is usually served cold. Indispensable at every meal, *kimchi* has special nutritional meaning in the Korean diet and is also thought to provide psychological comfort to Koreans. There are more than 200 varieties of *kimchi*, each with different ingredients and preparation methods where red pepper, garlic, spring onion and ginger are the principle sub-ingredients. However, cabbage *kimchi* and radish *kimchi* are the two most commonly consumed types.

Nutritional properties of kimchi

Although *kimchi* is low in caloric content, thereby contributing an insignificant amount of macronutrients, it has served an important nutritional role in providing vitamins and minerals in the Korean diet. In terms of vitamins, considerable amounts of carotene and vitamin C are contributed by *kimchi* that are already present in the raw ingredients. The level of carotene is particularly affected more by the raw ingredients, such as carrots and red pepper. However, some vitamins may be synthesised during the fermentation process, altering the nutrient content of *kimchi* as fermentation proceeds and *kimchi* matures. This is because fermentation changes the pH of *kimchi,* which in turn changes the content of various vitamins in *kimchi*. While the content of vitamins B_1, B_2, B_{12} and Niacin may increase up to twice the initial content at the optimal maturation of *kimchi* during the fermentation process, they then decrease as the taste of *kimchi* deteriorates due to over-fermentation and acidification. On the other hand, the content of carotene and vitamin C slightly decreases during the fermentation. It is interesting to note that the time taken for B vitamin content to peak coincides with the time when *kimchi* attains optimum taste. It is thought that *kimchi* tastes best after 2-3 weeks of maturation at 2-7°C (Lee, 1986). However, the nutrient content of *kimchi* varies and is largely determined from the raw materials of which *kimchi* is made. *Kimchi* has been the major source of vitamin C for Koreans for centuries, especially when fresh vegetables were not readily available during the long days of winter (Kim & Oh, 1996). In terms of minerals, calcium is a major component of *kimchi,* but it is low in iron. In fact, it has a higher calcium content and greater Ca:P ratio than animal foods (Kim, 1991). In addition, because of the amount and frequency of consumption of *kimchi*, this can be an important source of dietary fibre.

Health-related aspects of kimchi

Kimchi fermentation is mainly lactic acid fermentation by lactic acid bacteria (LAB). More than 30 species belonging to different genera of LAB have been found in *kimchi* (Cheigh & Park, 1994; Lee, Ko, & Ha, 1992; Lim, Park, & Han, 1989). With

many reports on the beneficial functions of LAB for humans, *kimchi* is gaining popularity as a functional food with possible anti-cancer and anti-tumour effects (Hur, Kim, Choi, & Park, 2000; Kim, Chang, Kim, Lee, & Choi, 2002). Furthermore, the probiotic effect of LAB grown to 10^8CFU/ml in *kimchi* assists digestion, keeps intestines healthy and aids bowel functions (Lee, 1997). Considering that probiotic foods contain LAB typically 10^6CFU/g of product, *kimchi* may have more LAB than cheese or yoghurt. High concentrations of fibre in kimchi also have a positive effect in preventing constipation and colon cancer (Lee, 1997). One of the recent health related findings of *kimchi* is its role in preventing heart disease (Hong, 2003). This study indicated that the average amount of homocysteine was significantly lower in subjects who consumed *kimchi* three times a day or more (9.8μmol/l) compared to those who consumed it approximately twice a day (10.5μmol/l) and those who consumed it twice a week (10.9μmol/l). High levels of folate and B vitamins are thought to be responsible for the homocysteine lowering properties of *kimchi*.

Current trend

Despite a long standing relationship that Koreans have with *kimchi*, both nutritionally and psychologically, it has been observed that the consumption of *kimchi* is decreasing, especially among younger Koreans. However, *kimchi* still remains the most commonly consumed food, after rice. It has been found that the per capita consumption of *kimchi* in Korea was estimated to be 100g per day for the last 20 years (Lee, 1997) and that *kimchi* accounts for approximately 40% of the total vegetable intake in Koreans (South Korean Ministry of Health and Welfare, 1999). The industrial production of *kimchi* has grown markedly since the 1980s to meet the consumption in Korea (at home) and abroad where Japan is the major export market. In 2001, US$68.7 million worth of *kimchi* was exported to 30 countries (Suh, 2002).

1.2.3.2 *Chang*

Chang refers to Korean fermented bean products. Korea, along with other Far East countries such as Manchuria, is widely accepted as the origin of soybeans (Kim, Kim, Park, Sohn, & Kwon, 2003). In fact, a range of different types of beans have been consumed and the use of fermented beans in Korea dates back to 700 AD (Yoon, 1980). The typical Korean fermented bean products include soy sauce, soy bean paste and red pepper soy bean paste, which comprise the principal condiments of Korean cooking. Although the sodium content of these fermented bean products is high, they have served an important role as sources of protein for many Koreans (Kim & Oh, 1996). However,

due to dietary transition in Korea, there has been a decrease in consumption of fermented bean products (Ministry of Health and Social Affairs, 1991). This is thought to be attributable to the popularity of less traditional foods among Koreans, particularly among younger Koreans (Kim & Oh, 1996).

1.2.4 Animal foods

Traditionally Koreans have had a plant-orientated diet and the intake of animal foods has been low. However, Koreans enjoy having a variety of animal foods and their products. The favourite meat dish among Koreans is *bulgogi*, small pieces of beef strips marinated in a mixture of soy sauce, sesame oil, garlic and other seasonings. Although Koreans enjoy other meats such as pork and chicken, lamb is hardly ever consumed.

Consumption of seafood, including a variety of fish and shellfish, is also common, contributing a significant amount of animal food products in the Korean diet. Lower egg prices and an increase in the importation of dairy cows has led to an increase in egg and dairy product consumption in Koreans (Kim, Moon, & Popkin, 2000). However, milk and other dairy products are not part of the traditional diet.

1.2.5 Fats and oils

Because of the low consumption of animal foods, the intakes of fats and oils of animal origin have been very low in Korea. Cooking oils have therefore been important fat sources in the Korean diet. Sesame and perilla oils are traditional Korean cooking oils that are indispensable for many Korean dishes. These oils differ not only in flavour but also in the fatty acid composition. While the amount of n-9 polyunsaturated fatty acid (PUFA) and n-6 PUFA in sesame oil is twice the amount found in perilla oil, the amount of n-3 PUFA in perilla oil is 43 times greater than that found in sesame oil (Hong & Kim, 1993). In fact, it has been reported that the linolenic acid of perilla oil is 64.82% which is the highest in the plants (Cui, Ding, Xiao, & Dai, 1997).

1.2.6 Meal patterns

Koreans generally have three meals a day. All three meals are similar although breakfast tends to be the lightest meal of the day, especially in urban areas. Korean meals include boiled rice (alone or mixed with other grains), hot soup, one protein-rich

main dish and a variety of side dishes including *kimchi*. Korean foods are not served in courses but served all at once. Each person is served with their own bowl of rice and soup but other dishes are eaten together. Korean side dishes are not as sweet as Japanese dishes and not as oily as Chinese dishes. For example, Korean vegetable side dishes are boiled or steamed before adding some oil (usually sesame or perilla oil) as a condiment whereas Chinese dishes are stir-fried in oil. Spoons and chopsticks are used at the table. Unlike western meals, there is no need to use knives at the table as foods are already cut into small pieces. Fruits are often served as an after-meal refresher. Traditionally fruits are eaten fresh. A barley tea has been the choice of beverage for Koreans for a long time, but more Koreans seem to enjoy just having filtered water nowadays. Consumption of alcohol in Asia is generally very low, but in Korea the levels are similar to those in Europe, North America and Australia, contributing about 4-5% of total energy (World Cancer Research Fund & American Institute for Cancer Research, 1997). However, there is a large gender variation in alcohol drinking among the Korean population as women drink considerably less alcohol than men.

1.3 Dietary Patterns and the Accompanying Nutritional and Health Status of Koreans in Korea

1.3.1 Dietary Patterns of Koreans in Korea

Food patterns and nutritional status of Koreans were reported by the latest Nutrition Survey in 2001. According to the results of the 2001 Survey, Koreans consumed 310.5g of cereals and cereal products, 290.8g of vegetables, 207.4g of fruits, 91.7g of meat and meat products, 64.1g of seafood, and 84.6g of dairy products per day per person. Food consumption reported in the 2001 Korean Nutrition Survey is tabulated in Table 1.1.

Among all foods, rice (white rice) was the single most consumed food item (by weight) by Koreans. It was found that Koreans consumed 215.9g of rice per day per person and that approximately 79Kg of rice was consumed per person per year in the form of rice only, excluding other forms of rice products. The next most consumed foods are Korean cabbage *kimchi* (91.9g per day per person) and tangerines (83.2g per day per person). Rice was also the most frequently consumed food by Koreans where 97.7% of Koreans consumed rice daily. On the other hand, the least frequently consumed food items by Koreans were dairy products (South Korean Ministry of Health and Welfare, 2002). This is probably related to the high prevalence of lactose

intolerance in the Korean population. In fact, it has been reported that Asian ethnic groups are most affected by lactose intolerance as adults (Sahi, 1994). Lactose intolerance is caused by an insufficiency of lactase activity at the brush border in the small intestine. Because the lactose present in dairy products is not hydrolysed, the unabsorbed lactose is fermented by colonic bacteria in the large intestine. The fermentation produces gases, which are responsible for the development of symptoms of lactose intolerance including stomach discomfort, flatulence and acute diarrhoea (Jackson & Savaiano, 2001).

Table 1.1 Average daily food consumption of Koreans by food categories[1]

Food categories (g)	Average	Men	Women
Cereal and cereal products	310.5	342.6	281.6
Potato and starchy foods	26.5	25.7	27.2
Sugar and sugar products	10.9	11.6	10.3
Pulses and pulse products	31.6	36.4	27.3
Nuts and nut products	2.7	2.5	2.9
Vegetables	290.8	316.6	267.6
Mushrooms	4.7	4.9	4.6
Fruits	207.4	179.0	233.0
Marine vegetables	9.0	8.9	9.1
Drinks and alcohols	112.7	141.5	86.8
Spices	31.2	34.6	28.1
Oils (plant)	9.8	11.0	8.7
Other (plant)	5.1	5.0	5.1
Sum of Plant foods	1,052.9	1,120.3	992.3
Meat and meat products	91.7	111.6	73.9
Eggs	21.1	24.5	18.0
Fish and seafood	64.1	73.2	55.8
Dairy products	84.6	90.2	79.5
Fats and oils	0.1	0.1	0.1
Other	0.2	0.2	0.2
Sum of animal foods	261.8	299.8	277.5
Total sum (g)	1,314.7	1,420.1	1,219.8
Proportion of plant food (%)	80.1	78.9	81.3
Proportion of animal food (%)	19.9	21.1	18.7

[1] Data from Korean National Nutrition Survey (South Korean Ministry of Health and Welfare, 2002).

Regional differences were observed in food consumption. The intake of rice and cereals was the lowest in Seoul, the biggest city and the capital of Korea, but similar in other parts of the country. The intakes of meat, dairy products and eggs of rural residents were only approximately 70% of that seen in urban Koreans (South Korean Ministry of Health and Welfare, 2002). This is probably because rural people are more accustomed to the traditional plant-orientated diet whereas urban residents have more Westernised diet, thereby incorporating more animal origin foods into their diet. While daily intake of seafood was over 80g per day per person in coastal areas or areas near the sea, the intake was under 68g in other areas (South Korean Ministry of Health and Welfare, 2002).

The results of the National Nutrition Survey presented in Table 1.1 clearly show that the consumption of plant foods is still dominant in dietary patterns amongst Koreans. In fact, it has been reported that the vegetable intake of over 280g per day per capita is among the highest in Asia (Kim & Popkin, 2000).

1.3.2 Nutrient intake of Koreans in Korea

The average daily intake of energy was 1975.8 kcal, protein 71.8g, fat 41.6g and carbohydrate 315.0g for Koreans. The constituent ratio of energy intake from carbohydrate, protein, and fat was 65.6:14.9:19.5 (South Korean Ministry of Health and Welfare, 2002). This is close to 65:15:20 which nutritionists would term an ideal ratio (The Korean Nutrition Society, 2000). The fat-derived energy in the Korean diet is much lower than that of Western nations. The average daily nutrient intakes of Koreans are presented in Table 1.2.

While vitamin C intake was adequate, total energy, calcium, iron, vitamin A, and riboflavin intakes were found to be insufficient compared to the Korean Recommended Dietary Allowances (RDA). In particular, calcium intake was only 71% of the Korean RDA (South Korean Ministry of Health and Welfare, 2002). This is probably attributable to low consumption of dairy products among Koreans.

The findings from studies suggest that the average daily intake of iron among Koreans was 9-13mg (The Korean Nutrition Society, 2000). Furthermore, the Korean studies reported that iron deficiency was found in 15.7% and 26% of Korean adult females by hypoheamoglobinemia (Hong, Kim, & Kim, 1999) and by serum ferritin levels (Lee, Kim, & Kim, 1997) respectively. These suggest that the problem of iron-

deficiency anaemia may still exist among Korean women even if it may be no longer serious.

Despite the efforts made to decrease the level of sodium intake in Korea, by recommending less discretionary salt use, the sodium intake was still very high in Koreans. It has been reported that Koreans consume up to 20g of salt a day (The Korean Nutrition Society, 2000). This is one of the highest levels reported in the world, along with the Japanese who consume 14-20g of salt per day (Kono, Ikeda, & Ogata, 1983), and where salt-preserved fish is common. Thick stews and *kimchi* are some Korean foods that are high in sodium content as they contain considerable amount of salt. People in rural areas were consuming approximately 5% more sodium compared to their urban counterparts (South Korean Ministry of Health and Welfare, 2002).

Table 1.2 Average daily nutrient intakes of Koreans[1]

Nutrients	Average	Men	Women
Energy (kcal)	1,975.8	2,200.1	1,773.6
Protein (g)	71.6	80.9	63.5
(Animal protein, (g))	(34.3)	(40.0)	(29.0)
Fat (g)	41.6	47.6	36.6
(Animal fat, (g))	(20.1)	(23.9)	(16.8)
Carbohydrate (g)	315.0	340.9	291.6
Fibre (g)	6.6	7.2	6.4
Calcium (mg)	496.9	533.6	463.8
Phosphorus (mg)	1,168.9	1,300.9	1.050.0
Iron (mg)	12.2	13.2	11.2
Sodium (mg)	4,903.4	5,312.0	4,534.9
Potassium (mg)	2,843.9	3,055.9	2,653.0
Vitamin A (RE)	623.8	681.8	571.3
Thiamin (mg)	1.27	1.40	1.13
Riboflavin (mg)	1.13	1.27	1.03
Niacin (mg)	16.9	18.7	14.8
Vitamin C (mg)	132.6	127.5	137.5
Proportion of animal protein (%)[2]	47.9	49.4	45.7
Proportion of Energy from fat (%)[3]	19.5	20.2	18.8

[1] Data from Korean National Nutrition Survey (South Korean Ministry of Health and Welfare, 2002)
[2] Proportion of animal protein (%) = Animal Protein/Total Protein x 100
[3] Proportion Energy from fat (%) = [Energy from fat/Energy from (Protein + Fat + Carbohydrate)] x 100

Although zinc intake was not examined in the National Nutrition Study in Korea, other Korean studies reported that the mean daily zinc intake of adult Koreans was around 5-9mg, which is lower than that of Western nations (Kim, Baik, & Jung, 1999; Oh & Yoon, 1997). It has been suggested that marginal zinc deficiency may be prevalent in Korea due to low zinc intake compounded by low zinc bioavailability (Joung et al., 2004).

1.4 Dietary and nutrition transition in Korea

1.4.1 Dietary transition

Korea has experienced remarkable economic development over the past half century. From the early 1960s to the end of the 1970s, a series of economic development plans were launched and implemented in Korea. From the 1970s to the end of the 1990s, rapid economic progress occurred. This transformed Korea from an agricultural into a highly industrialised country in an extremely short period of time. The GNP and GDP dramatically increased over this period and this economic growth in turn increased national food availability and the consumer purchasing power for foods. Changes in policy also took place and food items were open to importation. Following this, rapid changes in the diet and nutrition of Koreans have occurred.

The total intake of food per capita per day is steadily and gradually increasing. The consumption of cereals and cereal products decreased considerably, from 559.0g in 1969 to 340.5g in 2001. However, the consumption of fruit increased from 48.1g to 207.4g, more than a four-fold increase, in the same period. An even more prominent increase was seen in the consumption of foods of animal origin. The intake of meat, poultry and meat/poultry products increased almost 14-fold between 1969 (6.6g) and 2001 (91.7g). This was in line with the increased supply of these foods (Korean Rural Economy Institute, 2000) which was a result of the improvement of animal husbandry and the promotion of live stock farming (Moon, 1996). The intake of dairy products also increased markedly from 2g in 1969 to 84.6g in 2001, but the increase was most remarkable between 1980 and 1985. This is attributable to an increase in the importation of dairy cows and the growth of the animal-feed industry (Kim et al., 2000). The consumption of fish and shellfish showed a different trend in that it also increased rapidly, but then gradually decreased from 1985 onwards. These changes are directly reflected in the proportion of foods of animal origin during that period where the

percentage of foods of animal origin consumption increased from 3% to 19.9%, almost seven-fold (Table 1.3). The overall intake of vegetables, however, did not change much in the process of transition and vegetables are still the most consumed subsidiary food after staples. The dietary intake trends of Koreans between 1969-2001 are summarised in Table 1.3.

1.4.2 Dietary transition – effect on nutritional status

As a result of this dietary transition, the percentage of energy derived from carbohydrate decreased from 80.3% in 1969 to 65.6% in 2001 and the percentage of energy derived from fat increased from 7.2% to 19.5% during the same period. Despite an almost three-fold increase in fat-derived energy, Koreans still consume less than 20% of energy from fat. On the other hand, protein intake stayed relatively constant, contributing between 13-16% of the total energy. However, the proportion of protein derived from animal sources steadily and remarkably increased from 11.6% in 1969 to 47.9% in 2001. These increases are a reflection of increased consumption of meat, poultry, dairy products and seafood as previously described. Table 1.4 summarises the nutrient data of Koreans between 1969-2001.

In accordance with the increased intake of fruits, vitamin C intake has continuously increased. However, in spite of the large increase in dairy product consumption, calcium is still one of the nutrients in which Koreans are most deficient. Low consumption of milk and dairy products in the diet is most likely to be responsible for low calcium intake in Koreans.

The nutrition transition observed in Korea was somewhat similar to those of other countries in that intakes of cereals decreased while consumption of all animal food products, including dairy products, increased significantly. However, high vegetable consumption and a low rate of increase in fat intake, despite the significant increase in animal food products, are considered to be unique aspects of the nutrition transition in Korea (Lee et al., 2002). In fact, the proportion of energy derived from fat was considerably lower than that of other Asian countries (Kim et al., 2000). China, for example, showed a dramatic increase in fat intake where fat provided over 30% of the total energy intake in 75% of urban households (Popkin, Paeratakul, Ge, Zai, & Gao, 1993).

Table 1.3 Dietary intake per capita per day by food group in the Korean population during 1969-2001[1]

Food categories (g)	'69	'75	'80	'85	'90	'95	'98[2]	'01
Plant foods								
Cereal and cereal products	559.0	474.0	495.0	384.0	344.0	308.9	347.0	310.5
Potato and starchy foods	75.6	54.6	35.8	3.8	43.1	21.2	36.6	26.5
Pulses and pulse products	24.9	31.1	46.9	74.2	58.1	34.7	31.0	31.6
Vegetables	271.0	246.0	301.0	273.0	281.0	286.2	283.5	290.8
Fruits	48.1	22.4	41.3	64.1	68.8	146.0	197.5	207.4
Marine vegetables	0.8	1.9	1.5	3.2	6.0	6.6	7.7	9.0
Drinks and alcohols/ Spices	41.0	17.7	36.6	21.7	34.7	47.6	116.0	143.9
Oils (plant)	-	3.1	4.4	6.9	5.6	7.5	5.7	9.8
Other (plant)	3.5	0.1	0.0	0.0	9.4	11.9	17.5	23.4
Sum of Plant foods	1,024.0	850.0	963.0	867.0	850.0	871.0	1,024.5	1,052.9
Animal foods								
Meat, poultry and meat/poultry products	6.6	14.3	13.6	38.9	47.3	67.0	69.0	91.7
Eggs	4.2	5.1	8.3	20.6	19.5	21.8	22.5	21.1
Fish and seafood	18.2	47.8	65.7	80.6	78.6	75.1	66.3	64.1
Dairy products	2.4	4.7	9.9	42.8	52.2	65.6	87.5	84.6
Fats and oils	-	0.1	0.1	0.1	0.4	0.1	2.1	0.1
Other	0.6	0.0	0.0	0.0	0.0	230.0	0.1	0.2
Sum of animal foods	32.0	72.0	98.0	183.0	198.0	230.0	247.5	1,314.7
Total sum (g)	1,056.0	922.0	1,061.0	1,050.0	1,048.0	1,101.0	1,290.0	1,314.7
Proportion of plant food (%)	97.0	92.2	90.8	82.6	81.1	79.1	80.8	80.1
Proportion of animal food (%)	3.0	7.8	9.2	17.4	18.9	20.9	19.2	19.9

[1] Data from Korean National Nutrition Survey (South Korean Ministry of Health and Welfare, 2002).

[2] The dietary intake was measured by a weighing method at household level until 1995 and by a 24 Hour recall method at individual level from 1998.

Table 1.4 Nutrient intake per capita per day in the Korean population during 1969-2001[1]

Nutrients	'69	'75	'80	'85	'90	'95	'98[3]	'01[5]
Energy (kcal)	2,105	1,992	2,052	1,936	1,868	1,839	1,985	1,975.8
Protein (g)	65.6	63.6	67.2	74.5	78.9	73.3	74.2	71.6
Fat (g)	16.9	19.0	21.8	29.5	28.9	38.5	41.5	41.6
Carbohydrate (g)	423	399	396	342	316	295	325	315.0
% Energy derived from Protein	12.5	12.8	13.1	15.4	16.9	16.1	15.0	14.9
% Energy derived from Fat	7.2	8.6	9.6	13.7	19.9	19.1	19.0	19.5
% Energy derived from Carbohydrate	80.3	80.0	77.3	70.9	69.2	64.8	66.0	65.6
% of animal protein to total protein	11.6	20.6	28.7	41.7	39.8	47.3	48.0	47.9
Micronutrients								
Calcium (mg)	444	407	598	569	517	531	511	496.9
Iron (mg)	24.8	12.4	13.5	15.6	22.7	21.9	12.5[4]	12.2
Vitamin A (RE)[2]	1,400	1,362	1,688	1,846	1,662	443	625	624
Thiamine (mg)	1.76	1.21	1.13	1.34	1.15	1.16	1.35	1.27
Riboflavin (mg)	1.28	0.77	1.08	1.21	1.27	1.20	1.09	1.13
Niacin (mg)	27.8	15.34	19.1	25.7	21.6	16.7	15.7	16.9
Vitamin C (mg)	89.9	78.9	87.9	64.7	81.2	98.3	123.1	132.6

[1] Data from Korean National Nutrition Survey (South Korean Ministry of Health and Welfare, 2002).

[2] Vitamin A is expressed as international unit (IU) until 1990.

[3] The dietary intake was measured by a weighing method at household level until 1995 and by a 24 Hour recall method at individual level from 1998.

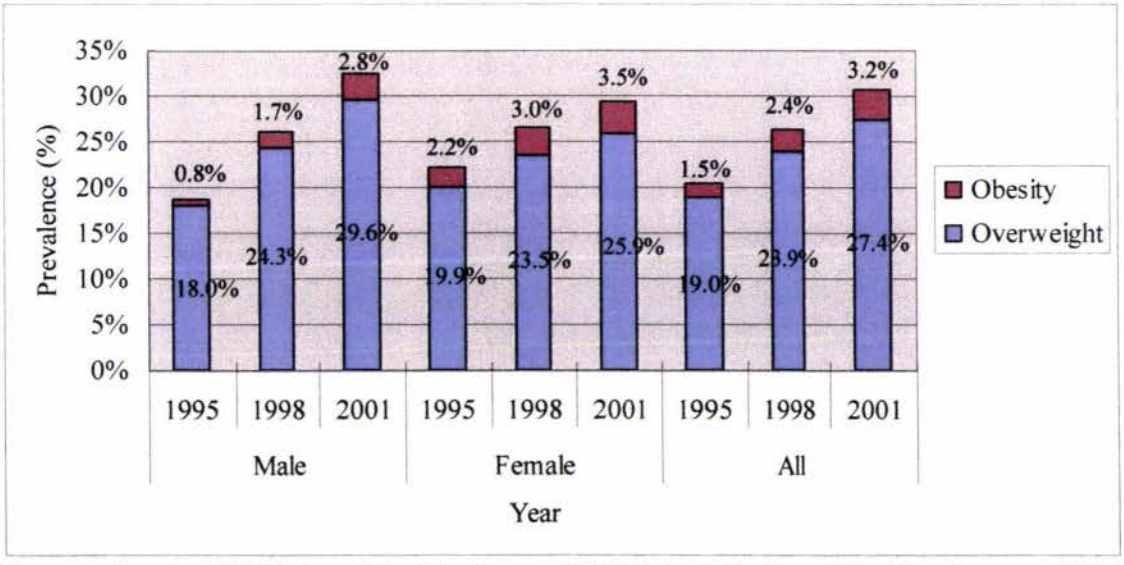
[4] The decreased iron intake at 1998 is mostly due to a correction of iron content of rice from 3.7mg/100g to 0.5mg/100g in the 5th edition of the food composition table.

[5] Data from the 6th edition of the food composition table are used in 2001

1.5 Anthropometry of Koreans

Although there are studies which report height and weight of Koreans, only the national surveys from 1995 have anthropometric data that incorporates international standards for measuring obesity. As classified by the World Health Organisation, Body Mass Index (BMI) of 25.0-29.9 kg/m^2 is considered as being overweight and ≥ 30.0 Kg/m^2 as being obese (International Obesity Task Force, 1998). There is a trend towards a higher prevalence of overweight and relatively lower prevalence of obesity in Koreans (Figure 1.1). However, the proportion of both overweight and obesity is gradually and continuously growing in both men and women. The national representative data suggest that obesity is more prevalent in women while overweight is more prevalent in men in Korea. In 2001, almost a third of the adult population was considered as either being overweight or obese. In particular, the obesity rate has more than doubled between 1995 and 2001 ($\geq$ 20 years old).

Figure 1.1 Prevalence of overweight and obesity among adult Koreans[1]



[1] Data are from the 1995 National Nutrition Survey, 1998 National Health and Nutrition Survey and 2001 National Health and Nutrition Survey (South Korean Ministry of Health and Welfare, 1997, 1999, 2002).

The principal cause of this increasing obesity problem is the adoption of a westernised lifestyle characterised by over-eating, decreased physical activity and sedentary occupations (Moon, 1999).

Although the national Korean surveys incorporate the international standards suggested by the WHO for the BMI categories for measuring obesity, evidence is

accumulating that ethnic differences should also be taken into account when discussing BMI. This is because ethnic groups generally differ in body frame and body composition, and ethnicity is one of the factors affecting the relationship between BMI and percentage of body fat. In fact, it has been reported that Caucasians have a higher BMI for a given level of body fat percentage when compared to other ethnic groups including Asians (Deurenberg, Yap, & Staversen, 1998). Hence, Deurenberg claimed that ethnic-specific cut-off values should be based on the relationship between BMI and percentage body fat, and on morbidity and mortality risks in relation to BMI for specific ethnic groups (Deurenberg, 2001). With other studies further showing the occurrence of obesity related diseases in Asians at a much lower BMI level compared to Caucasians (Deurenberg-Yap, Chew, & Deurenberg, 2002; Moon, Kim, Jang, Yoon, & Kim, 2002), WHO and the International Obesity Task Force reassessed the BMI classification criterion of overweight and obesity for the Asian population and the criteria have been proposed as BMI $\geq$23 and BMI $\geq$25 respectively (International Obesity Task Force, 2002). These are a few units lower than the corresponding reference points, i.e., BMI $\geq$25 for overweight and BMI $\geq$30 for obesity, categorised by the WHO for European populations (WHO, 1997a) and also the cut-off points used in New Zealand (New Zealand Ministry of Health, 1999). Because "Asian" is an umbrella term for many different nations, each with distinct physical characteristics, individual criteria are required for each country. In light of this, the Korean Society for the Study of Obesity (KSSO) has recently established a BMI classification for the Korean population. However, the cut-off criteria set up by KSSO is the same as the classification criteria proposed for Asians by the WHO.

1.6 Disease patterns of Koreans

The dramatic economic growth which has affected dietary and nutrition transition has consequently affected the morbidity and mortality of Koreans.

1.6.1 Morbidity of Koreans

The proportion of Koreans suffering from chronic disease morbidity steadily increased from 29.9% in 1995 to 41.0% in 1998 and to 46.2% in 2001 (South Korean Ministry of Health and Welfare, 2002). According to the National Health and Nutrition Surveys in 1998 and 2001, hypertension was one of the most frequently reported

chronic morbidities in Koreans (South Korean Ministry of Health and Welfare, 1999, 2002).

Hypertension

Almost a third of the population aged over 30 years old is classified as being hypertensive, and the rate of hypertension is increasing. In 1998, 27.8% of the whole population (30.2% for male and 25.2% for female) was hypertensive and this rose to 29.8% (34.4% for male and 26.5% for female) in 2001; hypertension was classified as having either systolic pressure of ≥140mmHg or diastolic pressure ≥90mmHg, or taking anti-hypertensive medication at the time of being tested (South Korean Ministry of Health and Welfare, 1999, 2002).

High sodium intake is known to be implicated in the development of hypertension (Weinberger, 1996). It seems obvious that the generally high sodium intake among Koreans may be related to the high prevalence of hypertension in this population. In addition, the increase in hypertension is probably closely linked to the increase in BMI among Koreans, as studies carried out in various ethnic groups of Asian population indicate that the prevalence of hypertension is comparatively high in Asian population compared to other ethnic groups, at a given BMI (Deurenberg-Yap, Yian, Kai, Deurenberg, & van Staveren, 1999; Hu et al., 2000; Jones, Kim, Andrew, Kim, & Hong, 1994; Ko, Chan, Cockram, & Woo, 1999).

1.6.2 Mortality of Koreans

A shift in the major causes of death - from communicable to non-communicable diseases - is estimated to have taken place around 1970 (Lee et al., 2002). Currently, the major causes of deaths for Koreans are malignant neoplasm and diseases of circulatory systems.

Malignant neoplasm

A stratification of site-specific cancers reveals that the major causes of cancer deaths for Koreans are lung, stomach and liver. Cancers of colon, breast and lung are on the rise. The mortality rate from stomach cancer is steadily decreasing in the Korean population. However, 24.3 deaths per 100,000 of the population were due to stomach cancer in 2003, and stomach cancer still remains one of the leading causes of cancer death in Korea (Korea National Statistical Office, 2004). This is among the highest in

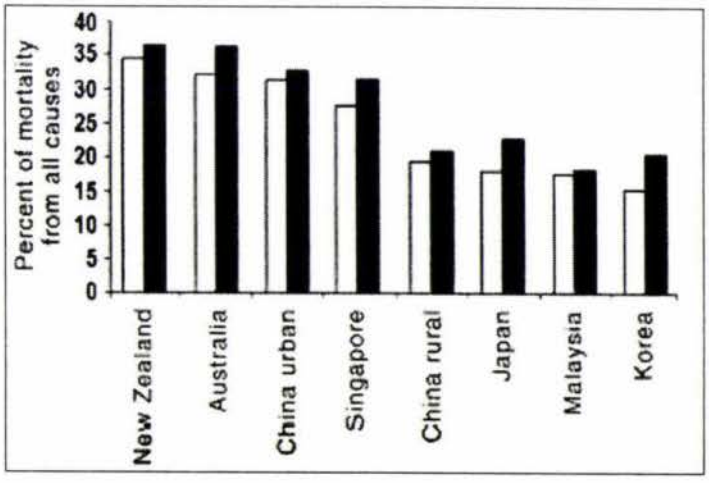
the world along with Japan, and it has been noted that both countries have diets that are traditionally high in salt (Joossens et al., 1996).

Stomach cancer is strongly correlated with a diet that is high in salt, low in animal fat and animal proteins, and high in complex carbohydrates (Correa, 1986). Salt is not a direct acting carcinogen. However, studies suggest that high concentrations of salt destroy the mucous barrier that protects the surface membrane of the stomach, facilitating initiation of target cells by a suitable carcinogen present in the diet and thus acts as a co-carcinogen (Cohen & Roe, 1997; Correa, 1986; Mirvish, 1983). Furthermore, animal models have shown that diets high in salt enhance *Helicobacter pylori* colonisation by inducing cell loss and gastric epithelial hyperplasia, which may lead to gastric carcinogenesis (Fox et al., 1999). Frequent consumption of pickled vegetables was found to be positively associated with prevalence of *Helicobacter pylori* infection (Tsugane, Tei, Takahashi, Watanabe, & Sugano, 1994).

Cardiovascular disease (CVD)

Korea is categorised as an 'intermediate CVD mortality' country, along with Japan and rural China, where total death from CVD is around 20-30% of total death from all causes (Figure 1.2).

Figure 1.2 Cardiovascular disease mortality as percent of mortality from all causes in countries of Asia-Pacific region (1995-1996) (□): male; (■): female. (Adapted from Khor, 2001)



The mortality rate from CVD in Korea is almost half the level in New Zealand and Australia. The rate is also lower than most Asian countries, including China and Japan. However, the picture is different upon the stratification of the CVD mortality into coronary heart disease (CHD) and cerebrovascular disease. The CHD mortality is

highest in New Zealand and lowest in Korea, but cerebrovascular disease is higher in Korea than in most other countries in the Asia-Pacific region (Figure 1.3 and Figure 1.4) (Khor, 2001). In fact, it has been reported that cerebrovascular disease accounts for more than 50% of total cardiovascular mortality in Korea (Kesteloot & Zhang, 2000).

Figure 1.3 Coronary Heart Disease mortality rates in the Asia-Pacific region. (□), male; (■), female. (Adapted from Khor, 2001)

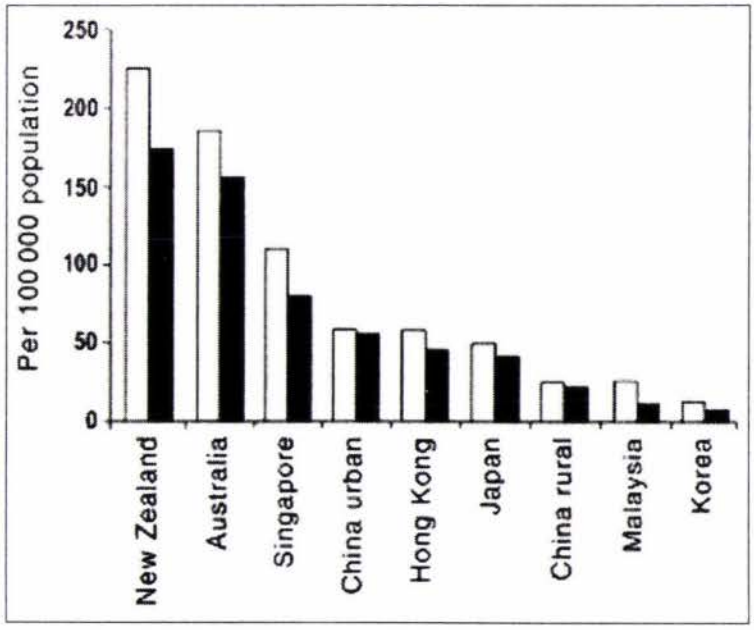
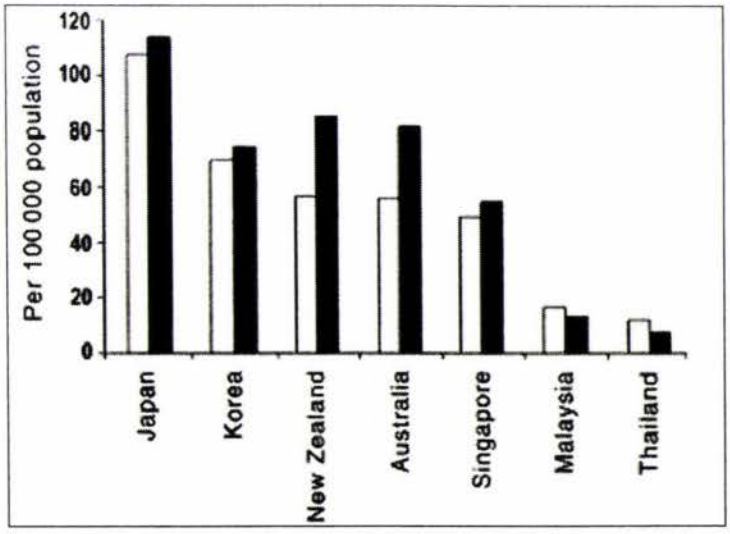


Figure 1.4 Cerebrovascular Disease mortality rated in the Asia-Pacific region. (□), male; (■), female. (Adapted from Khor, 2001)



The high mortality rate from cerebrovascular disease and exceptionally low mortality rate from CHD among Koreans are probably closely linked to their dietary

habits. The consumption of saturated fat and cholesterol, which are two of the most atherogenic dietary risk factors for CHD (American Heart Association The Nutrition Committee, 1997), is low among Koreans because the intake of animal foods are low. Moreover, the high intake of plant foods, which lower serum cholesterol concentrations through the protective effect of dietary fibre (Anderson et al., 2000; Erkkila, Sarkkinen, Lehto, Pyorala, & Uusitupa, 1999; Kushi, Meyer, & Jacobs, 1999; Rimm et al., 1996), through the reduction of plasma homocysteine levels by folate and other B group vitamins (Rimm et al., 1998) and through the protective effect against in vivo lipid peroxidation of antioxidants (Miller, Appel, & Risby, 1998), may explain the extremely low mortality rate of CHD among Koreans.

On the other hand, the traditionally high salt diet of Koreans may explain the high mortality rate from cerebrovascular disease in Korea, as clinical and experimental evidence suggests that salt intake is directly related to cerebrovascular disease. Japanese research (as cited in Meneton, Jeunemaitre, de Wardener, & Macgregor, 2005) demonstrated that the incidence of cerebral hemorrhage was the highest in the regions where people consumed about 27g of salt per day (with individual levels up to 60 g/day) whereas a much lower prevalence of cerebral hemorrhage was reported in regions where residents consumed 14g salt per day.

1.7 Nutrition and Health of Migrants

When migrants arrive in a new country they often bring with them their own dietary culture, together with their traditional beliefs relating to food. However, as they assimilate into the host country blending of the two cultures results. The process by which migrants adopt the eating patterns of the host country and make changes to their traditional diet is referred to as dietary acculturation (Negy & Woods, 1992). Because dietary acculturation is a complex multidimensional process, how dietary change occurs within the larger process of sociocultural acculturation is currently poorly understood (Berry, 1980). However, there is little doubt that changes in food consumption patterns of migrants begin to mirror that of the host country after immigration. Most studies relate to migration of other Asian, such as Chinese and Japanese, and Hispanic populations into USA.

1.7.1 Dietary changes of migrants

One of the first studies pertaining to the dietary practices of Chinese migrants in the USA reported that the frequency of rice consumption decreased after immigration, while the frequency of hot and cold cereal use at breakfast increased. The respondents in this study also reported that they ate more meat, dairy products and beverages such as soft drinks and alcohol drinks, but less seafood (Grivetti & Paquette, 1978). Findings from other migrant studies also showed that migrants were keeping certain traditional dietary practices while incorporating some foods from the host culture (Lee, Sobal, & Frongillo, 1999; Satia-Abouta et al., 2000).

However, as Chinese migrants assimilated into the dominant society, the frequency of traditional food consumption decreased (Grivetti & Paquette, 1978). Similar findings have been observed from studies of Japanese (Wenkam & Wolff, 1970) and Hispanic migrants in the USA (Romeo-Gwynn et al., 1993). While the consumption of traditional foods such as vegetable and complex carbohydrates had decreased in the process of assimilation, most of the new foods adopted in the host country were foods rich in animal fat and simple sugars (McGee, Reed, Yano, Kagan, & Tillotson, 1984; Romeo-Gwynn et al., 1993; Wenkam & Wolff, 1970). For example, the fat intake among Mexican Americans has increased as a result of adopting foods which include butter, mayonnaise and sour cream (Romeo-Gwynn et al., 1993). Although findings have been inconsistent as some studies report no associations (Lee et al., 1999) or inverse association (Elder et al., 1991; Woodruff, Zaslow, Candelaria, & Elder, 1997) between acculturation and dietary fat intake, typically, dietary acculturation is positively associated with fat intake (Pan, Dixon, Himberg, & Fatma, 1999). This has been observed across different ethnic groups including Chinese (Satia-Abouta et al., 2001), Japanese (Huang et al., 1996) and Mexicans (Neuhouser, Thompson, Coronado, & Solomon, 2004).

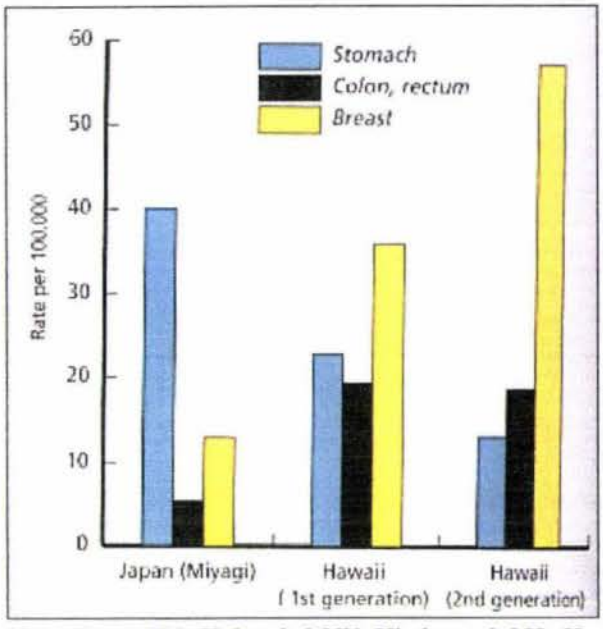
The dietary changes of migrants are particularly well established in generation-specific studies. The Japanese American study found that while second generation Japanese Americans consumed a diet closer to the traditional Japanese diet, their succeeding generation consumed more westernised foods that are high in fat, sugar and calories (Kudo, Falciglia, & Couch, 2000). The changes in dietary habits of migrants inevitably led to changes in disease patterns.

1.7.2 Changes in disease risk

Evidence is accumulating that the changes in dietary patterns and physical activities of migrants consistent with the Western lifestyle appear to result in an increased incidence of degenerative diseases such as cancer (Parker, Davis, Wingo, Ries, & Health, 1998). In particular, dietary habit has been suggested as an important cause associated with increased morbidity and mortality from these degenerative diseases (Huang et al., 1996). For example, the percentage of energy from fat in the diet of American Chinese was found to be higher than that of native Chinese (35% vs 22% respectively) (Lee et al., 1994), and this is thought to be strongly related to the three times higher incidence rate of colorectal cancer in American Chinese compared to the rate observed in native Chinese (Parkin, Whelan, Ferlay, Raymond, & Young, 1998). Moreover, a near doubling of risk has been reported for breast cancer among Asian migrants after 10 years of residence in America (Wu & Bernstein, 1998). The risk of CHD was also reported to be increased with the length of residence in the USA in Chinese migrants (Gerber & Madhaven, 1980). Similarly, increased prevalence and mortality from CHD have been reported in Japanese migrants to the USA and Indian migrants to UK compared to their native counterparts in Japan (Yano et al., 1988) and siblings in India (Bhatnagar et al., 1995) respectively.

Generation-specific studies further provide compelling evidence of the contribution of diet in the changes of disease patterns among migrants. Kolonel et al. (as cited in World Cancer Research Fund & American Institute for Cancer Research, 1997) demonstrated the contrasting patterns of cancer incidence among native Japanese and Japanese migrants of successive generations in Hawaii. While stomach cancer rates dropped in the migrant cohorts, cancer rates of colon/rectum and breast increased significantly in both migrant generations. The difference in rates of stomach and breast cancers was particularly noticeable between the native Japanese women and the second generation Japanese migrants (Figure 1.5). As changes in the food consumption patterns of migrants mirrored that of the host country, the disease pattern of migrants also accordingly mirrored that of the host country.

Figure 1.5 Cancer incidence for selected cancers in Japanese women by generation in Hawaii and Japan, 1968 – 1977.



Note. From J.N. Kolonel, M.W. Hinds, and J.H. Hankin, 1980, Cancer patterns among migrants and native-born Japanese in Hawaii in relation to smoking, drinking, and dietary habits In: Gelboin, H.V. et al (eds) *Genetic and Environmental Factors in Experimental and Human Cancer* (pp327-340) Tokyo: Japan Sci Soc Press as cited in *Food, Nutrition and the Prevention of Cancer: A global perspective*, 1997 Washington DC: American Institute for Cancer Research

1.7.3 Nutrition and Health of Korean migrants

The immigration history of Koreans is relatively short compared to other ethnic groups and it was not until the early 1990s that Korean migrant health studies began to be conducted in the USA, the country where most migrant Koreans are living. Consequently, relatively little is known about the dietary acculturation and its implication for health in Korean migrants. In particular, there are only limited studies on nutrient intakes. However, findings from previous investigations on dietary intake of Korean migrants to the USA suggest that Korean-Americans prefer Korean traditional foods (Gordon, Kang, Cho, & Sucher, 2000; Ludman, Kang, & Lynn, 1992), though the consumption of traditional Korean foods tends to decrease with acculturation (Lee et al., 1999; Park, Paik, Skinner, Ok, & Spindler, 2003).

1.7.3.1 Food patterns of Korean migrants

Many of the traditional food habits of Korean migrants have been reported to

continue after immigration. In a survey of Korean Americans in the San Francisco Bay area, rice remained as a staple food with nearly all respondents consuming rice at least once a day. This study reported that *kimchi* consumption was also maintained with almost 80% of respondents consuming *kimchi* daily (Gordon et al., 2000). Other Korean American studies also report maintenance of rice and *kimchi* as core dietary elements (Lee et al., 1999; Ludman et al., 1992).

Kim, Yu et al. (2000) reported increased intakes of meat, fruits and dairy products after immigration to America. Despite the fact that milk is not traditionally consumed in Korea, increased milk consumption was also reported by Korean migrants in California and Connecticut, USA (as cited in Kim & Chan, 2004). Studies of adult Korean Americans in the San Francisco Bay area (Gordon et al., 2000) and pregnant Korean American women in New York (Ludman et al., 1992) also reported increased consumption of milk and dairy products with nearly half of respondents reporting daily consumption of milk in both studies. This was consistent with the results from a nationwide survey of Koreans in the USA (Lee et al., 1999). Such changes in the dietary pattern show that these foods were more accepted as part of the diet in the USA. The increased consumption of milk and dairy products is thought to be due to the availability and lower cost of milk in the USA (Kim et al., 2000). The adaptation to lactose consumption observed in Korean migrants is discussed later in section 4.3.2.

1.7.3.2 Diet quality and nutrient intake

A study conducted by Cross et al. investigated the diet quality of middle-aged and older adult Korean Americans in Chicago. The respondents obtained highest scores for grains, vegetables, total fat, saturated fat, and cholesterol and lowest scores for sodium and dairy (Cross, Kim, Yu, Chen, & Kim, 2002). Although the score for dairy was found to be low, milk was a main source of calcium for Korean Americans in this study (Cross et al., 2002). Despite the increased intake of milk and dairy products generally observed in Korean Americans, calcium intake among Korean Americans was found to be inadequate (Kim, Yu, Liu, Kim, & Kohrs, 1993; Kim, Kohrs, Twork, & Grier, 1984). However, because the consumption of *kimchi* and other vegetables was high in Korean migrants, it was thought that the intake of vitamin C, vitamin A, folate, riboflavin, and niacin would likely be adequate (particularly as vegetables including *kimchi* are among the best sources of these nutrients) (Cross et al., 2002).

1.7.3.3 Acculturation and food patterns

Research conducted by Lee, Sobal et al. (1999) was one of the first and most comprehensive investigations of acculturation and dietary practices among Korean Americans at a national level. The study reported that frequently-eaten Korean foods included rice, *kimchi*, garlic, green onions, Korean soups, sesame oil, Korean stew, bean paste and chilli bean paste; while frequently-eaten American foods included oranges, low-fat milk, bagels, tomatoes and bread. Frequently consumed foods common to both cultures were onions, coffee, apples, eggs, beef, carrots, lettuce, fish and tea. The researchers found that Korean Americans consuming a more typical US diet had lived in the USA for a mean of 19 years and were more acculturated (acculturation measured by scores based on acculturation indicators such as English proficiency, American education, and length of stay). The researchers also found that acculturation was significantly positively associated with frequency of consumption of US foods and negatively associated with frequency of consumption of traditional Korean foods. This is consistent with the results of the study on Korean women in Connecticut, USA (as cited in Kim & Chan, 2004), which found that higher acculturation level was associated with less frequent consumption of traditional Korean foods. Another study conducted by Kim and Chan (2004) in New York, USA, reported similar findings in that low-acculturated migrants tended to consume significantly more traditional foods, such as rice and *kimchi,* whereas high-acculturated migrants tended to consume significantly more non-traditional foods, such as bread, cereal, pizza, chocolate, and diet soft drinks. Despite the different dietary intakes associated with degree of acculturation, Lee et al. (1999) reported that fat intake, dietary quality and dietary diversity did not vary according to acculturation status.

1.7.3.4 Acculturation and nutrient intakes

Although changes of food patterns in migrant Koreans have been investigated, there are extremely limited studies on nutrient intakes relating to acculturation. However, a recent New York based study found that acculturation was statistically significantly associated with some nutrients. The study reported that higher acculturation was related to higher intake of percent energy from total fat, thiamine, vitamin E, and folate and that lower acculturation was related to greater intake of sodium, niacin and dietary fibre (Kim & Chan, 2004). Similar findings were reported from a Connecticut based study (as cited in Kim & Chan, 2004), which found that fat intake was higher in the more acculturated group. Despite the increased fat intake associated with acculturation, the fat intake of both low and high acculturation groups

was still lower than that of general US population in both studies (Kim & Chan, 2004). On the other hand, fat intake was found to have no association with acculturation in a nationwide study of Koreans in the USA (Lee et al., 1999). Accordingly, these findings support the results of an earlier study that Korean migrants tend to maintain their traditional dietary habits more compared to other Asian ethnic groups (Kim et al., 1993).

1.7.3.5 Disease patterns of Korean migrants

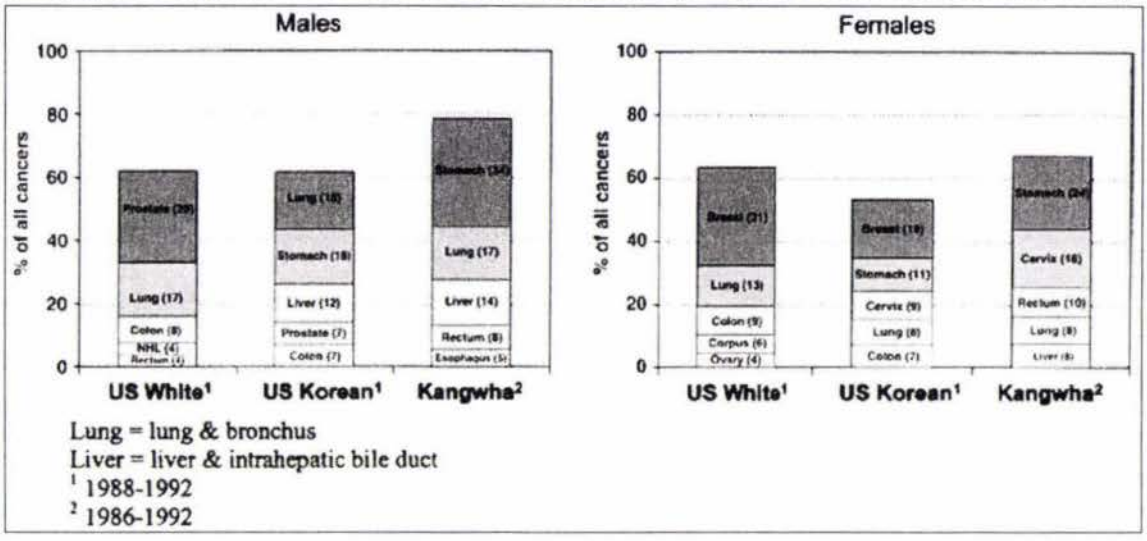
Despite the growing numbers of Koreans relocating across different continents, inter-country research on disease prevalence or incidence on Korean populations is very limited. However, the following patterns have emerged:

Gomez et al. (2003) investigated the differences in cancer incidence patterns between Koreans in the USA, native Koreans in Korea and US whites. The study found that while stomach cancer was the most common cancer in native Koreans in both males and females, the rates among US Koreans was half that of their Korean counterparts. However, the incidence was still higher than in US whites. On the other hand, rates of prostate and breast cancers were noticeably higher in US Koreans than their Korean counterparts, being the fourth and the most common cancers among US Korean males and females respectively, but the incidence of these cancers was lower than in US whites. The incidence of colon cancer was also intermediate in US Koreans (fifth most common cancer in both genders) compared to colon cancer incidence in US whites (third most common cancer in both genders) and native Koreans, where colon cancer did not rank amongst the top 5 cancers. The findings of this study are graphically illustrated in Figure 1.6. The findings from this study show some resemblance to the Japanese study presented earlier in Figure 1.5.

A study which investigated cardiovascular risk factors in elderly Koreans in Australia and Korea found that Australian Koreans had increased cardiovascular risk factors, such as increased adiposity, compared to their Korean counterparts. In particular, central obesity was found to be associated with the years of residency in Australia. More Australian Koreans were found to have abdominal obesity (measured by WHR) above the CVD risk threshold, though Australian Koreans were not more obese than native Koreans. However, no difference was found in lipid profiles between the two cohorts. The researchers indicated that both Koreans and Australian Koreans have favourable cardiovascular profiles compared to the general Australian population, despite some of the differences observed in the two Korean cohorts (Richman et al., 2000). Such profiles found among Australian Koreans may be due to the relatively short residence of

respondents in the host country (mean length of residency in Australia was 11.8 ± 6.2 years). The changes in disease patterns exhibited by Korean migrants are probably related to the changes in lifestyle, including dietary habits.

Figure 1.6 The five cancers contributing most to overall cancer incidence burden, among US Whites, US Koreans and native Koreans (Adapted from Gomez et al., 2003).



1.7.4 Migrants in New Zealand

There are only a few published studies that investigated the diet and nutrition of Asian migrants in New Zealand. However, the dietary patterns found in Asian migrants in New Zealand are similar to those reported in other migrant studies.

The study by Tan (2001) that examined the dietary changes of mainland Chinese women living in Auckland (aged between 20-45 years) found that migrant Chinese had excessive fat-derived energy but low carbohydrate-derived energy. Inadequate intake of calcium and high intake of sodium were also identified as the main nutritional problems in this population. A trend towards increased fat intake was also noted in migrant Chinese children (aged between 7-10 years) living in Auckland (Lu, 2002). Another Chinese study that investigated the food consumption patterns of pre-school Chinese children living in Dunedin reported that less than 40% of children were eating the recommended number of servings of fruits and vegetables (Soh, Ferguson, & Wong, 2000).

1.7.5 Korean migrants in New Zealand

The wave of Asian immigration into New Zealand began in the late 1980s when the government introduced the 'open door' immigration policy (Tay, 1996). However, it was not until the early 1990s that the majority of Koreans emigrated to New Zealand and therefore the immigration history of Koreans to New Zealand is relatively short. Nonetheless, the latest census reported that Koreans are the third largest Asian ethnic group in New Zealand after Chinese and Indians, comprising 8% of the New Zealand Asian population (Statistics New Zealand, 2002). In fact, Koreans experienced the highest rate of growth among all ethnic groups of New Zealanders when this group increased by more than 20-fold from 930 in 1991 to 19,023 in 2001 (Statistics New Zealand, 2002). Most Koreans live in Auckland and Koreans comprise 9% of the Auckland Asian population (Ministry of Health, 2003).

Despite the marked increase in the number of Korean immigrants, to date no studies have examined the nutritional outcomes resulting from the migration of Koreans to New Zealand. Hence, a study is needed to determine the dietary habits and the impact of the diet on risk factors for health and disease among Korean migrants.

1.8 Aims of the study

Migration affects an individual in many ways that may lead to changes in dietary intakes. Exposure to a different food culture and food supplies in New Zealand may affect food choices and the dietary intakes of Korean migrants in New Zealand.

Women generally tend to be more involved and therefore have greater responsibility in the selection and preparation of food than men. It has been found that married women contribute more to their husband's dietary quality than the reverse (Schafer, Schafer, Dunbar, & Keith, 1999). In Korea, women traditionally have the principle responsibility for feeding the family, and as primary caregivers the behaviour of women is particularly important for the diet and health of the family unit. In addition, middle-age is a stage in life where risk for chronic disease may increase. Furthermore, middle-age is also considered an important age group as it is the time during which some unique physiological changes occur, particularly in women. As a result, the nutritional status of women in this age bracket is of interest in the field of nutrition because it may consequently affect morbidity and mortality. Therefore, this pilot project

will study the dietary habits of migrant Korean women aged between 40 and 55 years.

Any migrant population is generally mobile. Moreover, those who have entered New Zealand with a Long Term Business Visa, which was introduced from 1999, are not guaranteed permanent residency in New Zealand at the time of arrival and therefore may have only temporary residency. Because it is likely that immigration status is associated with lifestyle characteristics of migrants (Gomez, Kelsey, Glaser, Lee, & Sidney, 2004), the more permanent residents of New Zealand will be included in this study. Hence, only those who have lived in New Zealand for 5 years or more will be recruited for this study. Furthermore, assessing the dietary intakes of individuals with a relatively long residence in New Zealand and gaining an understanding of the adaptation process of acculturation of Koreans in New Zealand who have migrated to New Zealand may help current and future migrants of Korean descent to establish healthful dietary habits and lifestyle.

The aims of this study are:

1. To assess dietary intake, activity level, body composition, body fat distribution, blood pressure and blood glucose level in a sample of middle aged (40-55 years) migrant Korean women who have lived in New Zealand for 5 years or longer.

2. To assess overall nutritional status of this group and analyse both positive and negative aspects of their current nutritional and health practices with a view to suggesting modifications for improvement, if necessary.

3. To compare the data from this group with that from national studies of health and nutrition in New Zealand and Korea and investigate if there are any differences with respect to their overall nutritional status.

CHAPTER 2. METHODOLOGY AND METHODS

2.1 Preparation for the Study

The study is comprised of three main sections: questionnaires, 24-dietary recalls and body measurements. The questionnaires were piloted on seven Korean women who qualified to participate in this study. The eligibility criteria for study subjects in this study are Korean females aged between 40 to 55 years who have lived in New Zealand for at least 5 years. Those with known medical conditions or serious diseases such as renal failure, diabetes and liver disease were excluded as people with such conditions are thought to be practicing an atypical diet. The feedback from this pilot survey, such as order of questions, was incorporated into the final version to improve the quality of the questionnaires. The poster for advertisements, information sheets and consent forms were prepared and translated into Korean. The questionnaires were not translated, as these were to be researcher-administered.

The finalised questionnaires and other relevant documents were submitted to the Massey University Human Ethics Committee for the approval of the research procedures involving human subjects. Ethical approval was obtained (see Appendix 2) and in accordance with its policies, written informed consent to participate in the survey was obtained from the volunteers before the study commenced (see Appendix 5).

2.2 Study Promotion

For greatest exposure to the Korean community, the study was advertised through various media and social networks to enlist participants. The advertisement was placed in popular Korean magazines and newspapers published in Auckland. The poster was also placed at Korean supermarkets, grocery stores, and restaurants. In terms of social

networks, a Korean General Practitioner and a pharmacist whose clients were mostly Korean agreed to promote public awareness of the study by inviting volunteers to take part. The advertisement was placed on their respective notice boards. Lastly, the study was promoted via different religious communities (including churches, catholic churches and the Buddhist community).

2.3 Subject Recruitment

Women who were interested in participating in the study contacted the researcher by phone or email. Volunteers who fulfilled the eligibility criteria were then sent information sheets providing a detailed description of the study, including the experimental protocol and their rights as a participant. Two diabetic women who had made an enquiry were not able to take part in the study because they met one of the exclusion criteria. A total of 50 participants were identified; fifteen women recruited through the advertisements and the rest recruited through the personal networks of the researcher and of the 15 volunteers who contacted the researcher through the advertisement. All participants were made aware that they could withdraw from the study at any time up to the completion of the data collection at visit three. Any questions raised by the volunteers regarding the study were answered. All volunteers provided written informed consent before proceeding with the study (see Appendix 5 for the consent form). Each participant was told that she would receive a summary of the study results as well as a brief analysis of her individual nutrient intake, body composition, blood pressure and blood glucose profile results at the end of the study (see Appendix 7).

The participants came from all areas of greater Auckland. The greatest number of participants came from the North Shore district. This was expected because the Korean population density has been reported to be the highest in this area (Ministry of Health, 2003).

One interesting question raised by two volunteers before the study began was around the use of the English language throughout the study. They expressed hesitation about participating in the study if it involved any English. Although the researcher had

already decided to carry out the entire study in Korean, including the questionnaires, such disclosures by the participants may be noteworthy for future studies, particularly if the study were to be done in older populations.

2.4 Data Collection Programme

Data were collected over three visits at times and venues suitable to each participant. Data collection included questionnaires, dietary intake measurements and anthropometric and biochemical measurements. Each visit took approximately an hour and the programme is described as follows.

2.4.1 Visit one

Each participant completed the first researcher administered questionnaire and a first 24-hour dietary recall. The first questionnaire was to determine dietary and physical activity patterns of the participants.

2.4.2 Visit two

The second 24-hour dietary recall was carried out and the various body measurements were made. These included anthropometric measurements, body fat measurement using a Bioelectrical Impedance Analysis (BIA) machine, and blood pressure. The details of anthropometric measurements, body fat measurement using BIA machine and blood pressure measurements are described in appropriate sections of 2.5.3.

2.4.3 Visit three

The third and final visit consisted of the third 24-hour dietary recall and a second questionnaire that contained demographic and medical questions. Finally, the blood

glucose level was measured. The details of blood glucose measurements are described in 2.5.3.8.

2.5 Data Collection Procedure

2.5.1 Questionnaires

The questionnaire was in English. However, the questions were researcher administered using Korean so that language was not a barrier for any participants who may not have been comfortable with English. The researcher had prepared a copy of the questionnaire in Korean to provide consistency in translation while administering the questionnaire.

The questionnaire was in two sections. The first questionnaire was related to the dietary and physical activity patterns. It covered food consumption patterns and physical activity questions, such as physical activity levels and frequency of exercise. Questions on food consumption were asked because they provide useful information about how dietary changes occur. Furthermore, they also suggest what possible effects such changes can have for health outcomes (Romeo-Gwynn et al., 1993).

The second questionnaire was related to demographic, socioeconomic and medical details covering dietary habit change made since migration to New Zealand, health and nutrition beliefs, awareness of nutrition materials in New Zealand, health and medical related questions and other general questions. Questions relating to factors that have been shown to influence food choice and dietary acculturation were selected from the published studies and are discussed as follows.

Demographic factors

Numerous studies have shown that the length of residence in the host country, education, and proficiency in English language are closely related to the food habits of migrants. The longer the duration in the host country, the higher the levels of education and proficiency in English, the more dietary acculturation towards the host country may

be observed (Lee et al., 1999; Negy & Woods, 1992; Satia-Abouta et al., 2001). Proficiency in English language was further divided into reading competency and verbal proficiency, given that these factors may not necessarily be equal. A question on household composition was also included as different members of family may exert different in-family normative pressure in terms of dietary changes. For example, having young children in the family was shown to influence adopting new foods, particularly with bilingual children (Tan & Wheeler, 1982). On the other hand, having elderly members in the household may act to maintain the traditional diet.

Socioeconomic factors

Purchasing power is considered to be one of the most fundamental considerations in dietary studies (Freedman, 1974). Axelson (1986) further emphasises the importance of household economy as one of the major determinants of food habits in migrant populations. Hence, household income was determined instead of single income (income of the respondent). In addition to the income, questions regarding occupation and house ownership were also asked in order to provide further information around the social status of subjects and their wealth.

Psychosocial factors

Although investigated in Caucasian populations, studies have reported that psychosocial factors such as nutrition knowledge and beliefs are determinants of selecting diets (Glanz & Erickson, 1993; Kristal et al., 1995). Satia-Abouta et al. (2002) further proposed that, along with demographic and socioeconomic factors, psychosocial factors are also part of the acculturation mechanism in migrants. Hence, questions regarding psychosocial factors, such as belief in a relationship between diet and health, attitudes about whether the traditional Korean diet is healthier than a Western (Kiwi) diet, and awareness of nutrition information based on the above publications were asked. Furthermore, potential barriers in maintaining a traditional Korean diet, such as availability and cost, were also asked.

The final questionnaires are included in Appendix 6.

2.5.2 24-hour dietary recall

There are different methods for assessing the dietary intake of individuals, each with their own strengths and limitations. In this study, the 24-hour dietary recall was used to assess the dietary intake of study subjects. This method was thought to be the most appropriate method for this study for the following reasons. Firstly, it does not require literacy, which can be considered as the major strength. Secondly, because the data are collected after foods have been consumed there is less potential for individuals to alter their reported dietary habit, as compared to the food record method where the growing list of foods eaten throughout the day may cause individuals to alter their diet. Thirdly, a lighter burden is placed on the respondents and compliance is therefore generally higher. Lastly, it is a relatively inexpensive and quick method to estimate nutrient intakes.

However, there are several limitations in 24-hour dietary recall method. The major limitation is its reliance on the subject's memory. It requires the respondent to be able to identify foods eaten and to estimate accurately the portion sizes consumed. Furthermore, this method requires a degree of motivation on behalf of the respondent and persistence on the behalf of the interviewer (Acheson, Campbell, Edholm, Miller, & Stock, 1980). Another issue with 24-hour dietary recall method is 'flat slope syndrome' (Gersovitz, Madden, & Smiciklas-Wright, 1978). This phenomenon is where individuals have a tendency to overestimate low intakes and underestimate high intakes. In addition, even with several 24-hour dietary recalls from one person, it may not be possible to measure intake of infrequently consumed foods, when using this method (Liu, 1992).

Although a single use of 24-hour dietary recall is most appropriate for assessing average intakes of foods consumed, and is therefore very commonly used (Pao & Cypel, 1996), it provides a poor description on respondent's usual nutrient intake. This arises from the difference between day-to-day dietary intakes of people, sometimes referred to as intraindividual variability (Feskanich & Willett, 1993). To compensate for this, 24-hour dietary recalls were repeated in this study. Furthermore, dietary intake data of two weekdays and one weekend day were collected to take account of the possible variation in food consumption between weekdays and weekend. However, day-to-day variation in nutrient intakes was not assessed.

At each of three visits, respondents were asked to recall and report all the foods and beverages consumed in the last 24-hours (using the three step interview procedure). First, a list of all the foods they had eaten was recorded. Then a detailed description of each food and drink was recorded. This included the name, cooking method, amount or volume consumed, any accompaniments to the food and the brand if necessary. Amounts and volumes of the food eaten were measured using a digital scale at the time of interview in the participant's home. When this was inconvenient, estimates of portion size were made using measuring cups and spoons and other visual aids. In particular, photographs of portion sizes of common Korean dishes published from Korean Dietetic Association were used to help respondents to identify the amount of Korean food consumed. Finally, the researcher reviewed the foods eaten by the respondents. The foods listed by the respondents were read out in chronological order and checked for any missing foods including sauces and condiments, drinks, or any dietary supplements that had been eaten.

Korean families usually share main and side dishes at the dining table, except rice and soup. In addition, traditionally Koreans are not accustomed to measuring weight and volumes of the ingredients when cooking. Due to these eating habits, it was anticipated that estimating the portion sizes of foods consumed would be relatively difficult. However, having subjects who were aged between 40 and 55 with many years of cooking experience along with the aid of the photographs, estimation of portion sizes was achieved more easily than expected.

2.5.3 Body Composition Measurements

The body composition measurements included anthropometric measurements and body fat measurement using BIA. The researcher had undertaken specific training in anthropometric techniques and had qualified as a level one anthropometrist prior to the study. All anthropometric measurements were made in accordance with the International Society for the Advancement of Kinanthropometry (ISAK) standards. The measurements were all made by the researcher. The following measurements were made and the data recording sheets for all body measurements are shown in Appendix 6.

2.5.3.1 Height

Height was measured using a portable stadiometer with a metal tape fixed on the wall by means of a vertical plate. The subjects were asked to remove their shoes and stand with their feet flat on a hard flat floor. They stood with back, shoulder blades and buttocks against the wall and heels close together and against the wall. The subjects were asked to breathe in deeply and stretch to their fullest height, without altering their head position. The stadiometer bar was gently lowered onto the subjects head. The readings were taken to the nearest tenth of a centimeter. The measurements were repeated until readings of three measurements were within 0.5 cm of each other.

2.5.3.2 Weight

Weight was measured using Tanita digital balance scale (Model 1609N), accurate to ±0.1 kg. The scale was put on a hard flat floor. The subjects were asked to remove their shoes and dress in light clothing. They were then asked to stand still over the center of the platform with body weight evenly distributed between both feet, arms hanging loosely by their side and head facing forward. Weight was measured three times, each reading to the nearest 0.1 kg. The scale was regularly calibrated using a 5 kg weight between measurements.

BMI

The height and weight measurements were used to obtain the Body Mass Index (BMI). BMI was calculated as weight (in kilograms) divided by square of height (in metres). The BMI is commonly used to classify individuals' weight status: as underweight, overweight, or obese, and to identify individuals at risk for obesity-related diseases (International Obesity Task Force, 1998). In fact, it has been established that BMI is a significant predictor of type 2 diabetes and cardiovascular disease (Janssen, Heymsfield, Allison, Kotler, & Ross, 2002). It is widely used as it is a simple measurement to identify 'at-risk individuals'. However, one of the biggest limitations with BMI is the fact that it does not take into account the composition of an individual's body weight. This may result in misclassification of underweight, overweight and obesity.

2.5.3.3 Skinfolds

Skinfold measurement is one of the commonly used methods in assessing body composition as it is simple to obtain and less affected by hydration status than weight and height (Chernoff, 1991). In this method, body fat is estimated by measuring the thickness of the subcutaneous fat layer at different body sites using a skinfold caliper. Typically, two to eight different sites are selected for skinfold measurement. In general, it is recommended that one limb skinfold (triceps) and one body skinfold measurement (subscapular) are taken. This is to account for the differing distribution of subcutaneous fat because no single body region appears to have skinfold sites which are representative of the whole subcutaneous fat layer (Siervogel, Roche, Himes, Chumlea, & McCammon, 1982). Also these two sites are often used because the triceps and subscapular skinfolds thickness have been used as relative measures of extremity and truncal obesity respectively. Hence, the researcher had decided to measure triceps and subscapular skinfold thicknesses for this study.

The triceps skinfold was measured at the midpoint marked on the posterior side of the upper right arm. To mark this midpoint, a line was marked horizontal to the mid-acromiale-radiale line, that is, between the acromion process (the bony protrusion on the posterior of the upper shoulder) and the head of the radius (the lateral dimple of the elbow) using an anthropometric tape. The researcher then marked with a pen the intersection of this horizontal line with a vertical line that was at the most posterior surface to indicate the midpoint. The researcher grasped a vertical triceps skinfold at the previously marked point with the left thumb and index finger. The caliper was applied to about 1 cm distally from this skinfold and held for approximately two seconds before the reading was made.

The subscapular skinfold was measured on the subscapular point marked at the back of right shoulder blade. To mark this midpoint, the researcher palpated along the border of the scapular and identified the interior angle of the scapular. Participants were asked to place their arm behind the back to assist the identification of the site, when necessary. However, the site was not marked until the arm was returned to the original position at the side of the body. The researcher then grasped a subscapular skinfold 2 cm along a line running laterally and obliquely downwards from the previously marked subscapular point (approximately 45°) with the left thumb and index finger. Again, the

caliper was applied to about 1 cm distally from this skinfold and held for approximately two seconds before the reading was made.

All measurements were taken on the right side of the body with the participant standing, arms hanging comfortably and loosely at their side. The measurements were repeated at each site until readings of three measurements were within 0.5 mm of each other.

2.5.3.4 Body circumference

Body circumference measures are relatively simple, inexpensive and do not require a high degree of technical skill to perform. Therefore, these measures are often incorporated in large scale epidemiological studies to identify individuals at risk for certain diseases. In this study, body circumferences from three sites of the body, waist, hip and upper arm, were measured.

Waist to hip ratio (WHR) is calculated by dividing waist circumference (measured in centimeters) by hip circumference (measured in centimeters). The WHR is commonly used as an indirect measure of lower and upper body fat distribution. It is believed that upper body obesity, often referred as central obesity, measured by the WHR is moderately related to risk factors associated with cardiovascular and metabolic diseases in both men and women (Ohrvall, Berglund, & Vessby, 2000). However, one of the limitations with WHR which is of relevance to this study is the fact that the WHR of women is affected by their menopausal status (Svendsen, Hassager, Bergmann, & Christiansen, 1992). This is because postmenopausal women tend to have more of a male pattern of fat distribution (more distributed in the upper body) when compared to premenopausal women (more distributed in the lower body) due to hormonal changes (Ferland et al., 1989).

Upper arm circumference may be used to calculate arm muscle and fat areas as an indicator of nutritional status in conjunction with the triceps skinfold (Quigley & Watts, 1997).

Below are the descriptions of how the measurements were carried out.

The waist circumference (WC) was measured at the level of the narrowest point between the lower rib and the iliac crest while subjects were standing with arms at the sides. For those subjects where there was no obvious narrowing of natural waist, the measurement was taken at the mid point between these two landmarks. The measurement was taken at the end of a normal expiration.

The hip circumference was measured at the level of the greatest posterior protuberance of the buttocks. This site usually corresponds anteriorly to about the level of the symphysis pubis. The subjects were asked to stand with their feet together and with the gluteal muscles relaxed.

The upper arm circumference was measured at the level of the mid-acromiale-radiale, which had previously been marked. The measurement was taken perpendicular to the long axis of the humerus. The subjects were asked to stand erect with their arm hanging in a relaxed position by the side of the body and with their palm facing their thigh.

All circumference measurements were made using a nonstretch anthropometric tape. 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 measurements were recorded to the nearest 0.1 cm. The measurements were repeated until readings of three measurements were within 1.0 cm of each other for the waist and hip circumferences and 0.5 cm for the upper arm circumference.

2.5.3.5 Elbow Breadth

Including frame size in a body composition may be important because an estimate of frame size allows a researcher to differentiate between persons who weigh more due to a large musculoskeletal mass and those who are overweight due to a large fat mass (Himes & Frisancho, 1988). Among numerous skeletal measurements which can be used as an indicator of frame size, elbow breadth is often used. Elbow breadth is a good predictor of frame size because its association with skinfold (triceps and subscapular) measures is only weak (Frisancho & Flegel, 1983). Furthermore, there is also evidence

that elbow breadth has a lower correlation with subscapular skinfold corrected for age and arm muscle area (Frisancho, 1990).

The researcher measured the distance between lateral epicondyles of the humerus on the right arm. The subjects were asked to stand upright with their elbow flexed to a 90° angle with their palm facing inwards. The researcher palpated for the location for the epicondyles and applied the calliper directly on the epicondyles to a 45° angle.

The elbow breadth measurements were made using vernier bone calipers and measured to the nearest 0.1 cm. Three measurements that differed by no more than 0.5 cm were taken.

2.5.3.6 Bioelectrical Impedance Analysis (BIA)

The BIA was measured to estimate body fat levels using SEAC BIA machine made in Australia. Subjects were advised of the pre-testing conditions prior to the second visit where the BIA was measured. The pre-testing conditions are as follows;

1. The subject should not have eaten for 4-5 hours prior to testing.
2. Alcohol should not be consumed 24 hours prior to testing.
3. The subject should not have exercised for 12 hours prior to testing.
4. The subject should empty their bladder immediately before testing
5. It would be preferable that the test is not done immediately before or during their menstrual cycle.

The subjects were asked to remove their right sock. They were then asked to lie down on their back with legs slightly apart and hands resting next to the body with their palms down and not touching any part of the body. The inner thighs were not in skin to skin contact. The electrode sites were cleaned with alcohol and the electrodes were attached on following four sites;

1. White - placed on an imaginary line bisecting the ulner head (bone on the little finger side of the right wrist).
2. Red - first joint of the middle finger, third metatarsal head dorsum on the right hand.
3. Blue - placed on an imaginary line bisecting the medial mellealus (bone on the big toe side of the ankle).

4. Black - placed on the base of the second toe, second metatarsal head dorsum on the right foot.

The leads were attached to the electrodes. The subject were asked to lie quietly and still during the entire test. The required information, such as height and weight, was entered into the machine and the measurements of Fat Mass (FM) and Fat-Free Mass (FFM) were recorded.

2.5.3.7 Blood Pressure

Blood pressure was measured twice on the right arm using a standard mercury sphygmomanometer. The subjects were asked to sit down with their arm at mid-chest level so that their inner elbow was level with their heart when the pressure was taken. Systolic blood pressure was measured at the Korotkoff phase 1, which was the first appearance of a pulse sound. Diastolic blood pressure was measured at the Korotkoff phase 5, which was the disappearance of the pulse sound. The measurements were recorded to the nearest two mmHg. The pressure was dropped to zero between recordings (The National Heart Foundation of New Zealand Scientific Committee, 1977). The measurements were taken approximately five minutes apart while subjects rested in the sitting position.

According to World Health Organization (WHO) cut-off values, normal blood pressure was considered as systolic<140mmHg and diastolic<90mmHg; borderline as 140mmHg≤systolic<160mmHg and/or 90mmHg≤diastolic<95mmHg; and high blood pressure as systolic≥160mmHg or diastolic≥95mmHg.

2.5.3.8 Random Blood Glucose

Subjects were advised not to eat during the 2 hours prior to their blood glucose measurement. The blood glucose measurements were made using a MediSense Precision Q.I.D Blood Glucose System kit which is a product manufactured by Abbott Diagnostics Division, Australia. The tip of finger was cleansed with alcohol. A drop of blood was taken from the site using a finger prick device and applied to the testing strip. The readings were recorded and classified according to the WHO definition for possible

glucose intolerance (Alberti & Zimmer, 1998): <7.0 mmol/l for normal and ≥7.0 mmol/l for possible glucose tolerance.

2.6 Data Processing

The researcher reviewed all data at the end of each interview and checked with the subject if necessary. All data were entered into the Statistical Package for the Social Sciences SPSS for Windows (version 12.0 for Windows; SPSS, Inc., Chicago, IL).

2.6.1 Questionnaire Data

All the answers to the questionnaires were coded. For open ended questions, all the answers were reviewed first then the researcher developed appropriate codes. To determine participants' age, the Conversion Table of Date to Decimal Years was used with the participants' date of birth from the questionnaire. These data were then entered into SPSS.

2.6.2 Body Measurement Data

The median of the three readings for each anthropometric measurement was entered into SPSS. The mean of the two measurements was calculated and entered into SPSS for blood pressure. The BMI and WHR calculated from the appropriate body measurements along with percent body fat measured by BIA and random blood glucose measurements were also entered into SPSS.

2.6.3 Dietary Intake Data

The data from the 24-hour dietary recall were entered into the FoodWorks (1999 Xyris Software Aus Pty Ltd) programme. In the FoodWorks programme, the New Zealand Food Composition Database was chosen as the primary database for dietary

analysis. However, as most of the Korean food items were not available in FoodWorks, a database of Korean food nutrients had to be set up before starting data entry. Approximately 80 entries of Korean food items were added to the existing FoodWorks database as new foods. Nutrient values of each of these food items were adopted from the Korean Food Composition Table published by the Korean Nutrition Society (The Korean Nutrition Society, 2000). Some nutrient values, such as monounsaturated fatty acid, polyunsaturated fatty acid, saturated fatty acid, starch, sugar, vitamin B_{12} and D, selenium, and magnesium were not available in the Korean Food Composition Table. The nutrient values of these foods were not available in USDA or in other food composition databases. Because these food items were traditional Korean foods, choosing a similar New Zealand food from the New Zealand Food Composition Database for the values of missing nutrients from Korean Food Composition Table was not possible. It was also felt that it would be inappropriate to do so. Hence, the researcher had to exclude such nutrients from the dietary data analyses. Those Korean foods that have been added to the existing database are the raw food items, not in cooked status, such as boiled or steamed. Therefore, there may be slight discrepancies in nutrient values which may arise from cooking methods.

Prior to the computer entry of dietary intake data, the weight of food consumed by subjects had to be converted into the weight of edible portions. This was necessary as many common Korean food dishes such as steamed or grilled whole fish and broiled beef spare ribs (called LA spare ribs) contain bones. The conversion was done using the refuse value from the Korean Food Composition Table (The Korean Nutrition Society, 2000). For example, if a 100g of yellow croaker (one of the popular fish dishes consumed by Koreans which is often served grilled) had been eaten, the actual weight of the edible portion would be 60g as it has a refuse value of 40%.

Many study subjects were consuming dietary supplements. All dietary supplements were also entered into the FoodWorks for a clearer view of the nutrient intakes of study subjects. However, two separate databases were made, one with and the other without the contribution from dietary supplements. The dietary intakes only from the foods were used for the dietary intake analyses for this study because of the following reasons. Firstly, not all dietary supplements were available in FoodWorks. Secondly, even with the identical dietary supplements in FoodWorks (with same strength etc), it may be misleading to include dietary supplements in assessing nutrient intakes because of the issue of bioavailability of nutrients. However, it is possible that

excluding dietary supplements may have an effect on the actual nutrient intakes and nutritional status of the subjects, particularly in the reporting of insufficient intakes of some nutrients.

Once all the 24-hour dietary recall results were entered into the FoodWorks, they were exported to Microsoft Excess then to Microsoft Excel and then to SPSS for further statistical analyses. The nutrient values used in this study were the mean intakes of the three days of records.

2.7 Data Analysis

All the results of questionnaires, body measurements, and dietary intake data were entered into SPSS. All statistical analyses were conducted with SPSS. Descriptive statistics such as means, standard deviations, minima, lower quartile, median, upper quartile and maxima were used as representative parameters for all body measurements, nutrient intake data and responses from questionnaires.

The independent t-test and the Mann-Whitney test were used to detect possible significant differences between means for variables that are normally distributed and not normally distributed, respectively. The Pearson correlation coefficient and the Spearman correlation coefficient were used to test the link between variables that are normally distributed and not normally distributed, respectively. Chi-square test was also employed when comparing categorical variables. The P value of 0.05 was chosen for statistical significance. Furthermore, single sample t-test was used to determine whether the mean WHR of subjects was different to 0.8.

CHAPTER 3. RESULTS

3.1 Sample Characteristics

3.1.1 Demographic characteristics of the study subjects

A total of 50 women volunteered and completed the study. Study subjects were aged between 40 and 55 years old (mean: 47 years) and the length of residence in New Zealand ranged from 5 years to more than 13 years. The majority of subjects were married and living with their husbands. Table 3.1 illustrates the demographic characteristics of the study subjects.

Table 3.1 Demographic characteristics of the study subjects

Age (years)	47.02 ± 4.23 [1]
Young[†]	25 (50) [2]
Old	25 (50) [2]
Length of residence in NZ (years)	8.8 ± 2.1 [1]
Short residence[*]	28 (56) [2]
Long residence	22 (44) [2]
Marital Status	
Married and living with spouse	42 (84) [2]
Married and living without spouse	7 (14) [2]
Other (widowed)	1 (2) [2]

[1] Figures are mean ± standard deviation.
[2] Figures are number (percentage).
[†] Young age group < mean age for group; Old age group ≥ mean age for group.
[*] Short residence duration < mean years for group; Long residence duration ≥ mean years for group.

A range of household compositions were represented, but the predominant one was parents with children, either young or adult, living at home (90%).

3.1.2 Socioeconomic characteristics of the study subjects

The majority of women in the sample had obtained tertiary level education, with over 60% having an undergraduate or postgraduate degree. Despite the high level of education in this group, 54% of the subjects were not in paid employment, remaining instead as housewives. Even though the proportion of this group who are housewives is similar to the level observed in Korea, there was a pattern of underemployment in New Zealand. Underemployment in this context means the employment of highly skilled workers in jobs that do not require such levels of skill or experience. This was also evident in the occupations of the partners of participants. For example, 30% of subjects had been employed in professional/managerial jobs in Korea whereas only 6% were employed in the same occupational category since their immigration to New Zealand. Similarly, the employment of subjects' husbands in the professional/managerial sector dropped from 36% in Korea to 12% since their arrival in New Zealand. At least half of households had incomes below the national New Zealand average of $53,092 (Statistics New Zealand, 2001) and almost 3/4 of subjects owned their own houses. Socioeconomic characteristics of the group are summarised in Table 3.2 and occupational stratification of subjects and their husbands in Table 3.3.

3.1.3 Lifestyle characteristics of the study subjects

Smoking Habits

The number of subjects who smoked either in the past (4%) or present (4%) was only 8% and the rest were non smokers who have never smoked.

Sleeping Habits

Of the subjects, 18% reported that they sleep less than 6 hours a night on average, with 72% sleeping for 7-8 hours and 10% sleeping for more than 9 hours.

Residential neighbourhood

A similar number of subjects reported living in Korean or Asian neighbourhoods as those identified as 'Kiwi' neighbourhoods, 42% and 56% respectively.

Language proficiency

When subjects were asked how comfortable they were with their proficiency with the English language, only a small number reported that they are very comfortable with reading and speaking English (4% each). More subjects reported being comfortable with reading compared to speaking English: 28% of subjects reported that they were very

uncomfortable with reading English compared to 40% who reported that they were very uncomfortable with speaking English.

Self reported stress levels

The majority of women (62%) reported that they experience less stress in New Zealand. They claim that this is due to the more relaxed atmosphere, with more free time available to spend enjoying themselves in New Zealand. However, 22% of subjects reported that they have more stress in New Zealand. These subjects claim that their limited ability to comprehend English was one of the main reasons.

Table 3.2 Socioeconomic characteristics of the study subjects

Characteristics	Number	%
Education (general)		
High school	12	24
Tertiary	38	76
Certificate	3	6
Diploma	4	8
Bachelor degree	29	58
Master degree	2	4
Employment status		
Full time	7	14
Part time	16	32
Housewife	27	54
Household income		
<$20,000	3	6
$20,000 - $38,000	19	38
$38,000 - $60,000	12	24
>$60,000	11	22
Don't know	5	10
House ownership		
Own	37	74
Rent	13	26

Table 3.3 Occupational stratification of subjects and their husbands

Characteristics	in NZ n(%)	in Korea n(%)
Occupation of subjects		
Professional/managerial[1]	3(6)	15(30)
Skilled non-manual/manual[2]	16(32)	10(20)
Semiskilled/unskilled manual[3]	4(8)	0(0)
Housewife	27(54)	25(50)
Occupation of subjects' husbands		
Professional/managerial[1]	6(12)	18(36)
Skilled non-manual/manual[2]	20(40)	21(42)
Semiskilled/unskilled manual[3]	5(10)	0(0)
Househusband	8(16)	0(0)
NA	11(22)	11(22)
Husband works in Korea	8(16)	8(16)
Other[4]	3(6)	3(6)

[1]Skilled professional/managerial (e.g. physician, head nurse, lawyer, company owner or director) and lower level skilled professional/managerial (non-manual) (e.g. office manager, duty nurse).
[2]Skilled non-manual (e.g. office worker) and skilled manual (e.g. electrician, plumber).
[3]Semiskilled manual (e.g. excavator operator) and unskilled manual (e.g. building labourer).
[4]Includes those who got married in NZ, retired or widowed.

3.1.4 General health characteristics of the study subjects

A small percentage of women were currently taking medication for hypertension (8%) and high cholesterol (8%) at the time of the study. A further 16% had previously been treated for these conditions (8% hypertension and 8% high cholesterol). Individuals who had previously been diagnosed with these conditions, but were no longer taking medication reported making significant lifestyle modifications, e.g. diet and exercise. Only one woman reported having previously been diagnosed and treated for her diabetic condition. She also reported having made significant diet and lifestyle modifications which resulted in her blood glucose levels returning to normal.

Of the subjects, 36% were pre-menopausal, 58% post-menopausal and 6% had undergone a hysterectomy. Only three women were taking Hormone Replacement Therapy (HRT).

3.2 Anthropometric and Biochemical Characteristics

Various body measurements including anthropometric and biochemical measurements of study subjects are summarised in Table 3.4.

Table 3.4 Body measurement of the study subjects

Measurement	Mean	SD	Min	LQ	Median	UQ	Max
Weight (kg)	57.3	7.28	43.8	52.9	56.9	62.0	74.6
Height (cm)	157.3	4.58	147.8	154.0	157.7	160.7	166.8
BMI (kg/m^2)	23.3	3.00	17.3	21.4	22.8	25.1	30.9
Skinfolds							
Triceps† (mm)	23.5	6.77	8.4	19.2	22.0	28.3	41.2
Subscapular† (mm)	21.6	6.06	10.0	16.4	21.2	24.8	34.2
Humerous width† (cm)	5.9	0.37	5.2	5.6	5.9	6.2	6.8
Circumference							
Upper Arm† (cm)	28.9	2.68	21.7	27.5	28.9	30.3	35.7
Waist (cm)	75.2	7.87	59.9	70.2	74.7	79.8	94.5
Hip (cm)	93.2	5.42	85.5	89.1	92.8	97.4	104.7
WHR	0.81	0.05	0.70	0.76	0.80	0.84	0.96
% of body fat† (%)	30.4	5.69	19.8	25.7	30.5	33.8	42.5
Blood Pressure							
Systolic (mmHg)	113.5	22.34	84.0	99.8	111.0	120.8	220.0
Diastolic (mmHg)	71.6	12.54	56.0	60.0	68.5	80.0	105.0
Blood glucose† (mmol/l)	5.9	1.21	3.3	5.3	5.6	6.4	10.1

† Data are based on 49 subjects

There was no difference in these measurements between the shorter and longer resident groups ($P>0.05$).

3.2.1 Weight

The mean weight of study subjects was 57.3 kg. The majority of women (80%) claimed to have increased weight since coming to New Zealand. The perceived weight changes of subjects since migration to New Zealand are summarised in Table 3.5.

Table 3.5 Perceived weight changes of the study subjects

Characteristics	Number	%
Weight change since immigration		
No difference	13	26
Increase<5kg	15	30
Increase>5kg	19	38
Increase, amount not known	1	2
Decrease<5kg	1	2
Decrease>5kg	1	2
Decrease, amount not known	0	0

It was found that the group of women who reported weight gain had a higher average weight (59.1 kg) than those who did not (53.1 kg), (P=0.006).

3.2.2 Body Mass Index (BMI)

BMI categories are often used to define body fatness level. According to the New Zealand classification, more than 60% of the study subjects were considered to be within the healthy weight range and approximately a quarter were considered to be either overweight or obese. However, only half of subjects were considered to be within the healthy weight range and nearly another half were considered to be either overweight or obese according to the Korean reference range. Table 3.6 shows the classification of study subjects according to two classification systems used in New Zealand and Korea.

Table 3.6 BMI Classification of subjects by New Zealand and Korean standards

BMI Classification*	Underweight	Normal weight	Overweight	Obese
		n(%)		
NZ standard[1]	7(14)	31(62)	11(22)	1(2)
Korean standard[2]	2(4)	25(50)	11(22)	12(24)

[1] BMI cut-off values for categories: underweight; <20, normal weight; 20-24.9, overweight; 25-29.9 and obese; ≥30 (New Zealand Ministry of Health, 1999).
[2] BMI cut-off values for categories: underweight; <18.5, normal weight; 18.5-22.9, overweight; 23.0-24.9 and obese; ≥25 (KSSO).
*Significant difference between classification methods P=0.005 by Chi square. NB: Small number of subjects in 'Underweight' grouping.

The BMI was found not to be related to age in this group of women (r=0.174, n=50, P=0.226). Moreover, the BMI was found not to be different in women who are pre and

post menopausal (P=0.854).

3.2.3 Humerous width and frame size

Using the reference proposed by Frisancho (1984), the elbow breadths (humerous width) of subjects are classified into three groups of frame size in Table 3.7; small, medium, and large. Small, medium and large frame sizes refer to elbow width of ≤5.7cm, >5.7cm and <7.2cm, and ≥7.2cm respectively. Approximately 1/3 of the study subjects had small frame size and 2/3 medium, but no subjects were categorised as having a large frame.

Table 3.7 Frame size of study subjects by elbow breadth

Elbow breadth	Small	Medium	Large
No of subjects	18	31	0
%	37	63	0

3.2.4 Waist Circumference

The mean waist circumference (WC) of subjects was 75.2cm. The waist circumference measurement criteria were used to assess health risk. Similar to the BMI, two reference points were used (Table 3.8). While only 8% of the subjects had waist circumferences associated with increased disease risk according to the global standard, almost a quarter had increased risk according to the Asian standard.

Table 3.8 Waist circumference Classification of subjects by WHO global and Asian standards

WC Classification*	Normal n(%)	Increased disease risk n(%)
Global standard[1]	46(92)	4(8)
Asian standard[2]	38(76)	12(24)

[1] WC categories: normal; ≤88, increased disease risk; >88cm
[2] WC categories: normal; ≤80, increased disease risk; >80cm
*Significant difference between classification methods P=0.029 by Chi square.

The waist circumference was not related with the age (r=0.213, n=50, P=0.138). The waist circumference was found to be the same in women who were pre and post menopausal (P=0.449).

3.2.5 Waist to Hip Ratio (WHR)

The ratio of waist to hip circumferences is an indicator of central adiposity which is positively correlated with disease risk. In particular, a WHR greater than 0.8 is considered an indicator of cardiovascular risk for females (Russell, Parnell, & Wilson, 1999). Nearly half (44%) of subjects had WHR greater than 0.8. Although the mean WHR of the study population was 0.81, slightly above the value that is thought to have a significant association with an increased risk of chronic disease, it was found not to be significantly different to 0.8. A weak positive correlation was established between WHR and age (r=0.287, n=50, P=0.043). However, WHR was not found to be different in women who are pre and post menopausal (P=0.284).

3.2.6 Blood Pressure

The blood pressure of study subjects is summarised in Table 3.9 according to the World Health Organization (WHO) cut-off values, irrespective of whether they were taking hypertensive medication. At visit two, one subject was found to have a blood pressure of 220/105, which is at the extreme end of the reference ranges for both systolic and diastolic blood pressure. Consequently, she was advised to consult her GP and had been prescribed medication for hypertension by the third study visit. The majority of subjects had either normal or borderline blood pressures and only two women were deemed to be hypertensive under these criteria. These two women were also two of the four subjects (8%) who were on hypertensive medication as reported in section 3.1.4. Hence, these women were advised to seek further medical assistance from their GP. Systolic blood pressure was found to have a weak positive relationship with age (r_s=0.380, n=50) at a P=0.006. However, diastolic blood pressure was found not to be associated with age (r_s =0.182, n=50, P=0.207).

Table 3.9 Distribution of study subjects in different blood pressure categories

Blood pressure	**Normotensive**	**Borderline**	**Hypertensive**
Systolic Pressure	BP<140	140≤BP<160	BP≥160
No. of subjects (%)	45(90)	4(8)	1(2)
Diastolic Pressure	BP<90	90≤BP<95	BP≥95
No. of subjects (%)	43(86)	5(10)	2(4)

3.2.7 Blood glucose

Blood glucose levels ranged from 3.3 to 10.1mmol/l. The WHO classifies blood glucose level of ≥7.0mmol/l as glucose intolerant (Alberti & Zimmer, 1998). According to this classification, 16% of subjects were deemed to be possibly glucose intolerant. These women, however, were not aware of their possible glucose intolerant status and advised to seek medical advice from their medical practitioners.

3.2.8 Body Composition - Bioelectrical Impedance Analysis (BIA)

According to the body fatness categories recommended by Lohman (Lohman, 1992), the majority of women (86%) were classified as either above average (43%) or at risk (43%). Only 4% of subjects were in the average body fatness category. These results are summarised in Table 3.10.

Table 3.10 Classification of subjects according to body fatness categories[1]

Body fatness category	**% body fat**	Number	%
At risk[2]	≤ 8%	0	0
Below average	9-22%	5	10
Average	23%	2	4
Above average	24-31%	21	43
At risk[3]	≥ 32%	21	43

[1] Data are based on 49 subjects
[2] At risk for disease and disorders associated with malnutrition
[3] At risk for diseases associated with obesity

The percentage of body fat was not significantly correlated with age in this group of women (r=0.209, n=49, *P*=0.150). There was no significant difference between body fat percentage of subjects and their menopausal status (*P*=0.397).

3.3 Meal and Food Patterns

3.3.1 Meal Patterns

Data collected using the questionnaires and 24 hour dietary recalls were used to

investigate changes in meal patterns of subjects since immigration to New Zealand.

3.3.1.1 General meal patterns

Of the subjects, 78% reported that they usually eat three meals a day with 82% having breakfast every day. The majority (80%) of participants reported that they have snacks at least once a day and more than half of subjects (56%) reported that they ate away from home at least once a week. Reported meal patterns determined from the questionnaire are summarised in Table 3.11.

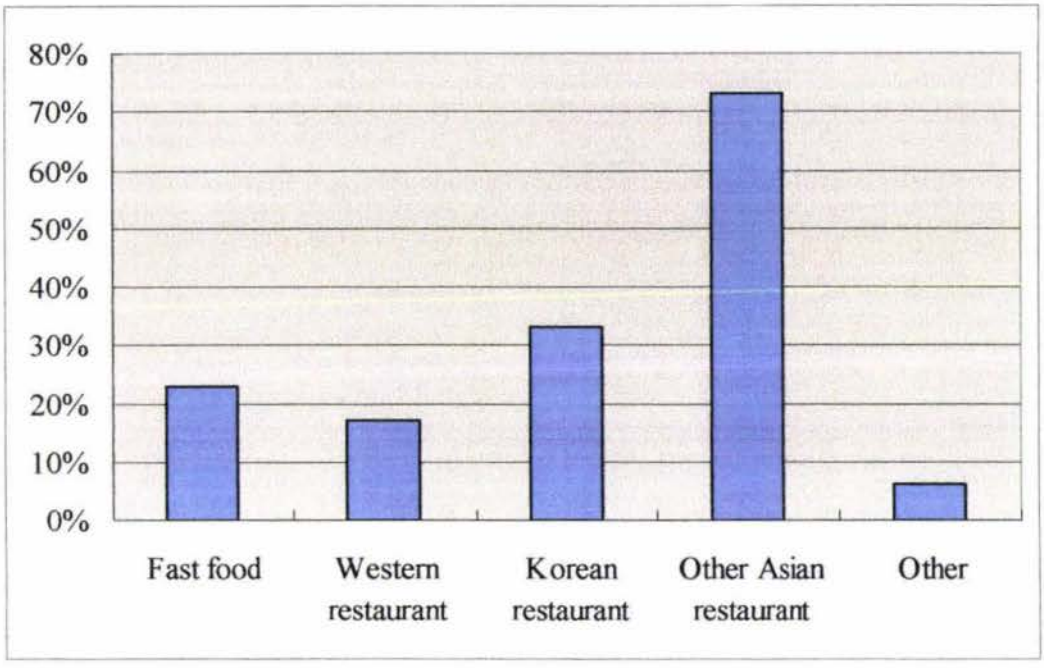
Table 3.11 Meal patterns of study subjects

Characteristics	Number	%
No of meals a day		
1	1	2
2	9	18
3	39	78
More than 3	1	2
No of snacks a day		
None	10	20
1	18	36
2	19	38
More than 2	3	6
Breakfast frequency		
Never or Seldom	4	8
A few times a week	5	10
Everyday	41	82
Eat away from home		
Never or Seldom	9	18
Less than once a week	13	26
Once a week	14	28
A few times a week	13	26
Once a day	1	2

Meals eaten outside the home

The most popular types of cuisine which were eaten outside the home were 'Korean' and 'other Asian' foods. Fast food restaurants, such as McDonald's, were visited mostly by subjects with young children (64% of women who dined at fast food restaurants had children). The distribution of types of cuisine eaten outside the home is illustrated in Figure 3.1.

Figure 3.1 Distribution of dine out cuisine[1]



[1] Data are based on 48 subjects who reported that they dine out

The reported eating out patterns derived from the questionnaires were reflected in the 24 hour dietary recall data. The latter further showed that Chinese (including *Yamcha*) and Vietnamese (Vietnamese noodles) restaurants were the most frequently visited places in the 'other Asian restaurants' category, each comprising 44% of those who reported 'other Asian' cuisines when eating. The latter also revealed that fish and seafood (50%) and steaks (37%) were the foods most commonly eaten when dining out in Western restaurants.

The types of cuisine chosen was found not to be related to the length of residence in New Zealand (short vs long) ($P>0.05$) or to the age of these women (young vs old) ($P>0.05$).

3.3.1.2 Trends in meal patterns

24 hour dietary recall data were analysed in order to identify any trends in the uptake of 'Westernised' dietary patterns. Each meal was categorised into four meal types; Korean food, Western food, eat out, and common. Common represents a meal type which cannot be categorised as being typically Korean or Western, e.g. meals were categorised as common when subjects had a piece of fruit or a pot of yoghurt as a meal, because it was felt that it would be inappropriate to categorise such meals as either Korean or Western. Meal patterns were similar on each of the three days, with breakfast being the most westernised meal. Dinner remained the least westernised meal with more than 80% of subjects having Korean food as dinner on all three days. Eating out was more frequent on the weekend with a similar distribution between lunch and dinner. Breakfast was not 'eaten out' on any of the three days. Figures 3.2, 3.3 and 3.4 illustrate the types of foods consumed on each 24 hour recall period.

Figure 3.2 Meal pattern of weekday 1

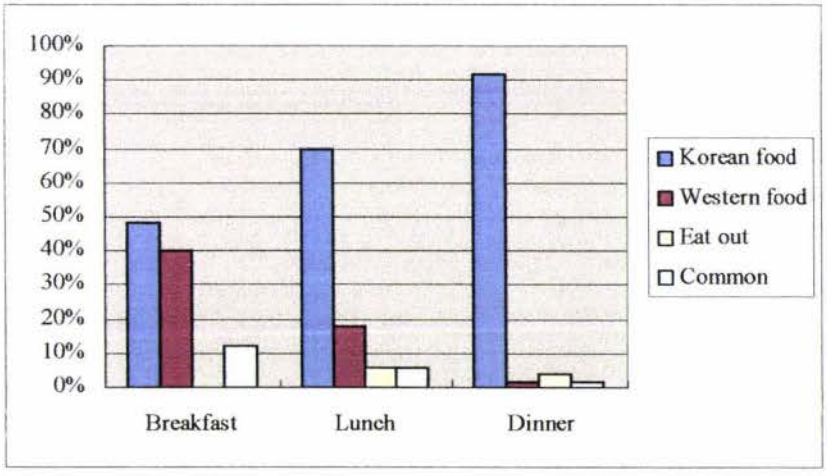


Figure 3.3 Meal pattern of weekday 2

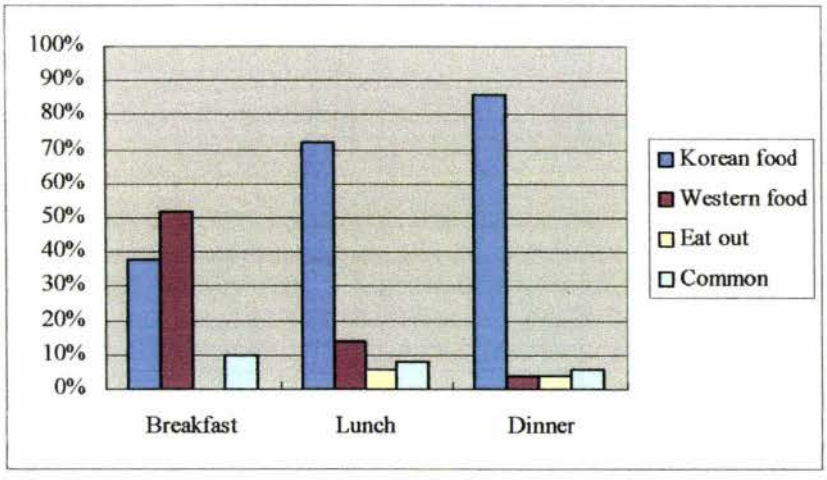
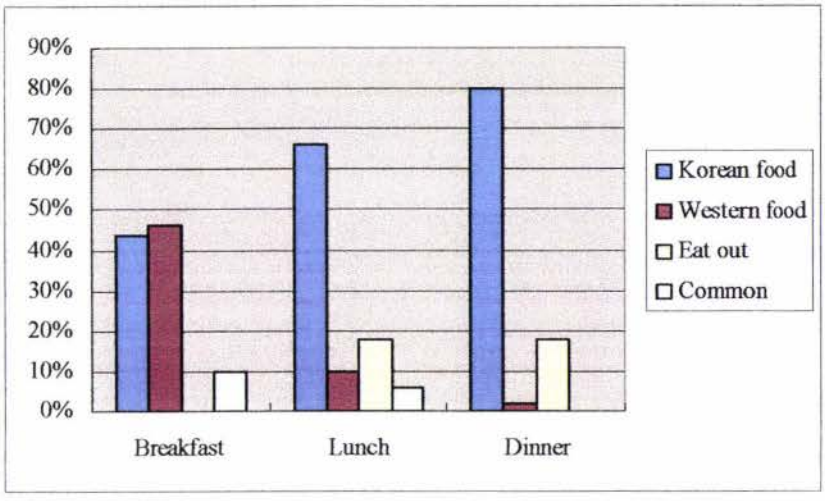


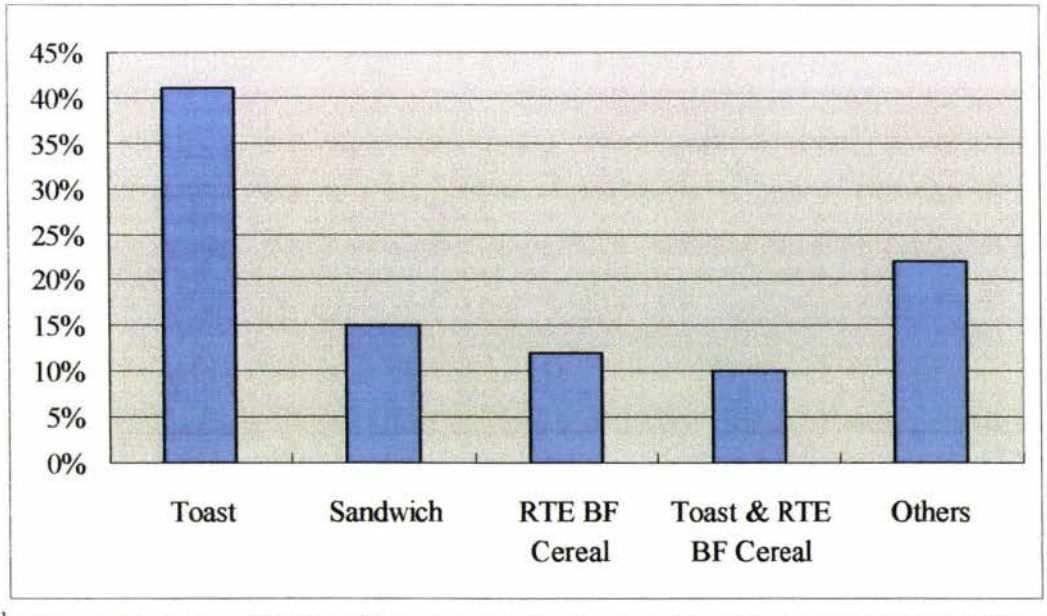
Figure 3.4 Meal pattern of weekend



3.3.1.3 Composition of Western breakfasts

Of the subjects, 41% of women had toast with jam and spread, 15% had a sandwich (bread with various fillings), 12% had ready-to-eat breakfast (RTE BF) cereals with milk and 10% had toast and RTE BF cereals (with milk) at the same time. Alternatively, 22% of subjects reported consuming other foods at breakfast including baked products such as muffin, croissant, pita bread and pancakes. This is summarised in Figure 3.5 below.

Figure 3.5 Type of foods eaten at Western breakfast[1]

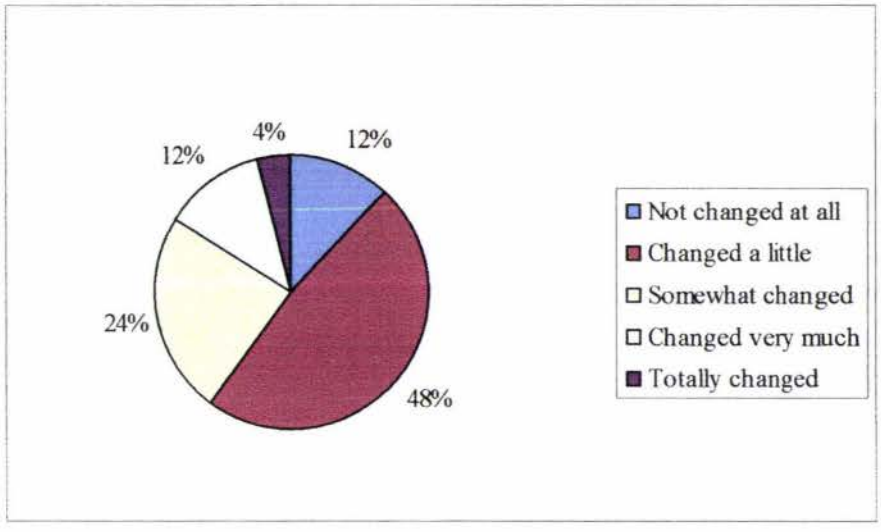


[1] Data, analysed from 24 Hour dietary recalls, are based on 33 subjects who reported having Western breakfast

3.3.1.4 Reported change in dietary habits

Of the subjects, 60% considered that they had made only subtle changes in their dietary habits since coming to New Zealand, reporting that their dietary habits had either stayed exactly the same as when they were residing in Korea or only changed a little. The remaining 40% acknowledged more substantial changes (somewhat changed, changed very much, and totally changed). Self-rated dietary habit changes of subjects since their immigration to New Zealand are summarised in Figure 3.6.

Figure 3.6 Dietary habit changes since immigration to New Zealand[1]



[1] Data are analysed from the questionnaire

Reported dietary habits change was not related to the working status ($P>0.05$), the income ($P>0.05$), or to the education ($P>0.05$). Furthermore, it was found not to be related to the duration of residence (short vs long) ($P>0.05$), the age of subjects (young vs old) ($P>0.05$), the household composition (whether living with children or not) ($P>0.05$), the neighbourhood characteristics (whether subjects are living in Asian/Korean neighbourhood or Kiwi neighbourhood) ($P>0.05$), or to the English proficiency of the subjects ($P>0.05$). The weight change claimed by subjects was not associated with the reported change in dietary habit in New Zealand ($P>0.05$) either.

3.3.2 Food patterns

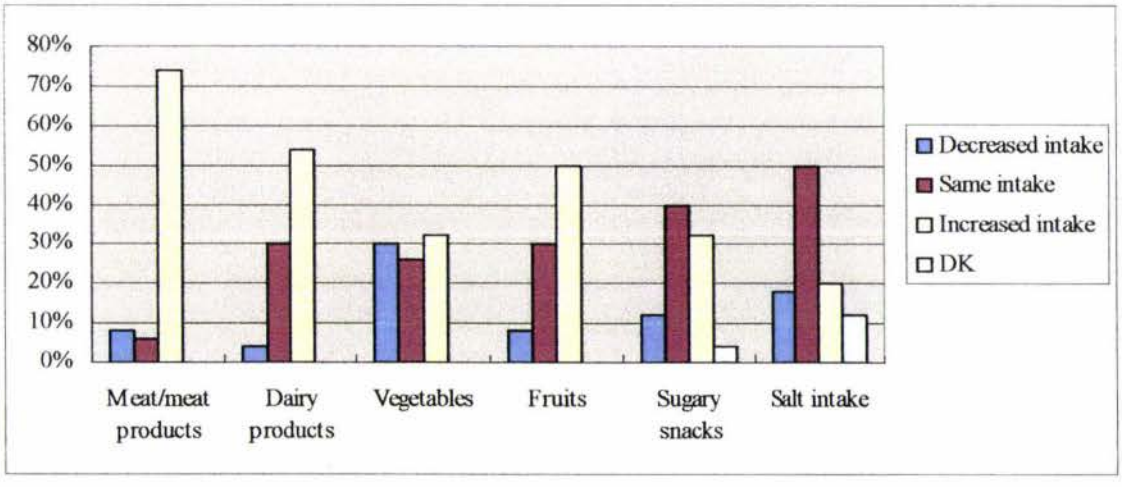
Data collected using the questionnaires including an open-end question were used to investigate changes in food consumption patterns of subjects since immigration to

New Zealand. Miscellaneous food habits practiced by subjects, which are observed from the 24 hour dietary recall, are also reported.

3.3.2.1 Overall change in food consumption

When presented with a list of specific food intake changes, the subjects reported making a variety of changes to their dietary habits since coming to New Zealand. The most common changes reported were increased consumption of meat/meat products, dairy products and fruits. The majority of subjects reported maintaining their intakes of salt and of sugary snacks, but over 30% reported eating more sugary snacks. In this instance, 'salt intake' included salt added to foods both during cooking and at the table. The latter was reported not being practised in most cases. The vegetable group had a unique pattern in that similar proportions of the group reported all three levels of changes: increased, decreased, and same intake. Reported changes in food consumption since coming to New Zealand are presented in Figure 3.7.

Figure 3.7 Reported changes in food consumption since immigration to New Zealand

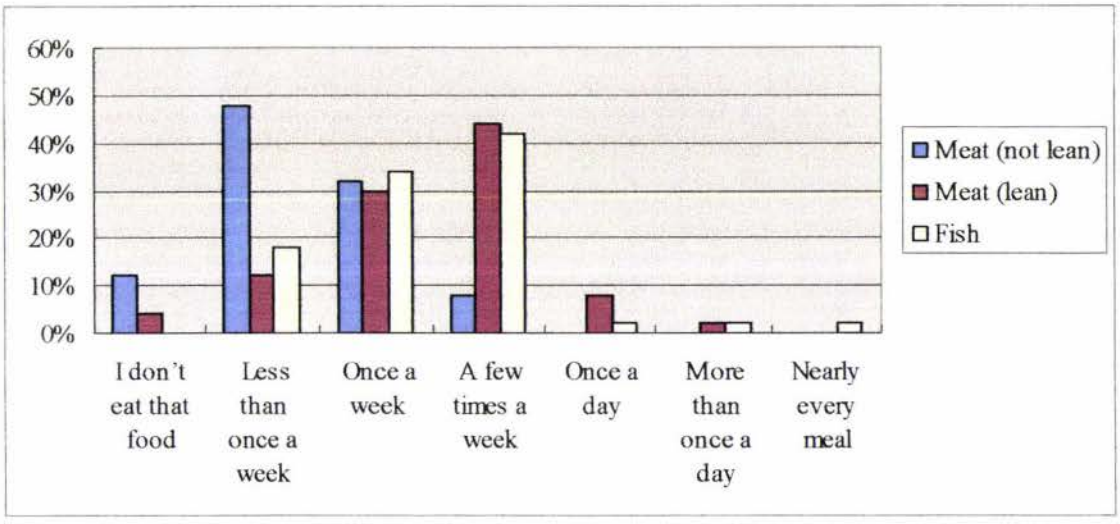


The changes reported in consumption of meat/meat products, dairy products and fruits were not affected by the duration of residency in New Zealand (short vs long) ($P>0.05$), proficiency with the English language ($P>0.05$), age (young vs old) ($P>0.05$), or by income level ($P>0.05$). Reported changes in consumption of vegetables, sugary snacks, and salt intake were also independent from the length of residency in New Zealand ($P>0.05$), proficiency with the English language ($P>0.05$), age ($P>0.05$) and income level ($P>0.05$).

3.3.2.2 The animal protein group

Fatty meats that are popular amongst Koreans, for example pork belly and *cha-bol-bak-i* (a fatty beef cut), were consumed much less frequently than either lean meats (meats include red meat and poultry) or fish. This is illustrated in Figure 3.8. Generally, the meat and fish consumption patterns of study subjects were in accordance with the New Zealand recommendation of 2-3 servings per week. Among the animal protein groups, the consumption of meat/meat products alone was further evaluated and illustrated in Figure 3.9.

Figure 3.8 Intake frequency of meat (not lean), meat and fish



Beef

The prominent peak of 'increased intake' in meat/meat products seen in Figure 3.7 was largely from an increase of beef consumption. As shown in Figure 3.9, 65% of the subjects reported that they consume more beef in New Zealand. From the open ended question in this section, it was determined that this was mainly due to the cheaper price of beef in New Zealand compared to Korea. Subjects considered the cheaper price (42%) and better availability (8%) as main reasons for their increase in beef consumption.

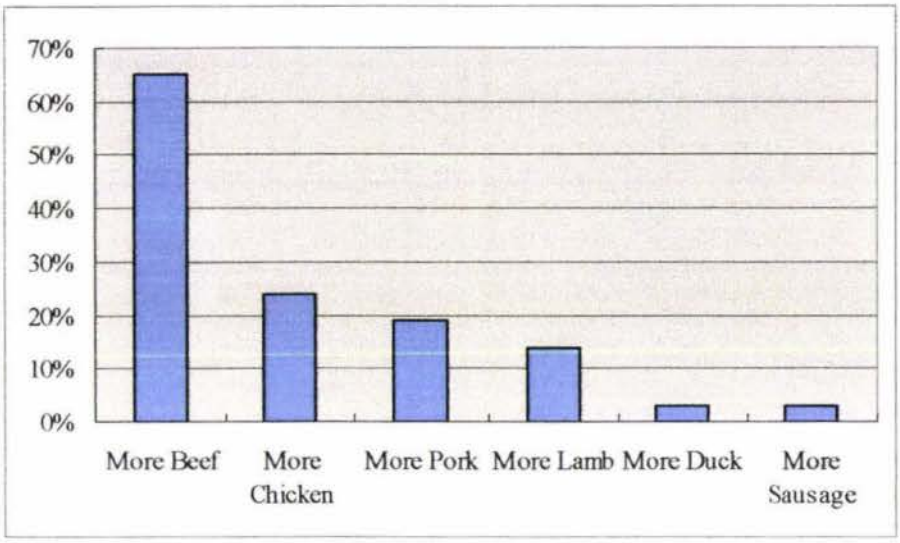
Lamb

Of the subjects, 14% reported an increase in lamb consumption. Although the increment may not be as large as the one observed for beef consumption, this is still noteworthy considering that none of those who reported increasing their lamb intake had been lamb eaters in Korea.

Changes in cooking methods

Among those who reported an overall increase in meat/meat products, 11% of subjects reported a change in cooking method. Whole grilled steaks are now consumed instead of a dish of small pieces of Korean style marinated meat.

Figure 3.9 Changes in meat and meat products consumption[1]

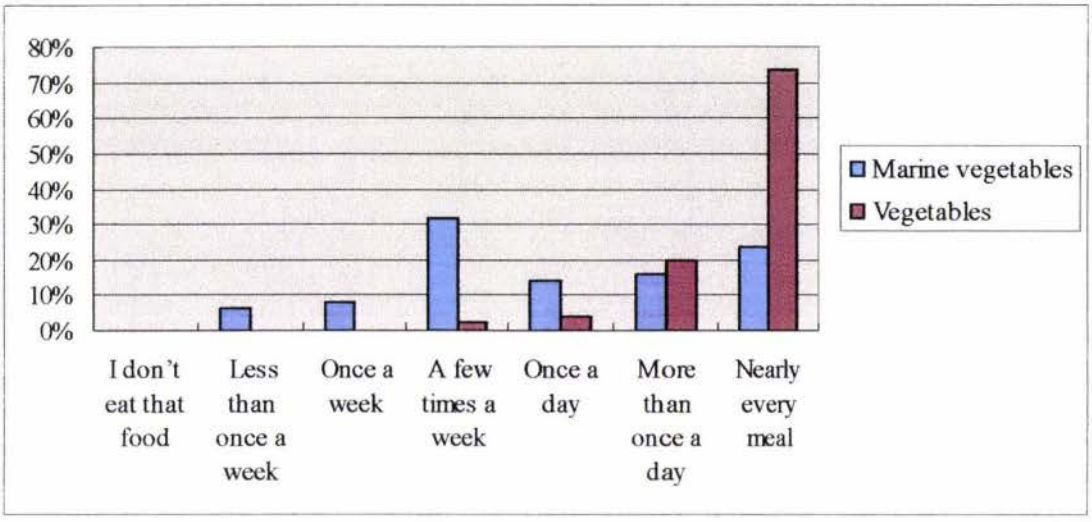


[1] Data, analysed from the open-ended question, are based on 37 subjects who reported that the sorts of changes they made include an increase in meat and meat products.

3.3.2.3 Vegetables

Subjects reported consuming traditional Korean marine vegetables, such as laver and sea tangle, much less frequently than other vegetables. Only 24% reported eating marine vegetables at most meals compared to 74% who reported eating other vegetables at nearly every meal. Intake frequencies for these two food groups are summarised in Figure 3.10. The high vegetable intake may be in part due to high consumption of *kimchi* as *kimchi* intake was included in the vegetables category. The intake frequencies of *kimchi* are also presented separately in section 3.3.2.5

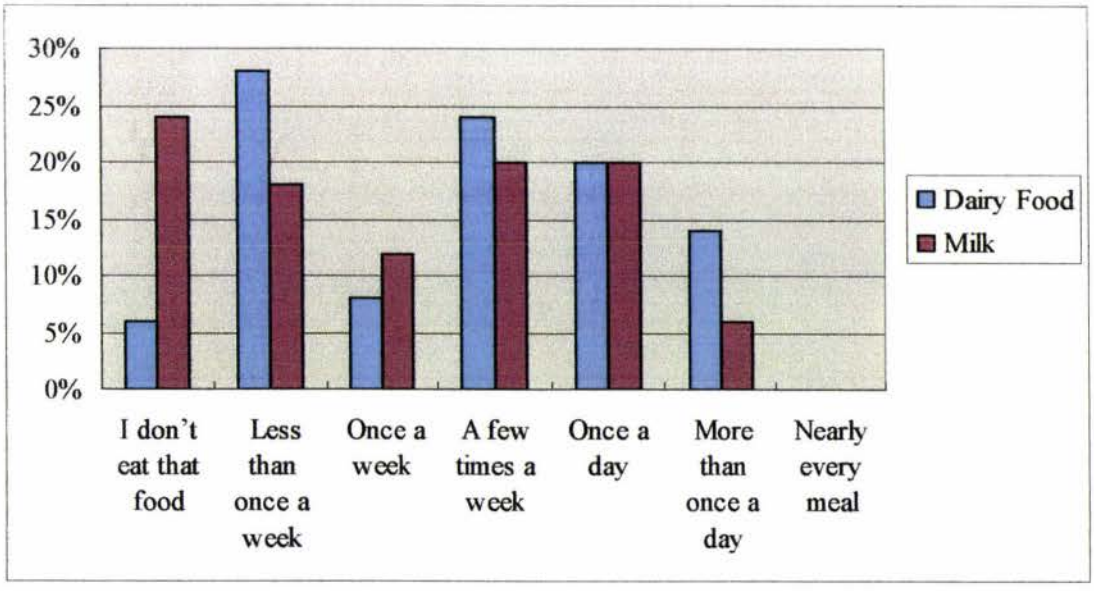
Figure 3.10 Intake frequencies of marine vegetables and vegetables



3.3.2.4 Dairy foods

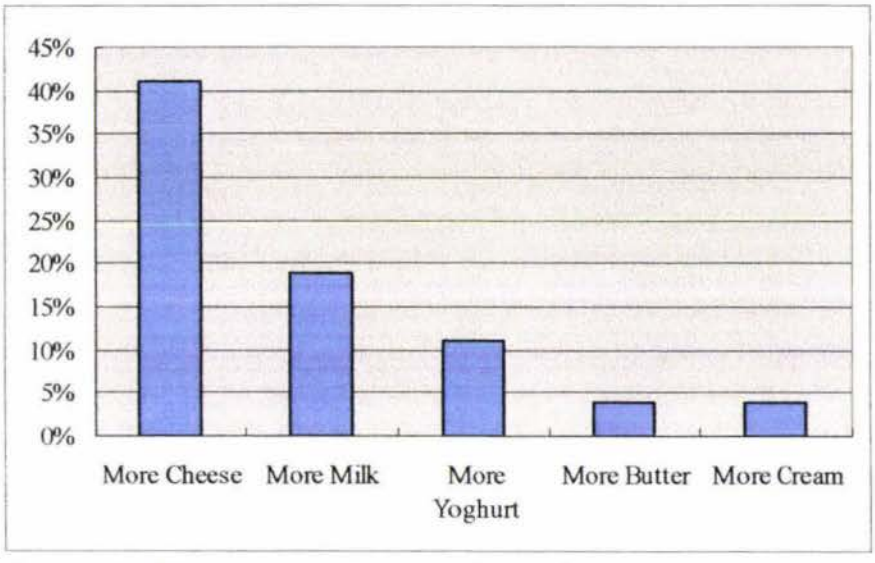
Reported intakes of milk and dairy products were low in this group of Korean women. Almost a quarter reported that they did not consume any milk and only 6% reported having milk more than once day. Dairy food consumption was more frequent than milk, but was still low compared to New Zealand standards. Intake frequencies for dairy food and milk are summarised in Figure 3.11. Although milk was found to be one of the least consumed foods as seen in Figure 3.11, Figure 3.7 indicates that more than 50% of participants reported an increased intake in overall dairy products.

Figure 3.11 Intake frequencies of Dairy food and milk



The observed increase in dairy products seems to be largely influenced by a significant increase in cheese consumption. Those who reported similar overall dairy product intake in section 3.3.2.1 (refer Figure 3.7) also reported an increased intake of cheese. This is an interesting finding considering the fact that Koreans traditionally do not consume much dairy food because of perceived lactose intolerance. The increase in cheese consumption was reported to be due to the wide variety of cheese that can be easily purchased in supermarkets (35%) and to cheaper price (18%). The changes in dairy product consumption are summarised in Figure 3.12.

Figure 3.12 Changes in dairy product consumption[1]

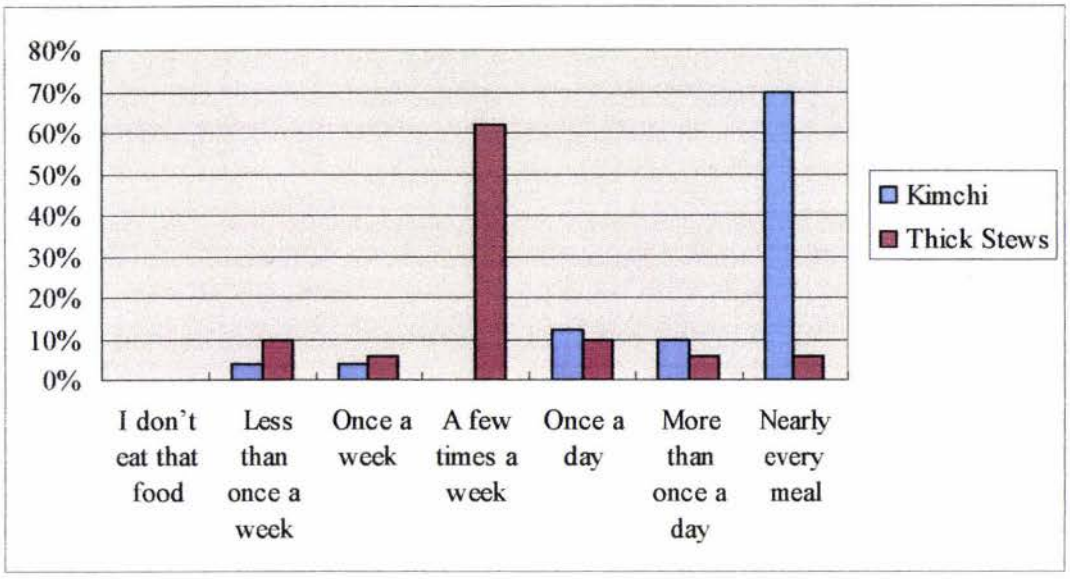


[1] Data, analysed from the open-ended question, are based on 27 subjects who reported that the sorts of changes they made include an increase in dairy products.

3.3.2.5 Korean traditional foods

Of the respondents, 70% reported eating *kimchi* at every meal. Fewer than 10% of subjects reported eating *kimchi* less than once per week. On the other hand, thick stews were consumed only a few times a week by the majority of subjects (60%). Food frequencies of the two most traditional Korean foods, *kimchi* and thick stews (thick broth), are summarised in Figure 3.13.

Figure 3.13 Intake frequencies of *kimchi* and thick stew.



3.3.2.6 Breads

Of the subjects, 10% reported (in the open-ended question) that breads are now consumed as meals in New Zealand whereas breads were usually consumed as snacks in Korea. This is reflected in section 3.3.1.3 (Figure 3.5) where toast and sandwiches were reported to be frequently eaten for breakfast.

3.3.2.7 Miscellaneous foods

Of the subjects, 14% were regular organic produce consumers. The organic foods consumed included milk, fruit juices, tofu, and vegetables. A number of subjects (12%) were having fresh fruit and vegetables juice extracts every day. Juices consumed included apple, carrot, tomato, broccoli, spinach, celery, cabbage and beetroot. Also three subjects reported consuming *saengsik,* which is believed to be a healthy food because it is not heat processed and hence maintains beneficial enzymes and nutrients. Three subjects ate bone marrow soup, which is also believed by Koreans to be a healthy food (one subject was using bone marrow soup as soup stock for all her soup-based cooking). Furthermore, two women reported that they and their families eat free range eggs.

The majority of subjects were using sesame oil, one of the traditional Korean cooking oils, for its cooking properties and/or for the flavour. Other widely used

cooking oils among study subjects were olive oil (40%) and soy oil (26%).

3.3.3 Attitudes towards food, diet, nutrition and health

3.3.3.1 Food preparation habits

The attitude of subjects towards food particularly with respect to cooking methods was investigated. The two most common ways of eating vegetables were raw (88%) and boiled (60%). Traditional *kimchi* was mostly home made. Cabbage *kimchi* (98%) and radish *kimchi* (38%) were the two most frequently consumed types of *kimchi* among subjects (data derived from the open-ended question). Subjects who reported buying *kimchi* (6%) all had full time jobs. The majority of subjects had healthy fat removal habits, removing visible fat before eating when having meat dishes. These attitudes are summarised in Table 3.12.

Table 3.12 Attitudes towards food

Characteristics	Number	%
Vegetable cooking method		
Fresh	44	88
Boiled	30	60
Steamed	7	14
Pickled	17	33
Stir-fried	13	26
***Kimchi* preparation**		
Mostly bought	3	6
Mostly home made	44	88
50:50	3	6
Fat removal		
I don't remove any and eat it as it is	1	2
I just remove the biggest lump	12	24
I remove as much as I can	35	70
I don't eat any visible fat	1	2
NA (Not Applicable)	1	2

3.3.3.2 Attitudes towards diet

Maintaining a Korean diet

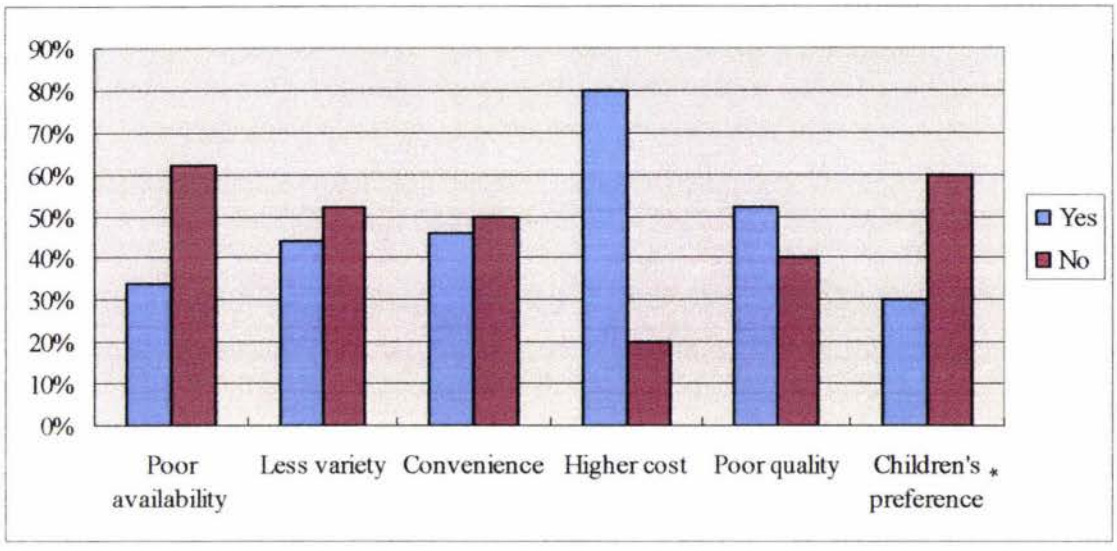
Subjects ranked in order of importance their reasons for maintaining a Korean diet when presented with 5 different reasons. Overall the most important reason for maintaining a Korean diet was 'taste'. The second most important reason was because subjects were 'more used to Korean cooking' and the third was the belief that 'Korean food is healthier than western food'. Reasons such as 'keeping traditional cuisine is important' and 'elderly family member preferring Korean food' were of least importance for these women.

Factors hindering Korean diet

Eighty percent of the subjects reported that the 'higher cost' of Korean food was the factor which most hindered these women in maintaining a traditional Korean diet. However, approximately 2/3 of the 20% who reported that 'higher cost' was not a hindering factor also acknowledged the higher prices of Korean foods in New Zealand. 'Poor quality' of Korean foodstuffs was the second most frequently stated hindrance (52%). This was particularly relevant to fresh produce such as Korean vegetables and fish that are not available in local New Zealand supermarkets. This, in turn, is related to poor availability of Korean food. However, 'poor availability' seemed to hinder these women less than other factors (34%). 'Children's preference' was reported to be the least hindering factor (30%) in maintaining a Korean diet among subjects. This factor only influenced women with younger children (statistically significant at $P<0.05$) but not women with older children. Of the women, 48% had young children and among these 46% reported children's preference as a hindering factor. The factors which hindered subjects in maintaining a Korean diet are illustrated in Figure 3.14.

Subjects who considered 'higher cost' and 'less variety' of Korean foods as hindering factors in maintaining a Korean diet were the ones who reported more substantial dietary habit change (substantial changes include subjects who stated somewhat changed, changed very much, and totally changed as illustrated in Figure 3.6) since arrival in New Zealand, $P=0.030$ and $P=0.025$ respectively. However, the other hindering factors were not significantly associated with reported dietary change ($P>0.05$). 'Higher cost', the most hindering factor, in these women was found not to be related to the income level ($P>0.05$).

Figures 3.14 Factors hindering Korean diet



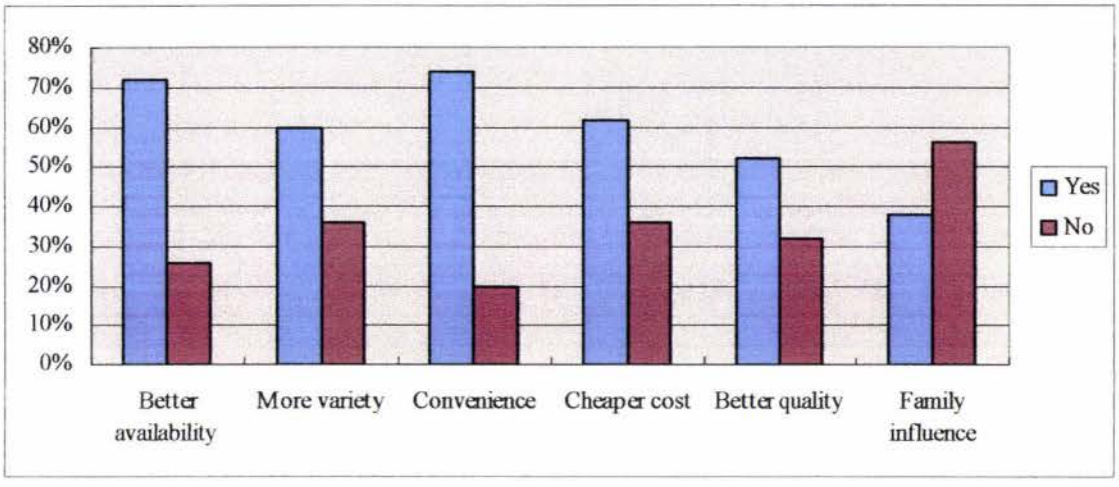
* Figures based on whole study population

Adopting Western diet

The two factors most commonly stated to encourage Western dietary patterns were 'convenience' (74%) and 'better availability' (72%). The majority of subjects who reported that 'convenience' was the factor influencing adoption of western foods emphasised the convenience of having a western style meal for breakfast. This was because a Western breakfast is easy and fast to prepare. However, there was some disparity between the questionnaire and the 24 hour dietary recall in that many of those who did not report convenience as an influencing factor actually reported eating RTE BF cereals, suggesting that other factors may be more important influences. More than half of subjects reported that 'cheaper cost' (62%), 'more variety' (60%) and 'better quality' (52%) were also factors which encourage them to adopt Western dietary patterns. The factors which influence subjects to change to a Western (Kiwi) diet are summarised in Figure 3.15.

'Convenience' was found to be statistically significantly linked to working status in this group of women in that subjects who were employed considered 'convenience' as the influencing factor in adopting a Western diet (P=0.009).

Figures 3.15 Factors influencing a change to Western (Kiwi) Diet



3.3.3.3 Nutrition knowledge

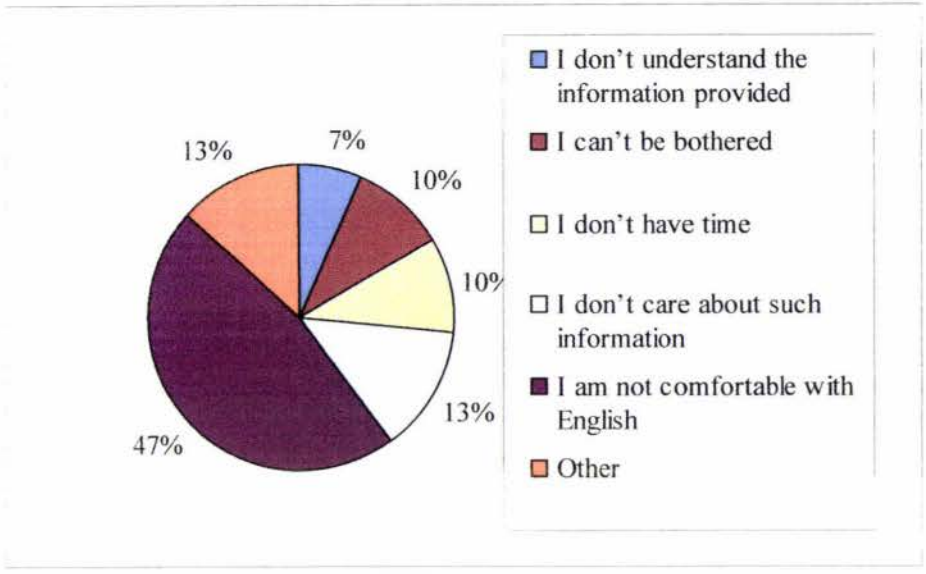
When presented with a list of nutrition information sources, almost half of the participants (42%) said that they were aware of the nutritional materials such as the Food Pyramid, the Heart Foundation "pick the tick" campaign, and the "5+ a day" campaign. Of these, the food pyramid was most well known and 5+ a day least well known. A number of subjects (40%) reported that they read the nutrition information on food packaging when shopping. Attitudes of study subjects towards nutrition are summarised in Table 3.13.

Table 3.13 Use of nutrition information

Characteristics	Yes	No n(%)	DK
Awareness of nutritional materials	21(42%)	29(58%)	-
Reading nutrition labels	20(40%)	28(56%)	2(4%)

Of those subjects who do not use the nutrition information provided, almost half (47%) reported that this was due to their limited capability of English. Half of the 13% of subjects who answered 'other' reported that the reason for not using nutrition information was due to small writing size which is very hard to read. These results are summarised in Figure 3.16 below.

Figure 3.16 Reasons for not using nutrition information



Awareness of nutritional materials was not related to either speaking (P>0.05) or reading (P>0.05) English proficiency. However, reading nutrition labels was found to have statistically significant association with both speaking (P=0.001) and reading (P=0.003) English proficiency. Education was found to have an association with the awareness of nutritional materials (P=0.007) but not with reading nutrition labels (P>0.05). There was no difference in these attitudes, or the awareness of nutritional materials and reading nutrition labels, between the shorter and the longer New Zealand residence (P>0.05).

3.3.3.4 Attitudes towards nutrition and health

The most frequently sought sources of health and nutrition advice were sources in Korean language; 74% from Korean media and 68% from friends (Korean friends). It was surprising to note that advice from health professionals, such as doctor and health and fitness centre, were the least used resources; 22% and 4% respectively. The results are shown in Table 3.14.

The supplements that are consumed by most subjects were nutritional supplements, such as omega 3 and evening primrose oil capsules, and vitamins/multivitamins. A personal decision to improve health was reported to be the strongest reason for taking supplements in this group of women. These results are also shown in Table 3.14.

Table 3.14 Attitudes towards nutrition and health

Characteristics	Number	%
Sources of Health and Nutrition Advice		
Doctor	11	22
Friends	34	68
Family	14	36
Health and Fitness centre	2	4
English Media	16	34
Korean Media	37	74
Other	7	14
Supplements consumed		
None	13	26
Vitamins/Multivitamins	16	32
Minerals	9	18
Nutritional Supplements	21	42
Invigorant*	6	12
Other	2	4
Reason for taking supplements		
Doctor's recommendation	2	4
Family and friend's recommendation	8	16
Personal decision (to improve health)	21	42
Advertisement	1	2
Other	1	2
NA	17	34

* Refers to herb drinks from Korean traditional medicine

3.3.4 Beliefs about health and diet

The majority of subjects (98%) reported that they agree to some extent that 'Diet is important in maintaining health': strongly agree; 76%, agree; 10%, somewhat agree; 12%. Only 2% of subjects reported that they disagree to some extent that 'Diet is important in maintaining health': somewhat disagree; 2%.

Although the majority of subjects (88%) reported that they agree to some extent that 'Korean diet is healthier than western diet': strongly agree; 24%, agree; 18%,

somewhat agree; 46%, the belief seemed somewhat less strong than the belief that 'diet is important in maintaining health'. A number (12%) of subjects reported that they disagree to some extent that 'Korean diet is healthier than western diet': somewhat disagree; 8%, disagree; 4%.

3.4 Dietary Intake

The amount of food consumed (nutrient intake) by subjects was similar on all three days, hence, the average of three 24 hour recalls was used to assess dietary intake of subjects.

3.4.1 Food intakes of subjects

Foods consumed by subjects were divided into either plant or animal food categories. Foods are then further classified as belonging to one of the 19 categories.

Comparison between the short and the long residence in New Zealand

Subjects who have lived longer in New Zealand tended to have lower intakes of plant foods than those who have shorter residence. The opposite was observed in the intakes of animal foods. The difference observed in food consumption between the longer and shorter residence was particularly large for fruits, dairy products and fats and oils (animal). However, only the difference reported in intake of fats and oils (animal) between the two groups was statistically significant (P=0.038). Intakes of other food categories, including sum of plant foods and sum of animal foods, were not statistically significantly different between the two resident groups (P>0.05). Furthermore, using the spearman correlation test, it was also found that length of residence in New Zealand was positively correlated with the intake of fats and oils (animal) (r_s=0.285, n=50, P=0.045), but not with the intakes of other food categories (P>0.05). The food intakes of the shorter and the longer resident subjects are tabulated in Table 3.15.

Table 3.15 Average daily food consumption of the shorter and the longer resident subjects by food categories[1]

Food categories (g)	**All subjects Average** n=50	**Short residence** n=28	**Long residence** n=22
Plant foods			
Cereal and cereal products	275.9 (86.5)	281.0 (81.7)	269.5 (93.8)
Potato and starchy foods	30.8 (43.0)	28.0 (34.1)	37.8 (53.4)
Sugar and sugar products	13.8 (14.1)	14.9 (15.8)	12.4 (11.8)
Pulses and pulse products	52.5 (75.9)	60.2 (86.9)	42.7 (59.6)
Nuts and nuts products	3.1 (6.5)	3.5 (8.0)	2.5 (3.7)
Vegetables	277.8 (128.3)	281.5 (133.9)	273.1 (123.8)
Mushrooms	6.1 (11.9)	7.5 (12.9)	5.8 (10.7)
Fruits	218.8 (193.4)	245.7 (231.0)	184.6 (128.5)
Marine vegetables	3.3 (2.5)	3.3 (2.6)	3.5 (2.5)
Drinks and alcohols	286.2 (250.3)	303.2 (255.9)	291.7 (249.0)
Spices	15.6 (12.0)	16.6 (9.9)	14.4 (14.5)
Oils (vegetable)	9.0 (7.9)	9.8 (9.6)	8.4 (5.1)
Other (plant)	3.4 (10.6)	1.2 (1.5)	6.3 (15.6)
Sum of Plant foods	1196.3 (448.9)	1244.6 (506.6)	1134.7 (365.0)
Animal foods			
Meat and meat products	74.7 (83.3)	71.8 (68.3)	78.4 (100.8)
Eggs	23.0 (18.9)	21.6 (18.0)	24.7 (20.3)
Fish and seafood	48.9 (47.1)	48.9 (49.5)	49.0 (45.1)
Dairy products	107.9 (133.5)	92.2 (130.3)	127.9 (137.8)
Fats and oils	0.4 (0.8)	0.1 (0.2)[†]	0.7 (1.1)[†]
Other	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Sum of animal foods	254.8 (171.7)	234.6 (155.4)	280.6 (191.0)

[1] Figures are mean (standard deviation)
[†] Intakes are statistically different by Mann-Whitney Test at P=0.038

Comparison between the older and younger women

The older women had almost twice the intake of meat and meat products (97.6g) compared to the younger women (51.8g). However, this was not considered statistically significant (P=0.052). Intakes of other foods, including total animal and total plant foods, were not statistically significantly different between the two age groups (P>0.05). No correlation was established between the age of subjects and the intakes of foods either (P>0.05).

Relationship between food intakes and socioeconomic factors

Income level and working status were not found to be related to intakes of any of these food categories ($P>0.05$). However, there was a significant difference in dairy food intakes between subjects with higher education level (with tertiary education) than those with lower education level (without tertiary education) ($P=0.044$). It was found that subjects with higher education consumed more than twice the amount of dairy products (126.5g) per day compared to subjects with lower education (49.0g). There was no association between intakes of other food categories and education level ($P>0.05$).

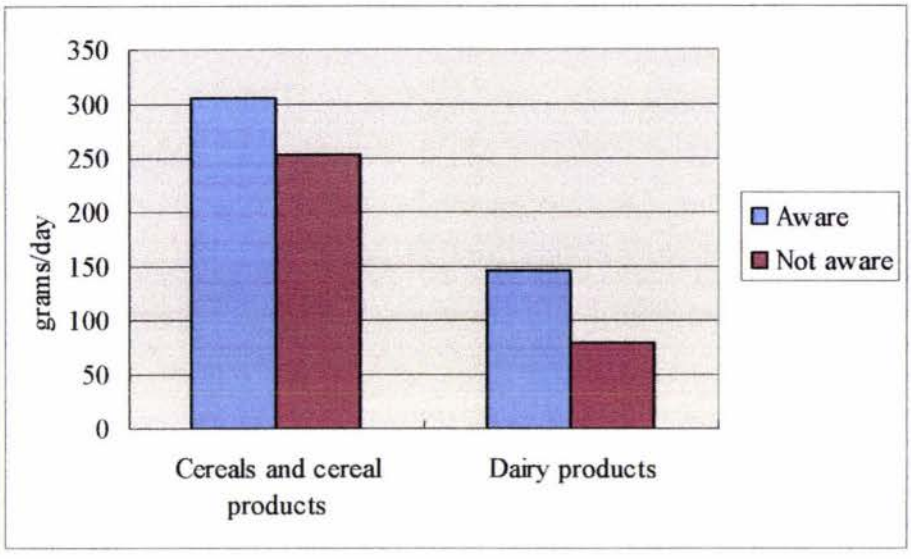
Relationship between food intakes and nutrition knowledge

Although the attitude to utilise nutrition information in subjects when shopping for foods was found not to be related to food intakes, awareness of nutritional materials, such as the Food Pyramid, was found to be related to intakes of cereals and cereal products ($P=0.046$) and dairy products ($P=0.004$) in subjects. Subjects who were aware of such nutritional materials had greater intakes of cereals and cereal products and dairy products (306.10g and 146.05g respectively) than those who were not (254.06g and 80.28g respectively). The awareness of nutritional materials was not related to intakes of other foods ($P>0.05$). The differences in intakes of cereals and cereal products and dairy products between those who are and are not aware of nutritional materials are illustrated in Figure 3.17.

Relationship between food intakes and subjects' belief in nutrition

Subjects who agreed that 'Korean diet is healthier than Western diet' consumed much less meat and meat products (61.6g) than those who disagreed (170.7g). However, the difference was not statistically significant ($P=0.08$). There was no link between intakes of other food categories and subjects' belief that 'Korean diet is healthier than Western diet' ($P>0.05$).

Figure 3.17 The difference in intakes of cereals and cereal products and dairy products between those who are and are not aware of nutritional materials



3.4.2 Food intakes - comparison with Korean National Survey data

Data from the Korean National Survey were used to compare the food intakes of the study subjects with those of Korean women living in Korea. The comparisons are indicative only as the two surveys used different methodologies. In order to make an appropriate comparison, the results from the present study were divided into two age groups to match with those from the Korean National Survey.

Subjects from the current study consumed lower amounts of cereals and cereal products, vegetables, marine vegetable, fruits, and spices than women living in Korea. On the other hand, subjects had greater intake of pulses and pulse products, eggs, and dairy products compared to their Korean counterparts. It was evident that while the intakes of plant foods tended to be lower, the intakes of animal foods tended to be higher in subjects when compared to women living in Korea. However, the intake of pulses and pulse products was higher in subjects than Koreans in Korea and the intake of meat and meat products was similar in the two cohorts. The latter contradicts the findings presented in Figure 3.7 that the majority of subjects reported an increase in meat and meat products consumption after immigration. Further, subjects had higher intake of animal oils/fats than their Korean counterparts and vice versa for vegetable oils. The results are tabulated in Table 3.16.

Table 3.16 Average daily food consumption of subjects by categories

Food categories (g)	Study subjects[1] All subjects average	40-49 yrs women n=37	50-55 yrs women n=13	Korean Survey[2] 30-49 yrs women	50-64 yrs women
Plant foods					
Cereal and cereal products	275.9	279.2	266.5	296.0	293.1
Potato and starchy foods	30.8	28.7	36.6	31.8	24.7
Sugar and sugar products	13.8	14.7	11.2	14.8	9.9
Pulses and pulse products	52.5	45.8	71.5	30.9	30.1
Nuts and nut products	3.1	3.3	2.3	2.8	3.4
Vegetables	277.8	282.7	264.7	325.3	330.3
Mushrooms	6.1	6.8	4.2	5.8	4.0
Fruits	218.8	225.4	199.9	270.0	264.5
Marine vegetables	3.3	2.9	4.5	11.6	7.8
Drinks and alcohols	286.2	293.1	266.8	109.7	61.8
Spices	15.6	17.8	9.3	32.3	33.0
Oils (vegetable)	9.0	9.9	6.5	12.0	7.5
Other (plant)	3.4	4.2	1.1	4.6	2.5
Sum of Plant foods	1196.3	1214.5	1144.2	1147.6	1072.6
Animal foods					
Meat and meat products	74.7	75.2	73.4	85.9	57.9
Eggs	23.0	21.9	26.0	18.8	9.9
Fish and seafood	48.9	44.2	62.3	68.1	62.6
Dairy products	107.9	95.8	142.5	48.7	36.1
Fats and oils	0.4	0.3	0.5	0.1	0.0
Other	0.0	0.0	0.0	0.3	0.0
Sum of animal foods	254.8	237.3	304.7	221.9	166.5

[1] Results from the present study
[2] Results from the Korean National Survey (South Korean Ministry of Health and Welfare, 2002)

The most prominent difference in food intakes identified between the two groups was in dairy products. The consumption of dairy products reported by subjects was more than twice the amount reported from the Korean National Survey. This is in accordance with the results reported in section 3.3.2.1 where most of subjects reported increased intake of dairy products since arrival in New Zealand.

Comparison of dietary intakes in younger women: current study vs Korean National Survey

The two groups consumed relatively similar amounts of total plant foods and total animal foods. In addition to the food consumption pattern described above, which was identified as being common to both age groups, young study subjects consumed less meat and meat products and fish and seafood than young Korean women. This may be due to the different age bands (Korean data were based on women aged between 30-49 years old and subjects between 40-49 years old; there were no subjects <40 years in current study) as intake of these foods can often be higher in the young.

Comparison of dietary intakes in older women: current study vs Korean National Survey

Two groups had similar total intakes of plant foods. However, older subjects consumed almost twice the amount of total animal foods than older Korean women in Korea. With the exception of fish and seafood, subjects had higher intakes of all animal foods compared to Korean women. The difference was particularly large in dairy products. Again, this may be due to the different age brackets used in two studies (data from present study was based on women aged between 50-55 years old and Korean data between 50-64 years old) where intake of animal foods can often be higher in the young.

Due to lack of comparable data from New Zealand National Nutrition Survey, comparison of dietary intakes of present study subjects with New Zealand women by food groups was not possible.

3.4.3 Nutrient intake status of subjects

3.4.3.1 Energy intake and Macronutrients

Energy intake

The average daily total energy intake of subjects was 1686.8 kcal. The lowest reported was 821.3 kcal and the highest was 2786.8 kcal.

Carbohydrate intake

The average carbohydrate intake of the whole group was 241.3g per day, which contributed to 55.1% of the total energy.

Alcohol intake

The alcohol consumption was very low among study subjects, only contributing 0.6% of the total energy. This is a common dietary habit for Korean women though Korean men tend to have much higher consumption.

Protein intake

The average protein intake of subjects was 70g per day providing 16.8% of the total energy. The average protein intake by body weight was 1.24g/kg.

Fat intake

Total fat intake per day was 49.7g with fat derived energy of 25.7%. The average daily cholesterol intake of subjects was 231.1mg.

Fibre intake

The average daily fibre intake of subjects was 17.2g. The fibre intake of subjects ranged from 8.0g to 40.0g per day.

The macronutrient intakes are summarised in Table 3.17. The percent energy from macronutrients was close to ideal range.

Comparison between the short and the long residence

The longer New Zealand residence women had lower intakes of carbohydrate and fibre than the shorter New Zealand residence. The intakes of macronutrients and the percent energy from macronutrients between the shorter and the longer New Zealand residence are summarised in Table 3.18.

There was no difference found in macronutrient intakes and the percent energy from macronutrients between the shorter and the longer residence ($P>0.05$). Two groups had similar intake of dietary cholesterol; 239.9(±116.6)mg for the longer residence and 224.2(±92.8)mg for the shorter residence ($P>0.05$). Furthermore, length of residency in New Zealand was found not to be correlated with macronutrient intakes and the percent energy from macronutrients ($P>0.05$).

Table 3.17 Average daily dietary energy sources and macronutrient intakes of whole group

Nutrients[1]	Mean	SD	Min	LQ	Median	UQ	Max
Energy (kJ)	7060.6	1812.8	3438.1	5634.6	6816.6	8428.8	11665.7
Energy (kcal)	1686.8	433.1	821.3	1346.0	1628.4	2013.6	2786.8
Protein (g)	70.0	21.6	31.0	53.2	65.45	85.58	119.0
Protein/weight (g/kg)	1.24	0.41	0.42	0.93	1.19	1.57	2.25
Total fat (g)	49.7	20.5	19.0	33.5	45.8	64.5	122.0
Cholesterol (mg)	231.1	103.1	61.0	161.6	202.2	293.2	521.0
Carbohydrate (g)	241.3	64.3	108.0	201.6	229.9	286.7	443.0
Alcohol (g)	1.3	3.4	0.0	0.0	0.0	0.3	17.0
Fibre (g)	17.2	6.7	8.0	12.7	15.6	18.8	40.0
Energy from Protein (%)	16.8	2.9	12.0	15.0	16.7	18.6	28.0
Energy from Fat (%)	25.7	6.6	14.0	21.0	24.8	30.5	46.0
Energy from Carbohydrate (%)	55.1	7.1	36.0	50.0	56.4	60.7	71.0
Energy from Alcohol (%)	0.6	1.4	0.0	0.0	0.0	0.1	7.0

[1] Data are based on 50 subjects

Table 3.18 Average daily dietary energy sources and macronutrient intakes of individuals with shorter and longer New Zealand residence

Nutrients	**All subjects' average** n=50	**Short residence** n=28	**Long residence** n=22
Energy (kJ)	7060.6 (1812.8)	7284.6 (1692.9)	6775.6 (1957.4)
Energy (kcal)	1686.8 (433.1)	1740.2 (404.4)	1618.6 (467.6)
Protein (g)	70.0 (21.6)	70.9 (20.9)	68.7 (23.0)
Total fat (g)	49.7 (20.5)	49.5 (16.7)	50.1 (25.0)
Carbohydrate(g)	241.3 (64.3)	253.9 (70.0)	225.2 (53.5)
Alcohol (g)	1.3 (3.4)	1.6 (3.9)	1.0 (2.6)
Fibre (g)	17.6 (6.7)	17.6 (7.9)	16.6 (5.1)
Protein E (%)	16.8 (2.9)	16.6 (3.5)	17.1 ((1.9)
Fat E (%)	25.7 (6.6)	25.1 (6.5)	26.4 (6.9)
Carb E (%)	55.1 (7.1)	55.7 (7.1)	54.3 (7.2)
Alcohol E (%)	0.6 (1.4)	0.7 (1.7)	0.4 (1.1)

Comparison between the younger and older women

The macronutrient intakes and the percentage energy from these macronutrients in the two age groups (young vs old) among subjects were not statistically different (P>0.05). No correlation was found between age of subjects and the macronutrient intakes or the percent energy from macronutrients (both P>0.05).

Relationship between energy and macronutrient intakes and socioeconomic factors

It was found that subjects with higher education level had significantly higher intakes of fat (P=0.023), percent energy from fat (P=0.013), and cholesterol (P=0.041) than subjects with lower education. No significant relationship was observed between education level and other nutrient intakes (P>0.05). Income level was not associated with intake of any of these nutrients (P>0.05).

Relationship between energy and macronutrient intakes and medical factors

There was no difference in intakes of total energy, fat, percent energy from fat, cholesterol, fibre, alcohol and percent energy from alcohol between subjects who reported taking medication or previously been treated for medical conditions and those who did not. The medical conditions tested were hypertension (P>0.05), hypercholesterolemia (P>0.05) and diabetes (P>0.05). No difference was found in

intakes of these nutrients between pre and post menopausal women either (P>0.05).

Relationship between energy and macronutrient intakes and anthropometric/ biochemical factors

It was found that BMI was positively correlated with percent energy derived from fat (r_s=0.321, n=50, P=0.023) but was not related to intakes of any other nutrients (P>0.05). Waist circumference was also found to be related to percent energy derived from fat (r_s=0.280, n=50, P=0.049) in this group of women, but not to other nutrients (P>0.05). However, there was no association between WHR and intakes of these nutrients (P>0.05). The percent body fat was moderately positively correlated with percent energy derived from fat (r_s =0.445, n=49, P=0.001), but not with intakes of other nutrients (P>0.05). Finally, blood glucose was found to be positively associated with both fat intake (r_s=0.329, n=49, P=0.021) and percent energy from derived fat (r_s=0.354, n=49, P=0.013) but was not related to any other nutrients (P>0.05).

Relationship between energy and macronutrient intakes and nutrition knowledge

Subjects who were aware of the nutritional materials (27.9%) had higher percentage of energy intake from fat compared to those who were not aware (24.1%), (P=0.033). There was no significant difference in intakes of other nutrients between subjects who were and were not aware of the nutritional materials (P>0.05). It was found that utilising nutrition information in subjects when shopping for foods was not related to intakes of energy or macronutrients (P>0.05).

Relationship between energy and macronutrient intakes and belief about health and nutrition

There was no difference in intakes of total energy, fat, alcohol, fibre, cholesterol and percent energy from fat and percent energy from alcohol between subjects who agreed that 'Korean diet is healthier than Western diet' and those who disagreed (P>0.05).

3.4.3.2 Micronutrients

Vitamin and mineral intakes

The average daily thiamin and riboflavin and niacin intake of subjects were 1.5mg, 1.3mg, and 15mg, respectively. The intake of total vitamin A Eq, vitamin C, and

folate were 935.4ug, 126mg and 316.8ug, respectively. Calcium, iron and sodium intake of subjects were 595.7mg, 12.8mg, and 3748.8mg, respectively. The intake range for some nutrients was large, particularly B-carotene Eq and total vitamin A Eq. Subjects who consumed fresh fruit and vegetables juice extracts every day had very high B-carotene Eq and thereby total vitamin A Eq intakes. The average daily vitamin and mineral intake of subjects are summarised in Table 3.19.

Comparison between the short and the long residence

Subjects who lived longer in New Zealand were found to have lower consumption of fruit and vegetables and higher consumption of dairy products than subjects who had lived for a shorter time in New Zealand. This is reflected in micronutrient intakes in that the longer New Zealand residence women had lower intakes of vitamin C and folate and higher intakes of calcium than the shorter New Zealand residence women. However, micronutrient intakes between the shorter and the longer New Zealand residence did not differ significantly ($P>0.05$). The average daily micronutrient intakes of the shorter and the longer resident subjects is summarised in Table 3.20.

Comparison between the younger and older women

There was no statistically significant difference in micronutrient intakes between the 'young and old' age groups ($P>0.05$).

Relationship between micronutrient intakes and socioeconomic factors

The micronutrient intakes of subjects were not related to education and income level ($P>0.05$).

Relationship between micronutrient intakes and medical factors

There was no difference in sodium intake between subjects who reported taking medication or previously been treated for hypertension and those who do not ($P>0.05$).

Relationship between micronutrient intakes and blood pressure measurements

The blood pressure, both systolic and diastolic, of subjects were not found to be related with sodium intake in subjects ($P>0.05$).

Relationship between micronutrient intakes and nutrition knowledge

Subjects who were aware of nutrition materials had statistically significantly higher intakes of thiamine (P=0.005), retinol (P=0.022) and calcium (P=0.031) than subjects who were not. These correlations seen are in line with the results reported earlier (section 3.4.1) in that women who were aware of nutrition materials had grater intakes of cereals and cereal products and dairy products than those who were not. There was no association between micronutrient intakes and reported reading of nutrition information when purchasing food items (P>0.05).

Relationship between micronutrient intakes and belief about health and nutrition

There was no difference in intakes of micronutrients between subjects who agree that 'Korean diet is healthier than Western diet' and those who disagree (P>0.05).

Table 3.20 Average daily micronutrient intakes of individuals with shorter compared to longer New Zealand residence[1]

Nutrients	**All subjects' average** n=50	**Shorter residence** n=28	**Longer residence** n=22	**Mean difference** Long - short residence
Thiamin (mg)	1.5 (1.0)	1.3 (0.6)	1.7 (1.4)	0.4
Riboflavin (mg)	1.3 (0.5)	1.3 (0.6)	1.3 (0.5)	0.0
Niacin (mg)	15.0 (5.0)	15.2 (5.2)	14.5 (4.9)	-0.7
Retinol (ug)	138.5 (84.3)	120.5 (68.4)	161.3 (98.0)	40.8
B Carotene Eq (ug)	4806.9 (4386.1)	4463.7 (3727.8)	5243.7 (5163.9)	780
Total vitamin A Eq (ug)	935.4 (716.1)	860.1 (616.3)	1031.2 (831.2)	171.1
Vitamin C (mg)	126.0 (73.7)	133.0 (82.3)	117.2 (61.7)	-15.8
Vitamin E (mg)	9.4 (4.4)	10.2 (5.3)	8.5 (2.7)	-1.7
Vitamin B6 (mg)	1.8 (0.6)	1.9 (0.5)	1.7 (0.6)	-0.2
Total folate (ug)	316.8 (130.8)	327.4 (147.1)	303.3 (108.5)	-24.1
Sodium (mg)	3748.8 (1182.9)	3725.0 (1313.0)	3779.0 (1023.1)	54.0
Potassium (mg)	3149.3 (1178.0)	3180.5 (1376.4)	3109.6 (894.0)	-70.9
Caclium (mg)	595.7 (284.1)	576.2 (283.2)	620.5 (290.0)	44.3
Phosphorus (mg)	1152.9 (366.6)	1163.8 (384.4)	1138.9 (351.2)	-24.9
Iron (mg)	12.8 (4.5)	13.4 (4.4)	12.0 (4.6)	-1.4
Zinc (mg)	8.3 (3.4)	8.2 (3.4)	8.4 (3.6)	0.2

[1] Figures are mean (standard deviation)

Table 3.19 Average daily vitamin and mineral intakes of whole group

Nutrients[1]	Mean	SD	Min	LQ	Median	UQ	Max
Thiamin (mg)	1.5	1.0	0.5	0.9	1.3	1.7	6.7
Riboflavin (mg)	1.3	0.5	0.6	0.9	1.2	1.7	2.8
Niacin (mg)	15.0	5.0	6.3	11.4	13.7	17.8	27.5
Retinol (ug)	138.5	84.3	24.4	75.4	128.5	189.2	370.0
B-Carotene Eq (ug)	4806.9	4386.1	607.1	2547.8	3540.8	5505.3	22814.3
Total vitamin A Eq (ug)	935.4	716.1	251.1	522.3	741.9	1028.9	3894.0
Vitamin C (mg)	126.0	73.7	24.8	69.0	112.3	166.9	315.2
Vitamin E (mg)	9.4	4.4	3.1	6.4	8.7	10.9	29.8
Vitamin B6 (mg)	1.8	0.6	0.6	1.4	1.8	2.1	3.1
Total folate (ug)	316.8	130.8	142.3	215.0	303.6	360.8	768.1
Sodium (mg)	3748.8	1182.9	1632.0	2959.2	3677.8	4517.5	6698.5
Potassium (mg)	3149.3	1178.0	1578.2	2278.7	3082.5	3634.9	7535.3
Calcium (mg)	595.7	284.1	230.0	370.8	526.4	724.9	1521.6
Phosphorus (mg)	1152.9	366.6	541.0	868.2	1083.8	1392.5	2111.4
Iron (mg)	12.8	4.5	5.8	9.3	12.3	15.5	25.7
Zinc (mg)	8.3	3.4	3.3	5.3	7.8	10.6	16.9

[1] Data are based on 50 subjects

3.4.4 Nutrient status – comparison with Korean National Survey data

The 24-hour dietary recall method was used in both the current study and the Korean National Nutrition Survey. However, not all surveys are identical in design and methodologies and differences may exist between surveys. Therefore, the comparisons made are indicative only. Again, the results from present study were divided into two age groups to match with the data from the Korean National Survey.

3.4.4.1 Energy intake and macronutrients

Energy intake

The energy intake was lower in subjects compared to their Korean counterparts among women aged between 40-49 years. However, the energy intakes were similar among the two groups in older aged women.

Carbohydrate intake

Subjects had lower intake of carbohydrates than Korean women in Korea. This may be related to lower consumption of cereals and cereal products in subjects compared to their Korean counterparts as reported in Table 3.16. The percentage energy derived from carbohydrates was also lower in subjects than that observed in Korean women living in Korea. In the older group, in particular, subjects had almost 20% less energy contributed from carbohydrates than women in Korea. This was in accordance with the lower amount of cereals and cereal products consumed in subjects compared to their Korean counterparts.

Alcohol intake

Subjects consumed less alcohol compared to women living in Korea. The alcohol intake of subjects was less than half of that reported by women living in Korea.

Protein intake

The protein intake was similar in the two groups. However, the percent energy derived from protein was slightly higher in subjects than their Korean counterparts.

Fat intake

The fat intake was found to be higher in study subjects compared to that of women in Korea. Similarly, greater percentage of energy came from fat in subjects than Korean women living in Korea. In particular, the percentage energy derived from fat of subjects aged between 50-55 years (28%) was more than twice the amount reported from the same age group in Korean women in Korea (13.3%). This may be a reflection of greater consumption of dairy products and eggs in subjects (142.5g and 26.0g respectively) compared to their counterparts in Korea (36.1g and 9.9g respectively) as reported in Table 3.16.

Fibre intake

The intake of fibre was greater in subjects than the level reported by their Korean counterparts. The difference observed may be due to the artefact arising from the different methods used when analysing food composition rather than the difference in actual level of dietary fibre consumption. The food tables used in the present study present dietary fibre values determined by the Englyst method whereas the food tables used in the Korean Survey present dietary fibre values determined by the AOAC total dietary fibre method.

The comparison of daily energy and macronutrient intakes of study subjects and Korean women in Korea is summarised in Table 3.21.

3.4.4.2 Micronutrients

Vitamin intake

The vitamin C intake in subjects was lower compared to that of women in Korea in both age groups; 131g vs 160.6g in the younger age group and 113.0g vs 153.1g in the older age group, respectively. This may be a result of lower consumption of foods from the vegetables category in subjects as reported in Table 3.16. The intakes of riboflavin and total vitamin A Eq were higher in subjects compared to Korean women in Korea in both age groups.

Mineral intake

The sodium intake was much lower in subjects compared to women in Korea in both age groups. This was in accordance with the findings in section 3.4.2, where it was found that subjects had lower consumption of foods from spices category (Table 3.16).

The potassium intake was slightly higher in subjects compared to women in Korea. The difference of potassium intake was larger in older women. Subjects had higher calcium intake than women in living Korea. This may be a reflection of greater consumption of dairy products in subjects compared to their Korean counterparts. The level of phosphorus intake was similar between the subjects and women in Korea.

The comparison of daily micronutrient intakes of study subjects and Korean women in Korea is summarised in Table 3.22.

3.4.5 Nutrient status - comparison with New Zealand women

Data from the New Zealand National Nutrition Survey (NZ population data for individuals aged 15+ years were used in this study) were used to compare the food intakes of subjects with those of New Zealand women. The 24-hour dietary recall method was also used in the NZ National Nutrition Surveys. However, again, the comparisons are indicative only as differences may exist between surveys. In order to make an appropriate comparison, the results from present study were divided into two age groups to match with data from the New Zealand National Nutrition Survey.

3.4.5.1 Energy intake and macronutrients

Energy intake

New Zealand women had greater energy intake than subjects.

Carbohydrate intake

Subjects consumed greater amounts of carbohydrate than New Zealand women in both age groups, hence a greater proportion of carbohydrate derived energy was observed in subjects compared to New Zealand women.

Alcohol intake

New Zealand women had up to 7 times greater alcohol consumption than study subjects. The percent energy contributed from alcohol was also higher in New Zealand women than subjects.

Table 3.21 Average daily dietary energy and macronutrient intakes of study subjects in two age groups

Nutrients[1]	Subjects Average	**Study subjects** 40-49 yrs women	50-55 yrs women	**Korean Survey** 30-49 yrs women	50-64 yrs women	**Study subjects** 40-44 yrs women	45-55 yrs women	**NZ Survey** 25-44 yrs women	45-64 yrs women
	n=50	n=37	n=13			n=16	n=34		
Energy (kJ)	7060.6	7009.5	7206.1	-	-	7083	7050	8417	7387
Energy (kcal)	1686.7	1674.5	1721.5	1944.3	1752.3	1692	1684	-	-
Protein (g)	70.0	68.6	73.8	71.1	62.7	69	71	77	72
Total fat (g)	49.7	48.0	55.0	39.5	25.9	48	51	80	70
Cholesterol (mg)	231.1	-	-	-	-	206	243	278	259
Carbohydrate (g)	241.3	243.4	235.1	317.8	311.2	247	239	229	202
Alcohol (g)	1.3	1.4	1.1	3.2	2.5	3	1	11	7
Fibre (g)	17.2	17.3	16.7	7.4	8.0	17	17	18	19
Energy from Protein (%)	16.8	16.6	17.2	14.6	14.3	16	17	16	17
Energy from Fat (%)	25.7	25.0	27.8	18.3	13.3	24	26	35	35
Energy from Carbohydrate (%)	55.1	56.0	52.8	65.4	71.0	56	54	46	47
Energy from Alcohol (%)	0.6	0.6	0.4	1.2	1.0	1	0	3	2

[1] Data are based on 50 subjects

Table 3.22 Average daily micronutrient intakes of study subjects in two age groups

Nutrients[1]	Subjects Average	**Study subjects** 40-49 yrs women	50-55 yrs women	**Korean Survey** 30-49 yrs women	50-64 yrs women	**Study subjects** 40-44 yrs women	45-55 yrs women	**NZ Survey** 25-44 yrs women	45-64 yrs women
	n=50	n=37	n=13			n=16	n=34		
Thaimin (mg)	1.5	1.30	1.91	1.29	1.06	1.3	1.5	1.2	1.2
Riboflavin (mg)	1.3	1.30	1.35	1.13	0.93	1.3	1.3	1.6	1.6
Niacin (g)	14.9	15.0	14.7	17.4	15.3	15.0	14.9	-	-
Niacin Eq (ug)	23.7	23.6	24.02	-	-	23	24	31	29
Retinol (ug)	138.5	129.6	163.6	-	-	139	138	406	428
B-Carotene Eq (ug)	4806.9	4963.8	4360.4	-	-	3811	5276	2825	3557
Total vitamin A Eq (ug)	935.4	953.2	884.9	664.2	616.3	769	1014	875	993
Vitamin C (mg)	126.0	130.7	112.8	160.6	153.1	113	132	105	105
Vitamin E (mg)	9.4	9.4	9.6	-	-	8.8	9.7	9.0	8.9
Vitamin B6 (mg)	1.8	1.9	1.6	-	-	1.7	1.8	1.3	1.3
Total folate (ug)	316.8	310.1	335.6	-	-	320	315	220	228
Sodium (mg)	3748.8	3687.5	3923.1	5229.7	5135.4	3985	3638	-	-
Potassium (mg)	3149.3	3105.6	3273.8	3078.1	2824.9	2881	3276	3045	3054
Calcium (mg)	595.7	583.9	629.3	490.7	480.2	552	616	759	712
Phosphorous (mg)	1152.9	1144.8	1175.9	1162.6	1078.5	1093	1181	1334	1267
Iron (mg)	12.8	13.1	12.0	13.1	12.7	12.5	12.9	10.5	10.3
Zinc (mg)	8.3	8.1	8.9	-	-	7.7	8.6	10.7	10.0

[1] Data are based on 50 subjects

Protein intake

The intake of protein and the percent energy contributed from protein were similar in the two groups.

Fat intake

The most notable difference in these two groups is the fat intake. The fat intake was greater in New Zealand women than in study subjects in both age groups. This was directly reflected in the higher percentage energy contributed from fat in New Zealand women compared to subjects.

Cholesterol intake

Parallel to the fat intake, the cholesterol intake was greater in New Zealand women than in study subjects in both age groups.

The comparison of daily energy and macronutrient intakes of study subjects and women in New Zealand is summarised in Table 3.21

3.4.5.2 Micronutrients

Vitamin intakes

Subjects consumed approximately one third of retinol compared to New Zealand women. However, the intake of B-Carotene Eq of subjects was approximately 2/3 higher than New Zealand women. Intakes of vitamin C, vitamin B6 and folate were also slightly higher in subjects. On the other hand, NZ women had higher intakes of riboflavin and niacin Eq than Korean women. Vitamin E intake was similar in the two cohorts.

Mineral intakes

The calcium and phosphorus level of subjects were lower than that of New Zealand women. On the other hand, the intake of iron was higher in subjects compared to New Zealand women. However, it may be possible that greater proportion is of non-heam iron from vegetables in subjects. Zinc intake was similar in the two cohorts.

The comparison of daily micronutrient intakes of study subjects and women in New Zealand is summarised in Table 3.22

3.4.6 Nutrient status – comparison of study subjects with Korean and New Zealand women

The Korean and New Zealand National Survey data use different age cut-offs, as presented in Table 3.21 and 3.22 complicating direct comparison between present study, Korean and New Zealand data. However, a crude comparison of the data from three surveys is made and notable differences highlighted.

3.4.6.1 Energy and macronutrient intakes

The intake of carbohydrates was the highest in Korean women living in Korea, the lowest in New Zealand women and intermediate in study subjects. The pattern was found to be the opposite for fat intake in that the highest level was reported in New Zealand women, the lowest in Korean women and intermediate in study subjects. These patterns were reflected in the proportions of energy derived from these macronutrients. However, the intake of protein and protein-derived energy were relatively close to each other in all three groups.

3.4.6.2 Micronutrient intakes

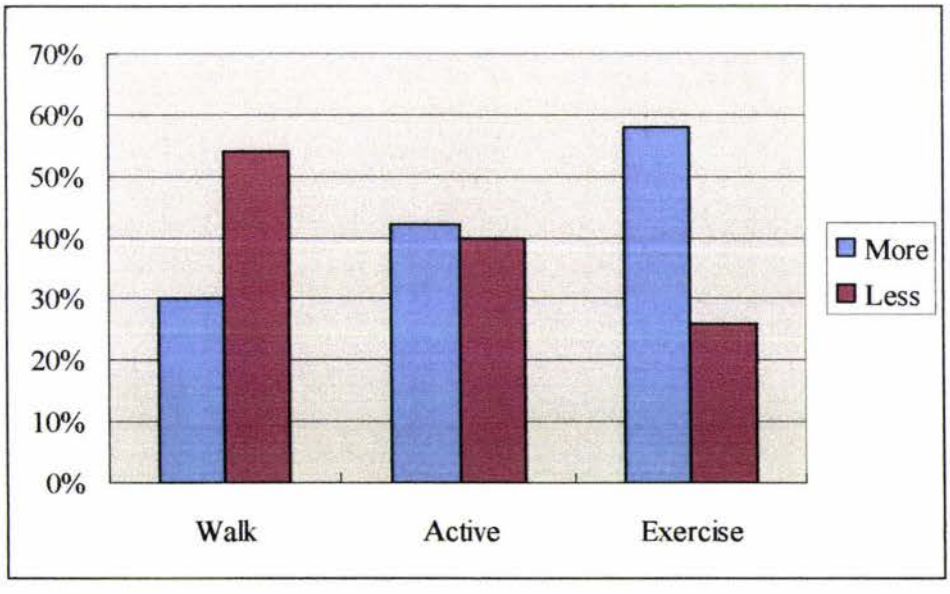
The calcium intake is also of interest. The calcium status was reported to be better in subjects than Koreans living Korea which may be a reflection of greater consumption of dairy products reported in subjects compared to their Korean counterparts. However, the calcium level of subjects was still lower than that of New Zealand women. The intermediate nature of study subjects was also observed in intakes of vitamin C. The intake was the highest in Korean women and the lowest in New Zealand women. This finding may be due to the generally high consumption of fruit and vegetables noted in Asian diets (Koreans) compared to relatively low consumption of fruit and vegetables in Western diets (New Zealand). The intakes of other nutrients were similar to each other in all three groups.

3.5 Physical Activity

3.5.1 Perceived physical activity characteristics of subjects

While 42% of subjects reported being more active in New Zealand compared to Korea, 40% reported being less active in New Zealand, showing no consistent pattern in perceived activity level change after immigration. However, different patterns were observed in 'Walking' and 'Exercise' behaviours of these women since migration to New Zealand. The number of subjects who reported having less opportunity to walk in New Zealand was almost twice the number reporting more opportunity to walk. On the other hand, the opposite trend was found for 'Exercise'. Fifty eight percent of subjects reported that they have more opportunity to exercise in New Zealand whereas only 26% reported that they have less opportunity. The perceived physical activity characteristics of subjects are summarised in Figure 3.18.

Table 3.18 Physical activity characteristics of subjects since arrival in NZ [1]



[1] Only positive answers to the changes in physical activity characteristics questions are presented

In the current study it has been observed that subjects consider their general activity level as either light (58%) or moderate (42%). No subjects reported that their general activity level was either sedentary or heavy.

3.5.2 Actual physical activity characteristics of subjects

3.5.2.1 Physical activity levels of subjects

Subjects spent most of their activity time doing light activities and least time doing heavy activities. Unlike other levels of physical activity (including walking) where almost every woman was participating, only 24% of subjects were engaged in heavy activity (thus it was not possible to perform statistical tests for women in heavy activity group). Subjects who reported spending greater time walking were those who have non-sedentary occupations such as dairy shop owners and shop assistants. The time spent by subjects participating in different levels of physical activity is tabulated in Table 3.23.

Table 3.23 Time spent by subjects participating in different levels of physical activity

Measurement	Mean	SD	Min	LQ	Median	UQ	Max
Walking (min)	105.4	154.7	0.0	30.0	60.0	120.0	900.0
Light activity (min)	214.6	156.8	30.0	90.0	180.0	300.0	600.0
Moderate activity (min)	103.4	118.0	0.0	30.0	60.0	120.0	600.0
Heavy activity (min)	5.1	11.4	0.0	0.0	0.0	2.5	60.0

Relationship between physical activity levels and demographic factors

The time spent by subjects walking, participating in light and moderate activities were negatively correlated with the duration of residence in New Zealand. The time spent walking, participating in light and moderate activities were also negatively correlated with the age of subjects. However, none of these were considered statistically significant ($P>0.05$).

Relationship between physical activity levels and socioeconomic factors

There was no statistically significant difference ($P>0.05$) in the time spent walking and participating in light and moderate levels of physical activity between the working and non-working women.

Relationship between physical activity levels and anthropometric factors

The number of minutes spent walking was found to be negatively correlated with BMI (r_s=-0.299, n=50, P=0.035), WHR (r_s=-0.316, n=50, P=0.026), and percentage body fat (by BIA) (r_s=-0.360, n=49, P=0.011). Walking time was particularly strongly and negatively related to waist circumference (r_s=-0.411, n=50, P=0.003). Time spent participating in both light and moderate activity was negatively correlated with these anthropometric factors but none were considered statistically significant (P>0.05). However, the number of minutes spent participating in moderate activity was found to be negatively associated with percentage body fat (by BIA) (r_s=-0.343, n=49, P=0.016).

3.5.2.2 Exercise characteristics of subjects

Nearly half (46%) of subjects reported being infrequently engaged in exercise: seldom or never engaged, 38%; less than once a week, 8%. The rest of subjects reported being more frequently involved in exercise, up to 6 or more times a week: 1-2 times a week, 28%; 3-5 times a week, 20%; 6 or more times a week, 6%. (Exercise refers to exercises that raise heart rate and make subjects sweat, and which last for at least 30 minutes.) These are somewhat contradictory to the perceived exercise characteristics of subjects reported earlier in section 3.5.1, where almost 60% of subjects reported that they have more opportunity to exercise in New Zealand compared to Korea.

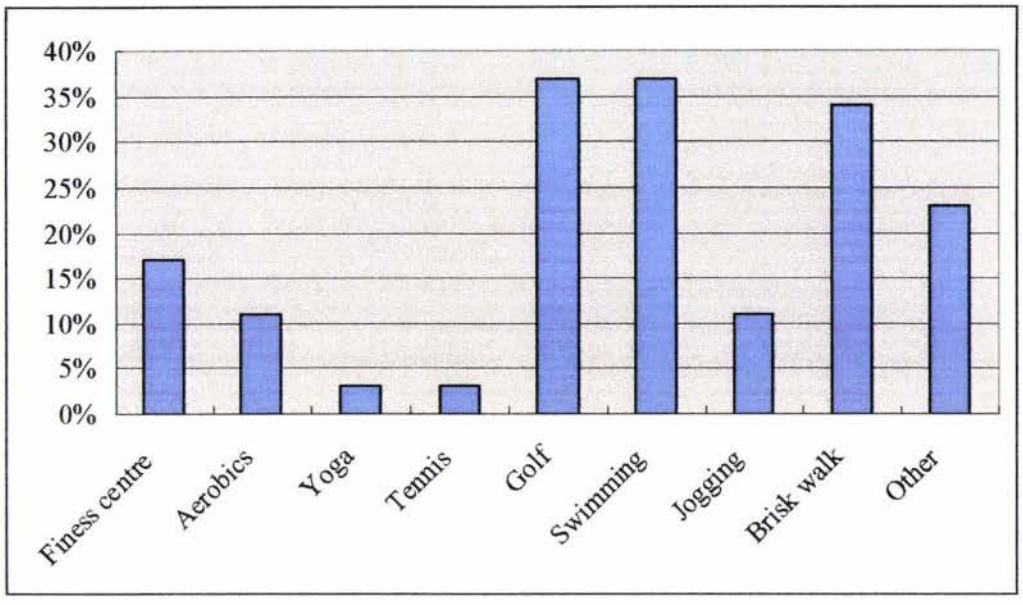
Types of exercise

Golf, swimming and brisk walking were the most preferred forms of exercise in these women. Others included *Tae-Kwon-Do* (Korean martial art), squash and table tennis. The types of exercise which subjects are engaged are illustrated in Figure 3.19.

Reasons for playing sports and exercise

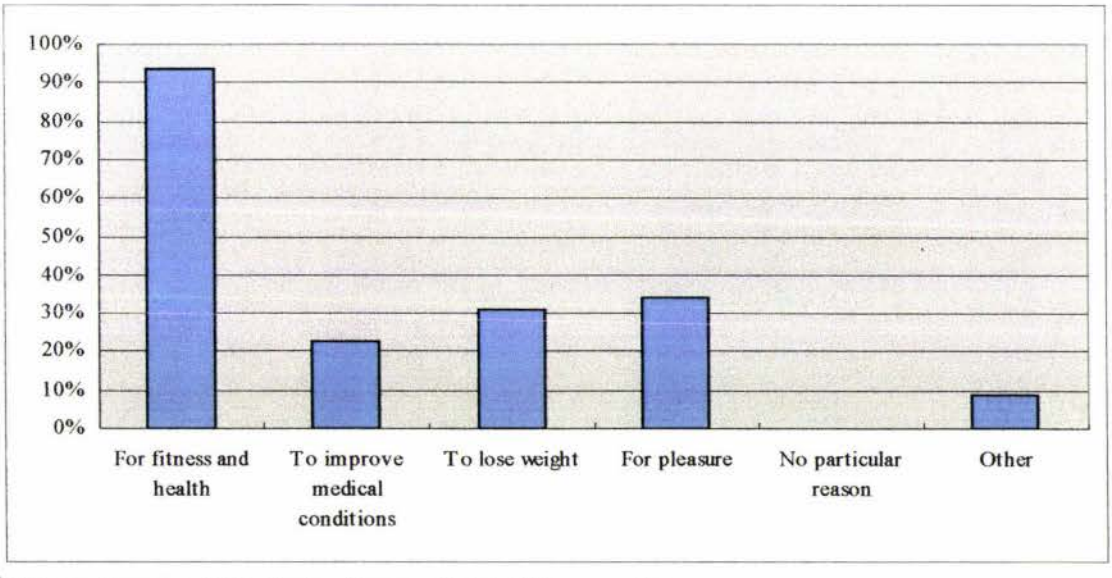
Subjects reported that 'fitness and health' was the main reason for playing sports and exercise (94%). Pleasure (34%) and weight loss (31%) were reported to be the second and third most important reasons in this population. However, the response rates for these were much lower than that for 'fitness and health'. Reasons for playing sports and exercise are illustrated in Figure 3.20.

Figure 3.19 Types of exercise[1]



[1] Data are based on 35 subjects who reported that they exercise

Figure 3.20 Main reasons for playing sports/exercise[1]



[1] Data are based on 35 subjects who reported that they exercise.

Factors affecting exercise frequency (infrequent vs frequent)

Demographic factors such as length of residency in New Zealand (short vs long) and age of subjects (young vs old), socioeconomic factors such as working status, income and education levels, anthropometric factors such as BMI, WHR, waist circumference and percentage body fat (by BIA), and nutrient intakes such as

macronutrient intakes and the proportion of energy derived from these macronutrients were found not to be related to exercise frequency (all $P>0.05$).

CHAPTER 4. DISCUSSION

4.1 Sample Characteristics of Subjects

4.1.1 Demographic and socioeconomic characteristics of subjects

The study subjects shared similar demographic and socioeconomic characteristics. Firstly, the subjects had similar family composition in that most women were married and living with their children. Unlike Chinese migrants in New Zealand where three generations live together (Tan, 2001), only two women were living with their parents (parents in-law). Secondly, the subjects were highly educated and had a high rate of house ownership. This is related to the immigration policy in that the majority of immigrants who entered New Zealand from Korea since the early 1990s were assessed using a points system. Immigrants who qualified under this category are highly educated with qualifications and expertise and wealth because these were given higher points in the selection process.

However, despite their high education and high qualification background, there was a tendency towards underemployment in this group. More subjects had been employed in professions that are ranked higher in the occupation classification when they lived in Korea compared to their occupation in New Zealand (Table 3.3). Apart from those who are qualified for specific skills, such as nursing, many women have become either housewives or engaged in occupations that do not require professional skills, e.g. shop assistants. For example, women who were lecturers at tertiary institutes in Korea became full time housewives in New Zealand. This 'well qualified but under employed' phenomenon of Korean migrants has also been observed in other ethnic groups in New Zealand. A study by Lidgard (1996) claims that only 26% of former professionals remained professional, 29% of former technicians remained technicians and 25% remained managers in their new country of residence. In the current study, a similar pattern of underemployment was also seen in the husbands' occupational profile (Table 3.3).

The underemployment of migrants may be due to lack of English proficiency, under-recognition of their degree or qualification and/or a combination of both. The study subjects reported limited ability to comprehend in English as one of the main

reasons for the increased stress levels in NZ (section 3.1.3). Lack of proficiency with the language may be related to either unemployment or underemployment in migrants and this may result in less income than they are accustomed to. Consequently lower income may act as an additional source of stress for some migrants.

The income (household) status of subjects was in fact relatively low with respect to the qualifications of the subjects and their partners indicating that underemployment may be prevalent in this migrant population. However, the high rate of house ownership reported by subjects was somewhat contradictory to the income level reported by subjects. This may be explained by the living arrangements reported. Approximately a quarter of subjects were not living with their spouse because their husbands were working in Korea. The husband who is in Korea earns money and sends supplementary income to his NZ home. Therefore the single parent households described in this study are not typical of many single parent households in NZ from an economic point of view. This may explain the relatively subtle variation in reported incomes between subjects (Table 3.2) and the lack of effect of income on certain factors as discussed below.

While it has been reported that higher socioeconomic groups generally consume a greater variety of food products than the groups of lower socioeconomic groups (Marshall, 1995), the nutrient intake or food consumption pattern of subjects did not differ with respect to the income level in this study. This also contradicts the findings from the latest National Nutrition Survey in Korea in that families with higher household income had generally better nutrient intakes (Korea Health Industry Development Institute, 2003). This is probably due to similar income levels amongst study subjects and perhaps also similar household composition. However, education level and dietary choice were found to be positively correlated in this study. For example, intake of dairy products was much higher in subjects with higher education level (with tertiary education) compared to the subjects with lower education level (without tertiary education). This is because people with higher education level are more likely to make healthier choices with regards to health related lifestyle choices, such as diet, exercise, and smoking habits (Wadsworth, 1997). Furthermore, studies have shown that people with better education were found to comply better with healthy eating guidelines which resulted in a marked effect on the food choices (Groth, Fagt, & Brondsted, 2001; Osler et al., 2002; Robinson et al., 2004). The fact that the women in this study were reasonably well off with high education and high rate of house ownership should be taken into account when making comparisons using the native Korean and NZ cohorts as these are the generalised findings at a national level.

4.1.2 Lifestyle characteristics of subjects

Smoking

Cigarette smoking has been identified as having serious health consequences; being one of the major causes of preventable death. Smoking is the leading cause of lung cancer and is also related to heart disease and chronic respiratory diseases (Doll, 1998; WHO, 1997b). Only 4% of the subjects reported smoking with the majority (92%) of them reporting that they never smoked. The pattern of smoking was similar to that reported in the latest Korean survey where approximately 5% of Korean women were current smokers (South Korean Ministry of Health and Welfare, 2002). This was probably attributable to the Korean culture in which smoking is generally socially unacceptable for women in Korea.

The low prevalence of smoking among Korean women was similar to Tan's study of Chinese population in New Zealand (Tan, 2001). However, the pattern was slightly different from the results of the 1996/1997 Health Survey which reported that about a quarter of New Zealanders smoke: 23.2% of European adults, 27.7% of Pacific adult s, 45.5% of Maori adults and 10.1% of people from the other ethnic groups (New Zealand Ministry of Health, 1999).

Despite the low prevalence of cigarette smoking in these middle aged women, a future study which includes men and a younger age group of the Korean population is required for better profile of smoking habits of Koreans in New Zealand.

Dietary supplements

Almost three quarters of subjects (74%) were consuming dietary supplements of some sort. Those who reported being regular organic produce consumers and/or had fresh fruit and vegetables juice extracts were all consuming dietary supplements. As mentioned earlier in section 1.1, Koreans believe health is one of the five blessings of life. It appears that strong concern about health amongst Koreans was still prevalent among this study population. However, given that only a small proportion of subjects obtained health and nutrition advice from health professionals and that their reasons for taking supplements are largely determined by lay opinion, it is possible that some subjects are taking supplements unnecessarily. Cheaper prices with a wide range of products in New Zealand compared to Korea may in fact exacerbate unnecessary use of supplements in these subjects.

One subject, who had the highest consumption of B-carotene, reported eating

organic produce, drinking fruit and vegetables juice extracts every day and consuming up to eight different supplements a day. It is highly likely that some nutrients from different supplements may overlap and that she may be consuming them in excessive doses, particularly nutrients with a narrow safety margin such as selenium. This strongly suggests that nutrition education is necessary in this population.

Physical activity

The majority of subjects who reported having less opportunity to walk in New Zealand compared to Korea reported that this is due to the different lifestyles in New Zealand compared to Korea. They considered that this is mostly due to less availability, and hence less usage, of public transportation in New Zealand. It is obvious that individuals travelling via their own vehicles are more likely to walk less than those who use public transportation. This may have substantially reduced the amount of time spent walking and thereby reduced total amount of physical activity. On the other hand, most subjects who reported having more opportunity to exercise in New Zealand compared to Korea related this to more free time available and better access to exercise and sports facilities, including cheaper cost, in New Zealand. However, despite the increase reported in perceived 'Exercise' behaviour, the actual amount of exercise undertaken by subjects appeared to be low with almost half (46%) of the study subjects either not, or very infrequently, engaged in exercise.

The current study is limited by reliance on reported physical activity practices. In fact, it has been reported that over-estimation of exercise may be a disadvantage of self-reported studies (Roter & Russell, 1994). However, it was still meaningful to find out that the level of physical activity and exercise in this population was quite low. Considering that over-estimation is possible in self-reported studies, the actual level of physical activity in these women may even be lower.

Lack of exercise has also been reported in other Korean migrant studies. Research conducted by Sohng et al. (2002) that examined the health-promoting behaviours of elderly Korean Americans demonstrated that respondents scored highest in nutrition but lowest in exercise. Similar findings were obtained from another American study showing that exercise was rated the lowest among adult Korean Americans (Kim & Song, 1997).

Anecdotal evidence from the present study indicates that some women perceived physical activity as a broad term which includes every human activity. Because they considered that their daily lives were already full of physical activities, such as

housekeeping duties and workday activities, they considered that they do not require any further intentional physical activity, such as purposeful exercise. However, most women appeared to acknowledge the importance of exercise, considering that daily activities are just work and that they should regularly be engaged in exercise. Physical activity is a complex concept. Future research which examines the various aspects of physical activity, including assessment of actual physical activity incorporating both the frequency and intensity, in this population is required.

Evidence is accumulating that regular physical activity can deliver a range of health benefits. Some of the benefits include: prevention of weight gain (Jakicic, 2002), enhanced insulin sensitivity and improved glucose tolerance (Araujo-Vilar et al., 1997), decreased blood pressure (Arroll & Beaglehole, 1992), and improved circulating lipid profiles (Williams, Krauss, Vranizan, & PD Wood, 1990). In New Zealand, moderate physical activity of at least 30 minutes a day or on most days of the week is recommended as this is thought to bring health benefits to people of all ages (National Health Committee, 1998). The findings from present study suggest that education on the importance of physical activity and its impact on health are required for this population.

4.2 Factors Related to Dietary Change

There are many determining factors that affect food choices in any given population. Migrants are particularly sensitive to these factors if they want to maintain a traditional diet. As discussed in section 1.7.3, Korean migrants tend to maintain their traditional food habits after immigration and their dietary acculturation is slower compared to other Asian ethnic groups (Kim et al., 1993). This section will discuss various factors that are related with the food habits of New Zealand Koreans, their attitudes towards diet and how these influence their dietary choices.

4.2.1 Factors related to maintaining diet

In contrast to the general notion among subjects that 'Korean diet is healthier than Western diet', the reason 'Korean food is healthier than Western food' was only ranked as the third most important reason for maintaining a Korean diet. This suggests that although subjects appreciate the healthful aspects of the Korean diet, personal factors such as preferences and skills (i.e. 'Taste' and 'Korean food cooking method is more

familiar') may be stronger determining factors than psychosocial factors such as belief and attitude for these women in maintaining the Korean diet.

The literature identifies taste as the strongest determining factor in food selection (Nguyen, Otis, & Potvin, 1996; Sporny & Contento, 1995). In particular, research conducted by Yeh and colleagues (1998) reported that unchanged taste preference maintains product preferences among Koreans even after leaving their native country. This study which tested hedonic rating in different ethnic groups found that, unlike Chinese whose hedonic preference changed more quickly after exposure to Western culture, Koreans did not significantly differ in acceptance rating whether residing in America or in Korea (Yeh et al., 1998). Findings from the present study and the study by Yeh et al. (1998) support findings from the study of Kim et al. (1993) that Koreans are likely to assimilate at a slower rate than other Asian ethnic populations.

There were only two subjects who lived with their parents and only a few subjects who considered their husband as an elderly family member in present study. This may explain the finding that 'Elderly family member preferring Korean food' was the least important reason for maintaining a Korean diet.

4.2.2 Factors related to changing diet

Although one key factor ('Higher cost') could be identified as preventing subjects from maintaining a Korean diet, several factors influenced subjects to adopt a more Western diet. The factors with respect to the changes in diet practices are discussed below.

Cost

The price of foods is known as one of the environmental variables which strongly influences eating behaviour in the general population (Glanz, Basil, Malibach, Goldberg, & Snyder, 1998) and also in migrant populations (Axelson, 1986). The findings from the present study parallel findings from these earlier investigations that 'Higher cost' was reported to be the strongest hindering factor in maintaining a traditional Korean diet. Furthermore, those who perceived 'Higher cost' as a hindering factor were the ones who reported more substantial changes in dietary habit since coming to New Zealand, though it was found not to be related to the income level. This is probably due to the relatively similar income ranges of study subjects as discussed earlier in section 4.2.1. However, 'Cheaper cost' of local Kiwi food items was only the third most frequently reported

factor by subjects, after 'Convenience' and 'Better availability', in adopting a Western diet. This may suggest that although higher cost is the strongest hindering factor in maintaining a Korean diet, cheaper cost is not necessarily a determining factor in adopting a Western diet, thus showing a complex mechanism of food choice.

Quality

Many Korean food items available in NZ are frozen (e.g. fish) or dried (e.g. Korean traditional vegetables, *namul*) and subjects considered 'Poor quality' (52%) as the second most hindering factor in maintaining a Korean diet. However, despite the same response rate (52%), 'Better quality' of local Kiwi foods was reported to be one of the least influencing factors in adopting a Western diet by Korean migrants. The fact that 'Poor quality' was a strong hindering factor in maintaining a Korean traditional diet may also be related to the cost of Korean food items. Given that the cost of Korean food items in NZ is high, it is possible that subjects consider the quality of Korean food items are not worth what they are paying for because many of them are not fresh, i.e. frozen or dried.

Availability

Freeman (1974) claimed that 'migrants are affected by availability of their ethnic foods when making food choices because the market environment can either allow or restrict access to the traditional foods'. In present study, 'Poor availability' was of least importance in maintaining a Korean diet compared to other factors, in contrast with previous studies where ethnic food availability has been considered to be one of the most important variables explaining the food consumption of immigrants (Murcott, 1995). This may partly be related to large numbers of Korean groceries in all suburbs of Auckland providing relatively easy access to Korean foods, but which may not necessarily be of satisfactory quality. On the other hand, 'Better availability' of local Kiwi food items was the second most important factor in adopting a Western diet. Data suggest that there may be an interaction between 'Quality' and 'Availability'.

Convenience

'Convenience' was considered as the leading factor in adopting a Western diet, particularly for breakfast. A similar finding was observed amongst Chinese immigrants in the USA, where the convenience of preparing Western-style breakfast was rated the most important factor influencing adoption of Western dietary practices after immigration (Satia-Abouta et al., 2000). 'Convenience' appears to be a particularly

important factor for those who are employed.

Many of subjects in the current study were fulltime housewives or only working part time and therefore may have less adoption of convenience Western foods at other times of day, e.g. lunch, as discussed in section 4.3.1. However, regardless of the working status, 'Convenience' was still the most important factor for these women.

In-family normative pressure

While other factors, such as 'Cost', were considered as stronger influencing factors, in-family normative pressure, such as 'Young children's preference' or 'Family influence', was considered as the least important determining factor in the diet of Korean migrants. However, anecdotal evidence indicates that approximately half of study subjects prepare Korean breakfast because their young children prefer to have Korean style meals with rice and hot soup to start the day.

4.2.3 Nutrition knowledge

Awareness of nutritional materials

There are many nutritional materials to promote healthful eating habits, targeted at a general public who may have little knowledge on nutrition. In this study, the Food Pyramid, Heart Foundation "pick the tick", and "5 + a day" were presented to subjects as examples of these nutritional materials. Despite the extended reach of such program activities in retailers and food producers, more than half the subjects were not aware of these nutritional materials. Moreover, 5 + a day was the least known of these, regardless of its high profile within the wide community settings. This finding may suggest that the penetration of these nutritional materials in minority ethnic groups is low, particularity in those with limited English.

Although the general penetration of these nutritional materials seemed low in this study population, once penetrated, they produced nutritionally significant effects. For example, those who were aware of nutritional information consumed greater amounts of dairy product than those who were unaware, thereby consuming a greater amount of calcium, which had been shown as one of the most problematic nutrients in subjects.

Education was related to awareness of the nutritional materials. This is because higher education is often related to greater material resources (Rogers, 1983). However, for nutrition information to be more effective, it should reach greater audience in the

form which people want (American Dietetic Association, 1996). In other words, materials should present information in the native language of migrants for the materials to be effective in migrant populations, with this applying particularly to written nutrition education materials (Reed, Meeks, Nguyen, Cross, & Garrison, 1998). A study carried out on Vietnamese immigrants in the USA demonstrated that culturally appropriate nutrition educational materials significantly improved the dietary quality of the immigrants over time (Ikeda, Pham, Nguyen, & Mitchell, 2002). Although English proficiency was not related to awareness of the nutritional materials in this study, these findings collectively suggest that development of nutrition educational materials featured in Korean language may improve dietary and nutritional quality of the growing Korean population in NZ.

Reading nutrition labels

One of the purposes of nutrition labelling was to heighten people's awareness of the nutritional content of foods (Weimer, 1999). Most adults come into contact with food labels when purchasing their food. Therefore, the potential impact of nutrition labelling on awareness and behaviour in food selection is thought to be large. However, because of the language barrier, the extent of the impact on migrants may not be the same. In fact, only 40% of subjects were using nutrition labels and label reading was not associated with either food or nutrient intakes in present study. Nevertheless, other research shows that nutrition label readers had diets lower in fat and higher in fruits and vegetables compared with non-users (Kreuter & Brennen, 1997). This is probably because people who are interested in health seek the information on food labels to make decisions when purchasing foods (Guthrie, Fox, Cleveland, & Welsh, 1995).

It is obvious that label reading was strongly linked to English proficiency in the present study. Despite the strong interest of subjects in health and nutrition, it is possible that their limited English ability may have prevented them from seeking information. Imported Korean foods also have nutrition labels, some in English (for those products which are specifically manufactured for the export market) and some in Korean. However, whether subjects read nutrition label of imported Korean foods was not investigated in this study. A future study on nutrition label reading which also includes Korean nutrition labels would better assess the impact of nutrition labelling on food selection.

4.2.4 Beliefs about Health and Diet

Cultural beliefs, traditions and ethnic preferences have a strong influence on people's diet (Chyun, Amend, Newlin, Langerman, & Melkus, 2003). Satia-Abouta et al. (2002) demonstrated that beliefs (i.e. belief in a relationship between diet and disease) and attitudes (i.e. attitudes about whether the traditional Chinese diet is healthier than a typical Western diet) are important predisposing factors in diets of Chinese migrants in the USA and Canada. The majority of subjects in present study also strongly believed the relationship between diet and health and that the Korean diet is healthier than a Western diet.

Koreans believe that they should eat well to be healthy and that eating well is the best medicine for promoting health. Koreans also believe that healthy foods are produced by nature, and that technology cannot make healthy foods. In fact, in Korean culture the general term used for seasoning, *yaknuym*, means 'thought of medicine'. Such mind states of Koreans have created a tendency amongst Koreans to disallow taking processed foods that are made through a mass production system (Lee, 2004). Furthermore, there is a concept of *Shin-to-bul-ee* in Korea. According to Kim, Moon et al. (2000), *Shin-to-bul-ee* translates as *a body and a land are not two different things*, meaning that "one should eat foods produced in the land in which one was born and is living". This is basically the notion that food from one's hometown will fit because one is accustomed to it.

Section 3.3.2.7 illustrated the strong belief of subjects in the relationship between diet and health. Subjects consumed these foods because they are perceived to be healthy foods. Anecdotal evidence from this study suggests that subjects believe the Korean diet is made to fit best for Koreans and therefore the Korean diet is probably the best diet for them. In addition, there was a general consensus amongst subjects that Korean meals are cooked predominantly with raw ingredients whereas Western meals involve more processed ingredients, such as tinned foods. They considered that processed foods are nutritionally inferior to fresh foods. Moreover, Western foods were perceived as high in fat and therefore not healthy. However, subjects viewed eating fresh salads as the healthy aspect of Western diet and considered this as the only superior aspect of Western diet in comparison to the traditional Korean diet which often contains a lot of cooked and pickled vegetables using salt.

The findings suggest that appropriate nutrition education in this population would help these women to attain optimum fusion of traditional Korean and Western eating habits.

4.3 Dietary Intake Assessment

The demographic and socioeconomic characteristics of subjects, together with the various factors that affect food choices described earlier, influence the dietary patterns that are characteristic of Korean residents in New Zealand. This section will discuss dietary patterns and dietary intakes of Korean migrants.

4.3.1 Eating patterns

Meal patterns

Meal patterns of migrants reported from studies of various ethnic groups show that host country meals (e.g. American meals) are favoured for breakfasts and lunches whereas ethnic meals are favoured for dinner (Yang & Fox, 1979). The same meal patterns were observed in Korean migrants living in the USA (Hurh & Kim, 1984; Lee et al., 1999; Schultz, Soindler, & Josephson, 1994).

In the present study, only breakfast was strongly westernised with the majority of women still preferring to have Korean foods for lunch in both weekdays and weekend. This may be partly due to the working status of subjects in this study, where over 85% were either fulltime housewives or only worked part time. It is possible that these women experience less social contact with the host culture and or are exposed to less social pressure to change their meal types. Further, the demographic nature of the study design may also partly explain this because the study was conducted on women only, all of whom have the skills to cook for themselves. However, Korean foods were by far the most favoured meal type for dinner in the present study, which was consistent with the findings of previous studies.

Convenience as an influencing factor in westernisation of the meal is discussed later.

Change in dietary habits

Unlike most other studies that demonstrated the relationship between dietary habit changes with sociodemographic factors, dietary habit change was not found to be related to any of the demographic or socioeconomic factors in the present study. This may be due to the small number of total participants in the study and the homogenous nature of the study population.

Two women (4%), who had interethnic marriages, reported substantial changes to their dietary habits; one woman reported that her dietary habit totally changed and the other woman reported that her dietary habit changed very much. This is consistent with an earlier finding from Sackett (1972) that people who marry someone who is not of their own ethnicity may change their diet to a large extent.

4.3.2 Food habits and intakes

Increased intake of animal products and decreased intake of vegetables are some of the dietary changes typically made by migrants (Kim et al., 2000). In fact, these changes were also observed in the present study. However, it has been reported that some traditional dietary staples such as rice and *kimchi* are still retained in the migrant Korean diet (Gordon et al., 2000; Lee et al., 1999). Intakes of some food groups are discussed in detail.

Cereals and cereal products

Despite the finding that subjects are consuming breakfast cereals and bread more often in New Zealand than in Korea, total intake of cereal and cereal products in study subjects was lower than the amount of women in Korea. This suggests that breakfast cereals and breads have replaced a traditional food item, steamed rice, particularly at breakfast and that these foods are not necessarily eaten in addition to the existing traditional foods. However, lower total intake of cereal and cereal products in subjects still implies that the consumption of cereal and cereal products has decreased in the process of dietary acculturation.

A finding from the present study that subjects are now consuming more bread which replaces other traditional foods, such as rice, is consistent with the results from other migrant studies (Lee et al., 1999; Satia-Abouta et al., 2000; Yang & Fox, 1979).

Pulses and pulse products

The findings from the present study show that the intake of pulses and pulse products was higher in subjects compared to their Korean counterparts. This is somewhat contradictory to other studies which found that soy consumption was decreased in migrant Asians compared to their native counterparts. Decreased soy consumption is thought to be related to the increased risk and incidence of breast cancer

among migrant Asians compared to native Asian counterparts. In fact, it has been found that Asian-born Asian-American women consumed more tofu than US-born Asian-American women, and that the risk of breast cancer decreased with increasing frequency of intake of tofu (Wu et al., 1996). Legumes and other calcium enriched soy products are also important non-dairy sources of dietary calcium. The protective effects of isoflavones found in these foods may be important for the bone health of Asians (Dalais et al., 1998). Given the benefits of high legume consumption, a higher intake of pulses and pulse products reported in subjects would be a desirable dietary habit to maintain in this population.

Vegetables

Of all food groups, the vegetable group best demonstrated the different levels of adaptation in the process of dietary acculturation in Korean migrants. As reported in section 3.3.2.1 (Figure 3.7), the vegetable group was the food group that showed the most evenly distributed responses in terms of reported changes in diet since immigration to New Zealand. This pattern of adaptation is similar to the adopter categories described by Rogers (1995): innovators, early adopters, early majority, late majority, and laggards, where very few innovators adopt the innovation in the beginning, earlier adopters following a short time later, followed by the early majority and late majority and finally the laggards after some time.

According to the adaptive behaviour suggested by Rogers (1995), those who reported decreased intake of vegetables seem to be the laggards whose main sources of vegetables are Korean vegetables. Since Korean vegetables are not as readily available in New Zealand, vegetable intakes of these traditionalists have decreased. It is obvious that consuming only traditional food items without any replacement or addition of new foods will result in decreased food intake. However, whether or not this affected their overall nutrient intakes was not assessed in this study.

On the other hand, those who reported having similar intakes may be early adopters, early majority and late majority who seem to have found ways to substitute traditional Korean vegetables with the local varieties. They reported having local vegetables such as silver beet instead of chard (a Korean vegetable that is similar to silver beet in both shape and taste) in New Zealand. It is a common practice for migrants to incorporate the food items available in the host country to prepare their traditional meals. The first generation migrants Chinese in Nebraska reported that they used local foods, such as tinned US vegetables, to prepare traditional Chinese dishes (Yang & Fox, 1979).

Finally, those whose intakes of vegetables have been increased may be classified as the innovators. These women reported eating lots of fresh vegetables and salads, incorporating plenty of unacquainted local vegetables in addition to the usual consumption of traditional Korean vegetables such as *kimchi*. These innovators are blending meals and dishes which consist of both Korean and New Zealand foods, and therefore forming a new trait. Migrants generating newly emerging traits from those accepted in the wider host society and from their own ethnic traits have previously been reported (Yancey, Ericksen, & Juliani, 1976). The formation of new traits observed in migrants is of nutritional value as this may add diversity and variety to the diet. Although only limited studies are available, theoretical work supports the formation of such new traits by migrants (Simpson, 1995).

These different patterns of changes in dietary habits are largely related to food availability, which is discussed later.

The World Health Organization (WHO) recommends 400g of fruits and vegetables intake per day (WHO, 1990). Furthermore, it has been suggested that the consumption of 400g/day or more of a variety of fruits and vegetables could, by itself, decrease overall cancer incidence by at least 20% (World Cancer Research Fund & American Institute for Cancer Research, 1997). The mean daily intake of total fruits and vegetables was 506g in the subjects. Although this was lower in amount than that of women in Korea, it was approximately 20% higher than the level recommended by the WHO. The mean intake of fruits and vegetables reported in subjects was also higher than the mean intake, of 404g/day, reported by NZ females (Ministry of Health and the University of Auckland, 2003). However, 38% of subjects from present study consumed less than 400g per day. It appears that the intake of fruits and vegetables in subjects were intermediate between the Koreans and New Zealanders.

Beverages

The subjects consumed extremely low alcohol, only approximately 1/10 of the 'standard drink' where each standard drink is defined as any drink containing 10 grams of alcohol (Alcohol Advisory Council of New Zealand, 2002). However, Korean men are much more likely to drink than Korean women. A future study which includes men is required to assess alcohol intake and the impact of alcohol drinking on their health.

Drinks and alcohol was one of the food categories that differed most among study subjects and Korean women in Korea. A detailed analysis on drinks and alcohol was not

performed. However, considering the very low amount of alcohol intake reported by the subjects, it is speculated that most of the intake in drinks and alcohol category was from non-alcoholic beverages. In fact, many subjects reported consuming various types of teas and only few subjects reported consuming soft drinks. Cold weather appeared to be responsible for higher consumption of drink, mostly hot teas, in subjects. Although the quantity consumed is much greater than that of their Korean counterparts, their contribution to total calories is expected to be minimal. In contrast to the barley tea as preferred drink in Korea, many subjects reported drinking green tea in present study.

The 24-hour dietary recall of the present study had been administered over 6 month period, from June to December (winter to summer). As seen above, seasonal effects may have influenced the food patterns of subjects, where it is often one of the limitations of dietary surveys. In fact, the availability of many foods varies by season, thereby affecting the study results. However, it is suggested that seasonal effects are greater for food patterns rather than nutrient intake (Gibson, 1990).

Meat

A large increase in intake of meat/meat products seen in the present study is one of the commonly observed dietary pattern changes in many migrant studies. In the current study, the majority of subjects (more than 70%) reported increased intake of meat/meat products since immigration to New Zealand. The changes in meat/meat products consumption seen in subjects presented in Figure 3.9 was similar to the findings reported from a Korean American study conducted in Chicago, USA. In this Chicago based study, 75% of respondents reported increased beef intake, 38% increased chicken intake and 20% increased pork intake (Kim et al., 2000) whereas in present study, 65%, 24% and 19% of subjects reported increased intakes of beef, chicken and pork respectively.

Although direct comparison of the results requires caution due to different nature of two studies, there is a clear suggestion that beef is the most popular meat among Koreans. The preference for beef among Koreans, coupled with cheaper prices of beef in New Zealand, may be the most important factors for the greater beef consumption observed in these subjects.

Although only 14% of subjects reported increased lamb consumption, this is still noteworthy considering that all of those who reported increasing their lamb intake were not lamb eaters in Korea. Lamb is not commonly available and therefore hardly consumed in Korea. With the unpleasant smell of lamb that many Koreans are not used

to, lamb is one of the least popular meats among Koreans. However, more availability, affordable cost and greater exposure to lamb meat in New Zealand culture appears to be responsible for inclusion of lamb in the immigrant Korean diet.

In addition to the changes in the types and frequencies of meat consumption, Korean immigrants may also consume more meat than usual at each meal time. There is a common perception that grated cheese is greater in quantity because of its volume compared to a slab of cheese of the same weight. Similarly, changes in the cooking method, i.e., eating a whole steak instead of a dish of small pieces of meat, as reported by some subjects may have influenced and perhaps increased the overall quantities of meat consumed in subjects. Whether such changes in the cooking method have significant effect on the quantity of food consumption would be an avenue for further investigation.

Dairy foods

Despite the fact that milk and dairy products are not part of the traditional Korean diet, increased intakes of dairy products were reported in present study. This finding parallels the observations from other Korean migrant studies, as previously described in section 1.7.3 (Gordon et al., 2000; Kim et al., 2000; Lee et al., 1999; Ludman et al., 1992). Increased intakes of dairy products was also observed in Chinese migrants where migrants commonly incorporated milk and other dairy products into their traditional diet (Hsu-Hage, Ibiebele, & Wahlqvist, 1995; Satia-Abouta et al., 2000; Yang & Fox, 1979).

What seemed unique, however, in present study was the large increase reported in cheese intake (41%), much higher than milk (19%). Another Korean migrant study undertaken in USA found that milk was frequently consumed but cheese and yoghurt were not popular (Gordon et al., 2000). As was reported in section 3.3.2.4, this may be partly due to the strong dairy market in NZ.

It has been proposed that lactose intolerance could be acquired from a diet that is low in lactose, which thereby results in a decrease in the lactase activity (Cuatrecasas, Lockwood, & Caldwell, 1965; Davis & Bolin, 1967). This theory probably would also be applicable to Koreans as dairy products were not part of the traditional diet for Koreans for a very long time. However, increased intakes of milk and other dairy products in the migrant population suggest that the ability to tolerate lactose can be improved. In fact, research suggests that lactose intolerant individuals adapt to lactose consumption by an increased tolerance to colonic lactose-fermentation products upon regular lactose ingestion (Johnson, Semenya, Buchowski, Enwonwu, & Scrimshaw,

1993). Lactose intolerance can also be improved by altering the physical form of the food that carries the lactose with cheese being reported to be more tolerable than others (Bannan & Levitt, 1996). A large increase of cheese intake reported in the current study further supports this.

Animal fats and oils

Although small in absolute quantity, the intake of animal fats and oils was up to 5 times higher in study subjects than their Korean counterparts. Moreover, animal fats and oils was the only food group which there was a statistically significant difference between individuals with long and those with short residence duration in NZ. The most common dietary source of animal fats and oils reported in subjects was butter, mostly as spread. Given that the use of butter as a spread is high in NZ compared to other Western nations, this suggests that subjects, particularly those with longer NZ residence, are adapting the dietary patterns of New Zealanders.

4.3.3 Nutrient intakes of subjects

All nutrient values are compared with the Korean Recommended Dietary Allowance (RDA) and the Australian Recommended Dietary Intake (RDI) values to assess the nutrient intakes of subjects. The latest Korean RDA was published in 2000 by the Korean Nutrition Society and based on Korean dietary characteristics (The Korean Nutrition Society, 2000). In New Zealand, the Australian RDI is used according to the recommendation of the Nutrition Taskforce (Ministry of Health, 2003).

The Korean RDA and Australian RDI are defined as the amount of a nutrient that is sufficient for almost all individuals (97.5%). By definition, the RDA and RDI exceed the nutritional requirement of practically all healthy people and most of the individuals may actually meet their requirements at a lower value. Thus using RDA and RDI should not be regarded as the lowest acceptable intake for each individual. To overcome some of the inappropriate applications upon the usage of current RDI, there is a trend towards moving to a system of reference values. Australia and NZ have also adopted a similar approach and developed Nutrient Reference Values (NRV) for Australia and NZ. The NRV is an umbrella term that encompasses four types of nutrient recommendations for healthy individuals; estimated average requirement (EAR); recommended dietary intake (RDI); adequate intake (AI); upper intake limit (UIL). Although the NRV (new set of recommendations) is anticipated to be better in assessing nutrient adequacy, this has not been officially accepted by the NZ government yet. Hence, the Australian RDI that is

currently used in NZ is used in this discussion.

The comparison of macronutrient and micronutrient intakes with the Korean RDA and Australian RDI are summarised in Table 4.1. The percentages of subjects with intakes lower than these recommendations are also included. In addition, the comparison of nutrient intakes with the Korean RDA and Australian RDI is illustrated graphically in Figure 4.1.

Table 4.1 Comparison of nutrient intakes with Korean RDA and Australian RDI[†]

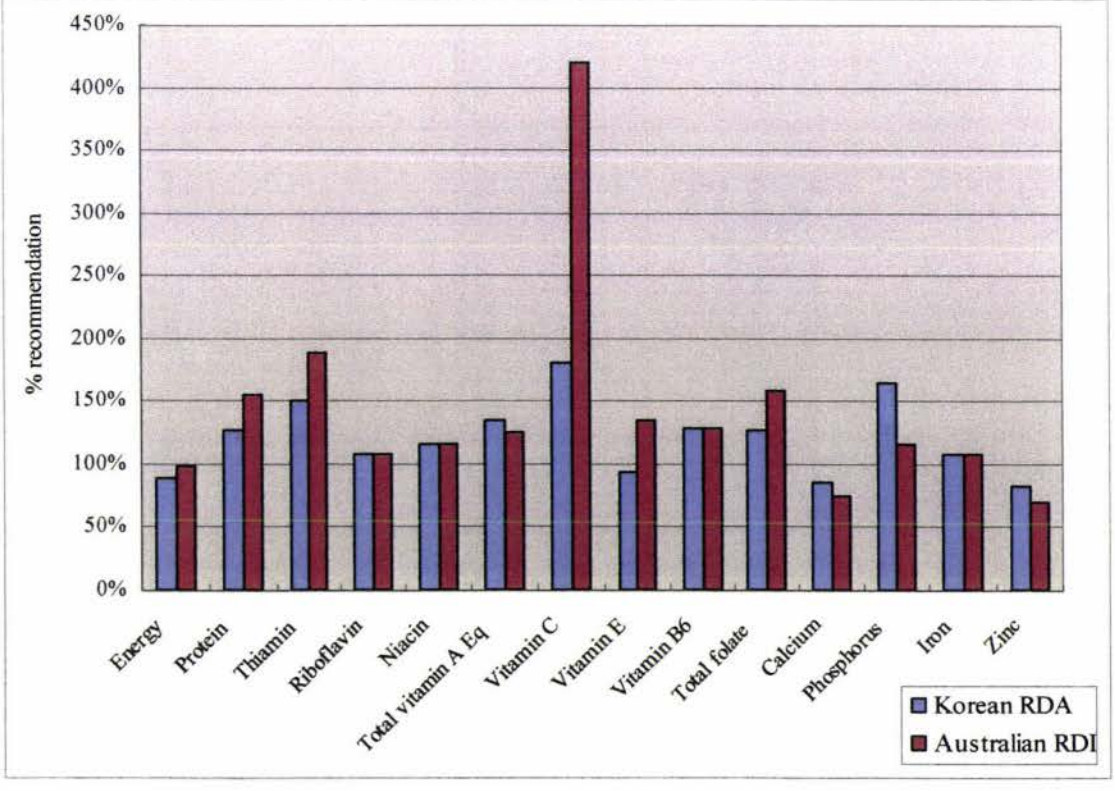
Nutrients	Intake of All subjects average	Korean RDA for 30-64 yr women[1]	% of subjects with intakes lower than Korean RDA	Australian RDI for 19-54 yr women[2]	% of subjects with intakes lower than Australian RDI
Energy and Macronutrients					
Energy					
(kJ)	7061	-	-	7200-8800	56
(kcal)	1687	1900-2000	64	-	-
Protein (g)	70.0	55	26	45.0	12
Micronutrients					
Thiamin (mg)	1.5	1.0	34	0.8	16
Riboflavin (mg)	1.3	1.2	52	1.2	52
Niacin (mg)	15.0	13	40	13	40
Total vitamin A Eq (ug)	935.4	700	48	750	54
Vitamin C (mg)	126.0	70	28	30	6
Vitamin E (mg)	9.4	10	60	7	28
Vitamin B6 (mg)	1.8	1.4	24	0.9-1.4	4
Total folate (ug)	316.8	250	38	200	16
Sodium (mg)	3748.8	-	-	920-2300	0
Potassium (mg)	3149.3	-	-	1950-5460	16
Calcium (mg)	595.7	700	74	800	82
Phosphorus (mg)	1152.9	700	8	1000	44
Iron (mg)	12.8	12-16	48	12-16	48
Zinc (mg)	8.3	10	68	12	82

[1] Data from Korean Nutrition Society (2000)
[2] Data from National Health and Medical Research Council (1991)
[†] Only the nutrients with RDA/RDI are presented

There are differences in age groupings between the two sets of recommendations, hence resulting in difficulty with direct comparison. Further, it is possible that some differences in nutrient intakes among study cohorts, i.e. subjects, Koreans in Korea, New Zealanders, may reflect differences in the food composition tables used in each study rather than actual differences in intakes. The difference in the nutrient intake, particularly nutrient contents in the plant, may also arise from the concentration of the element in the soil, soil pH, soil temperature, and moisture level (Jarvis, Jones, & Hopper, 1976; Van Bruwaene, Kirchmann, & Impens, 1984). This would be relevant to the nutrient contents of the Korean food items that have been grown in NZ soil, which are added to the FoodWorks using nutrient values in the Korean Food Composition Table. Hence, the nutrient values in the Korean Food Composition Table may not accurately represent the actual nutrient values of the foods consumed by subjects.

The median is considered a better summary statistic than the mean because the distribution of nutrient intakes may not be symmetric. However, the median values were not available in the report of the Korean National Nutrition Survey. Therefore, the mean nutrient values are used throughout the discussion.

Figure 4.1 Nutrient intakes of study participants as percent of Korean RDA and Australian RDI.



The intake of most nutrients was sufficient in study subjects with reference to the Korean RDA and Australian RDI. However, the intake of calcium and zinc appeared to be inadequate. This section will discuss the nutrient intake of subjects in detail.

4.3.3.1 Macronutrients

Energy intake

The mean daily energy intake of subjects was lower than the intake recommended by both Korean and NZ reference standards, accounting for 86-88% and 80-98% of these recommendations respectively. Sixty four percent and 56% of the subjects had intakes lower than these two recommendations, respectively.

The lowest energy intake (821.3kcal) was reported by a woman with the body weight of 73kg who was the second heaviest in the study population. Numerous studies have reported the frequent under-reporting of energy intake in overweight and weight conscious respondents (Black, Prentice, Goldberg, & Jebb, 1993; de Varies, Zock, Mensink, & Katan, 1994; Johnson, Goran, & Poehlman, 1994; Schoeller, 1990). Under-reporting of dietary intake may have been possible in this woman.

Protein intake

While the Korean RDA was based on the value of 1.00g/kg/day, namely, 55g for adult Korean women (The Korean Nutrition Society, 2000), the Australian RDI was based on the value of 0.75g/kg/day, namely, 45g for adult NZ women (Ministry of Health, 2003). This is presumably due to different sources of protein and hence, the quality of protein, in the two diets. While the principle sources of protein in the Korean diet are grains (31.3%), fish and shellfish (22.8%), meat and meat products (17.4%) and diary products (3.9%) (South Korean Ministry of Health and Welfare, 1999), the principal sources of protein in the New Zealand diet are beef and veal (14%), bread (11%), milk (10%), and poultry and fish/seafood (both 7%) (LINZ Research Unit, 1999).

The mean protein intake of subjects (70.0g) was well in excess of the values suggested by both the Korean RDA and Australian RDI, accounting for 127% and 156% of these reference values respectively. However, 26% and 12% of subjects still had intakes lower than the Korean RDA and Australian RDI, respectively.

The Nutrition Task Force further recommends that the protein intake should not

be greater than 1.6g/kg of body weight/day. According to this guideline, 24% of subjects had protein intake which exceeded their recommended intake level based on body weight. This suggests that whilst the mean protein intake was high, there was a wide range of intakes in the subjects.

Carbohydrate intake

In order to sustain normal physiological function, including brain metabolism and muscle function, healthy adults require at least 200g of carbohydrates per day and the carbohydrate derived energy should comprise at least 50% of the total energy (Macdonald, 1999). The FAO/WHO Expert Consultation also recommends that the percent energy contributed from a variety of carbohydrate sources be at least 55% of the total energy for an optimum diet (WHO, 1997a). Similarly, the New Zealand Nutrition Taskforce recommends that the total percent energy derived from carbohydrate be 50-55% (Nutrition Taskforce, 1991). On the other hand, a target carbohydrate derived percent energy by the Korean Nutrition Society is set at a slightly higher level, at 65% (60-70%) (The Korean Nutrition Society, 2000).

Of the subjects, 22% consumed less than 200g of carbohydrate per day. Almost three quarters (72%) of the population had intakes lower than the recommendation set by the Korean Nutrition Society whereas around a quarter of subjects had carbohydrate intakes lower than the recommendation set by the New Zealand Nutrition Taskforce.

It has been reported that diets high in carbohydrate increase conversion of carbohydrate to fat in the liver resulting in increased production of triglyceride (TG) (Parks & Hellerstein, 2000). Moreover, hypertriglyceridemia, particularly postprandial triglyceridaemia, has been suggested as a significant predictor of CHD (Davignon & Cohn, 1996). Koreans traditionally have low serum cholesterol concentration (Kesteloot et al., 1985) which is probably due to low intakes of foods of animal origin. As such, more concern has been reported with respect to hypertriglyceridemia than hypercholesterolemia in Koreans because Koreans are traditionally accustomed to a high carbohydrate diet (Lee & Lee, 1998). Higher TG levels, comparable to that of Koreans, were also observed in Japanese who also consume large amounts of dietary carbohydrates (Anuurad et al., 2004). Other Korean studies, however, reported either inverse (Lee & Chang, 1999) or no significant association (Lee, Lee, & Lee, 1999) between carbohydrate intake and serum cholesterol levels. As these findings suggest, the health effects of carbohydrate-induced hypertriacylglycerolemia in blood lipid still remain controversial (Parks & Hellerstein, 2000). More research is needed prior to restricting carbohydrate in the Korean diet. There was one woman with carbohydrate

intake greater than 70% in this study.

Fibre intake

The target for fibre intake in New Zealand is 25-30g per day. The recommendation set out by the Nutrition Taskforce further states that soluble fibre should comprise approximately one quarter of the total dietary fibre (Nutrition Taskforce, 1991). However, in this study, intake of dietary fibre did not differentiate between soluble and insoluble dietary fibre. In Korea, the general guideline suggests dietary fibre intake be 20-25g per day (The Korean Nutrition Society, 2000).

The fibre intake was low in study subjects, accounting for 57-69% of the NZ guideline and 69-86% of the Korean guideline. Despite the adequate consumption of vegetables and other plant foods, only 4% and 10% of subjects met the NZ Nutrition Taskforce and the Korean Nutrition Society target for fibre intake, respectively.

The fibre values used in the Korean food composition table are the values for crude fibre. The crude fibre is only part of the dietary fibre because it is the remainder of dietary fibre after extracting acid and base from the dietary fibre. Thus, the total dietary fibre intake of Koreans is expected to be higher than the reported values. However, because of the limited data on dietary fibre, it is difficult to assess the intake of dietary fibre in the Korean diet. A study conducted by Lee et al reported that the total daily dietary fibre intake of Koreans was 17.5g (Lee, Park, Kim, & Moon, 1994). This is similar to the level observed in the present study of 17.2g per day.

Although high fibre diet is found to block the absorption of minerals such as iron and calcium, it does not seem to interfere with vitamin absorption (Gallaher & Schneeman, 1996). Increased intake of fibre is associated with many positive health effects including decreased incidence of CVD, colon cancer and diabetes (Gallaher & Schneeman, 1996) through reduced cholesterol levels, improving bowel health and reduced post-prandial plasma glucose levels. Consumption of whole grains and vegetables is to be recommended to increase fibre intake.

Fat intake

The mean fat derived energy of 25.7% of subjects was higher than the guideline set by Korean Nutrition Society of 20% but lower than the guideline set by the New Zealand Nutrition Taskforce of 30-33%. Although the majority of subjects did not consume excess fat with reference to the NZ standard (10% of subjects had fat intakes

within the recommended range and 74% of subjects had fat intakes below the recommended range), the majority of subjects (78%) consumed excess fat with reference to the Korean standard. More than a quarter of subjects (16%) had fat intake greater than 33% of the total energy.

Koreans traditionally have eaten a low fat diet. Despite the modified diet through dietary acculturation among migrant Koreans, they appear to have retained the low fat traditional dietary pattern. In the study by Kim and Chan, the low acculturated group of Korean Americans had 25.3% and the high acculturated group had 26.9% of fat derived energy ($P<0.05$) where the mean age of subjects was 36.9 years and the mean length of residence in the USA was 9.9 years (Kim & Chan, 2004). Even in the high acculturated group, the fat derived energy was still lower than that found in the typical Western diet. Although a direct comparison cannot be made because this study used data from mixed gender, the fat intake of 25.7% observed in Korean New Zealanders is similar to these levels. Even lower fat intake of Korean Americans was reported in the study of Kim et al, where the fat derived energy was only 16.6% and 16.0% for men and women, respectively (Kim et al., 2000). This may be due to the different characteristics of the groups studied because subjects in this study were aged between 40 and 69 years (mean 56.4 years), slightly older than the current study population (mean 47.0 years). However, the mean length of residence in this USA study subjects was similar to that of the current study subjects (8.8 years), though it ranged from 1 to 35 years in the USA study, whereas it ranged from 5 to more than 13 years in present study. These findings indicate that Koreans tend to maintain their traditional dietary patterns even when they leave Korea, supporting a slow dietary acculturation in Korean migrants compared to other Asian migrants (Kim et al., 1993).

An inverse relationship between education and fat intake in the Western population has been reported (Neuhouser, Kristal, & Patterson, 1999). In contrast, the findings from the present study show that higher education was correlated with an increase in fat intake along with an increase in percentage energy from fat and cholesterol. Similar findings were obtained by the nutritional status study on Korean Americans (Kim et al., 2000). The study found that intake of total fat, and cholesterol was significantly positively associated with education level where respondents with more than 12 years of education consumed a greater amount of these nutrients than respondents with less than 12 years of education. The National Nutrition Survey in Korea also saw a positive relationship between education and fat intake (Korea Health Industry Development Institute, 2003).

Cholesterol intake

No national data are available on the cholesterol intakes of Koreans. However, the cholesterol intake of Koreans is thought to be around 200mg a day as animal food consumption in Korea is still relatively low (The Korean Nutrition Society, 2000). Higher consumption of animal foods, such as dairy products, reported in study subjects is not only reflected in a higher level of fat intake, but also in a higher cholesterol level. Nonetheless, the mean cholesterol intake of subjects was less than 300mg per day, the level recommended by WHO for prevention of CHD (WHO, 1982).

While the majority of subjects (76%) had daily cholesterol intake of less than 300mg, approximately 1 in 4 women had cholesterol intake higher than the recommended level. Even lower intakes were observed in other Korean migrant studies. The study by Kim and Chan (2004) (mixed gender) reported cholesterol intake of 193.8mg in the low acculturated group and 185.5mg in the high acculturated group and the study by Kim, Yu et al. (2000) reported cholesterol intake of only 131mg per day.

4.3.3.2 Micronutrients

Vitamin A

The mean daily vitamin A intake of subjects was well above the recommendations, accounting for 134% and 125% of the Korean and NZ recommendations, respectively. However, approximately half of subjects failed to meet the Korean and NZ recommendations: 48% and 54% of subjects did not meet Korean RDA and Australian RDI, respectively.

It is estimated that approximately 80% of the vitamin A intake was supplied from the carotenoids in Koreans (Choi et al., 2004). A study which compared the serum retinol and B-carotene concentration of Koreans with Westerners reported that the retinol level was lower and the B-carotene level was higher in Koreans than in Westerners (Yeum et al., 1992) indicating that vitamin A consumption is mainly acquired from plant foods in Koreans. A similar trend was also observed in the present study with less than 20% of the total vitamin A intake coming from retinol in subjects, whereas almost half of vitamin A was supplied from retinol in NZ women.

Vitamin A is found in animal liver, fish oil and eggs. Consumption of animal liver was not reported by any subjects and the main sources of vitamin A among subjects appear to be fish oil and eggs. B-carotene is found in carrots and green leafy vegetables. Generous servings of *kimchi* may be in part responsible for the generally high intake of

B-carotene in subjects. Retinol, B-carotene and vitamin A intake data from the present study reflect the observation that subjects retained traditional plant-based dietary habits in their host country.

Some subjects had very high intakes of B-carotene largely due to consumption of fresh fruit and vegetables juice extracts. B-carotene has low bioavailability and low efficiency in conversion to retinol when over consumed (Brubacher & Wesier, 1985), thus high intake of B-carotene is usually not toxic (Miller et al., 1987).

Vitamin E

The mean daily vitamin E intake of subjects was slightly below the Korean RDA (94%) but well above the Australian RDI (134%). Sixty percent and 28% of subjects did not meet Korean RDA and Australian RDI, respectively.

One of the main sources of vitamin E is vegetable oils. A similar intake of vegetable oils in subjects and their Korean counterparts may explain the similar level of vitamin E intake among subjects and their Korean counterparts.

Vitamin C

The subjects in this study reported very high vitamin C intakes with mean daily vitamin C intakes approximately 2-fold and 4-fold higher than the Korean RDA and the Australian RDI, respectively. Only a small percentage of subjects had vitamin C intakes below the recommendations; 28% below the Korean RDA and 6% below Australian RDI. The vitamin C intake of Korean migrants in the US was also shown to be high consuming 148mg per day (Kim et al., 2000).

The current NZ recommendation for vitamin C has been developed to prevent scurvy with a margin of safety and is set at a much lower level compared to the Korean (70mg/day) and other recommendations, such as the US RDA (60mg/day). The draft Australia and NZ NRV suggests slightly higher intake of 45mg for both adult males and females.

Rich sources of vitamin C include green young peppers, spinach, and citrus fruits. The high consumption of fruit and vegetables observed in these subjects suggests that inadequate intake of vitamin C would be unlikely in this population.

Vitamin C is unstable and can easily be oxidised. The content of this vitamin is

sensitive to preparation and cooking practices. Chopping and dicing vegetables destroy vitamin C through oxidation and boiling vegetables can result up to 50-80% of vitamin C loss. Although eating vegetables raw and fresh was reported to be the most popular way of consuming vegetables among subjects, the majority of subjects still reported enjoying having vegetables boiled and steamed. Furthermore, the nutrient content of raw vegetables was used in various recipes when analysing the nutrient composition of vegetables in this study. Hence, vitamin C intake of subjects in present study may be overestimated.

Thiamin

The mean daily thiamin intake of subjects was above the recommendation set by both Korea and NZ, accounting for 150% and 188% of these recommendations, respectively. The majority of subjects, 66% and 84% respectively, met the recommendations suggested by the two countries.

Thiamin is an important nutrient due to its role in carbohydrate metabolism. The high intake of carbohydrate in the Korean diet was taken into account when establishing the recommendation for thiamine intake for Koreans (The Korean Nutrition Society, 2000). Rich sources of thiamin include pork, beans and whole grain cereals. Whereas whole grain cereals (39.7%) were the principal source of thiamin for Koreans (South Korean Ministry of Health and Welfare, 1997), bread (29%) was the principle source of thiamin in NZ (LINZ Research Unit, 1999).

Riboflavin

The mean daily riboflavin intake of subjects was above the recommendations, accounting for 108% of both the Korean RDA and Australian RDI. Approximately half of subjects (52%) met these recommendations.

Milk, yoghurt and cheese are some of the best sources of riboflavin. A glass of milk can contribute up to 0.7mg of riboflavin. Meat, fish and some green leafy vegetables are also good sources of riboflavin. Because of low intake of milk and other dairy products among Koreans, riboflavin has been identified as one of the nutrients which Koreans are deficient in (South Korean Ministry of Health and Welfare, 2002).

Subjects in this study reported increased intake of dairy products since coming to NZ and consumed greater amounts of dairy products compared to their Korean counterparts. This may partly explain the slightly higher riboflavin intake in subjects

compared to women in Korea. However, the intake was lower than that of NZ women.

Those who do not consume dairy products should be encouraged to consume other riboflavin rich foods, such as meat and green leafy vegetables, to meet the requirement.

Vitamin B6

The mean daily vitamin B6 intake of subjects was above the recommendations set by Korea and NZ. Of the subjects, 76% had vitamin B6 intake higher than the Korean RDA and 96% had higher intake than the Australian RDI. It appears that vitamin B6 intake in subjects is generally sufficient.

Folate

The mean daily folate intake of subjects was well above the recommendations, accounting for 127% and 158% of the Korean and NZ recommendations, respectively. Of the subjects, 38% of subjects did not meet the Korean recommendations, while 16% did not meet the NZ recommendations.

Food sources of folate include vegetables, fruits, fruit juices and fortified cereals. Large losses of folate can occur during food preparation and storage where 50% to 90% of folate can be destroyed. Folate is particularly sensitive to heat and can also be lost by leaching. Because Koreans usually eat vegetables cooked, losses of folate through heat or leaching may occur. However, increased consumption of RTE BF cereals reported in subjects may have had a positive effect in folate intake as many RTE BF cereals in NZ are fortified with folate. The intake of folate was not assessed in the Korean Nutrition Survey, therefore, a comparison of the effect of fortification on folate intakes was not possible.

Folate is essential in DNA synthesis. Together with vitamin B12, folate is also needed for the conversion of homocysteine to methionine. An elevated level of plasma homocysteine is strongly related to CVD (Boushey, Beresford, Omenn, & Motulsky, 1995). Hence, deficiency of folate, or vitamin B12, can give rise to high plasma homocysteine levels. Food folate is inversely associated with homocysteine levels and studies have demonstrated that increased intakes of dietary folate or folic acid supplements decrease plasma homocysteine levels (Wald et al., 2001). However, the benefit of folate supplements in reducing the risk of CVD needs further research.

Folate is also important in the prevention of neural tube defects (NTD), which are the most common types of birth defect in humans. It is, therefore, particularly important that women of child bearing age meet the requirements. However, the subjects in current study were middle aged women and meeting folate recommendations may be of more relevance in terms of lowering CVD risks.

With the growing evidence of importance of this vitamin in health, the folate intake is recommended at a 400DFE per day for both male and female in USA (National Research Council (NRC), 2000). The current recommendation of 200ug of folate intake per day in NZ is probably too low. The draft Australia and NZ NRV, however, suggests intake of 400ug for both adult males and females.

Calcium

The mean daily calcium intake of subjects only reached 85% and 74% of the Korean and NZ recommendations, respectively. Despite the reported increase in consumption of diary products, which are the best sources of calcium, calcium was still the most insufficient nutrient in this group of Koreans. Only 26% and 18% of subjects met the Korean RDA and Australian RDI, respectively.

The findings from a recent Korean study that examined the bone mineral density of Korean males demonstrated that approximately 30% of subjects had osteopenia and that their calcium intake was significantly lower than those who had normal bone mineral density (Lee, Yu, Kim, Lee, & Lee, 2000), showing that dietary calcium intake is associated with bone mineral density. Calcium deficiency has been one of the prevalent nutritional problems in Korea. Inadequate milk and dairy food consumption, coupled with the intake of low bioavailable calcium foods, are thought to be responsible for the high prevalence of inadequate calcium intake in Koreans. While milk (37%), cheese (11%) and vegetables (5%) were the principal dietary sources of calcium for New Zealanders (LINZ Research Unit, 1999), milk (15.3%), dried anchovy (9.0%) and *kimchi* (8.5%) were the principal dietary sources for Koreans (South Korean Ministry of Health and Welfare, 2002).

Post-menopausal women are at a higher risk of bone loss because of estrogen deficiency. Estrogen deprivation occurring after menopause results in an increased bone resorption thereby causing bone loss. In the current study, post-menopausal subjects (672.7mg) consumed significantly more calcium than their pre-menopausal counterparts (539.9mg) (P=0.014). Higher calcium intake among post-menopausal subjects may be attributable to the higher intake of pulses/pulse products and dairy products reported in

this group. Post-menopausal women consumed almost twice as much pulses/pulse products and dairy products compared to pre-menopausal women; 71.4g vs 38.8g of pulses/pulse products and 134.7g vs 88.5g of dairy products, in post-menopausal and pre-menopausal women, respectively. However, the calcium intake in these post-menopausal women was still lower than both the Korean and NZ recommendations.

Similar findings were obtained in a study of adolescent nutrition which observed that Korean American adolescents had intermediate calcium intakes between those of Korean adolescents and American adolescents (American > Korean American > Korean) (Park, Paik, Skinner, Spindler, & Park, 2004). In another American study, the daily calcium intake was 723mg in Korean American women (Kim et al., 2000) which was approximately 20% higher than that of subjects in the present study. This study also reported an increase in dairy product consumption in Korean Americans where 53% of respondents reported increased dairy product consumption after immigration to USA (Kim et al., 2000). Increased intake of dairy products appears to be the factor which contributes most to improved calcium intake among Korean migrants.

There is growing evidence that the current RDA for calcium may be below its optimum level (Matkovic & Heaney, 1992). In light of this, the draft Australian and NZ NRV suggests higher calcium intake of 1000mg for adult women and 1300mg for women over 51 years of age. For subjects to reach these levels, even greater effort may be required to increase calcium intake. However, it is often difficult to meet daily needs of calcium without the consumption of dairy products. With research indicating that lactose intolerant individuals can manage up to one cup of milk (Bannan & Levitt, 1996), consumption of milk and other dairy products should strongly be encouraged in this population to improve calcium intake.

Because loss of bone mineral in middle age affects later fracture risk, adequate consumption of calcium during middle age is particularly important. The fact that post-menopausal women were eating more calcium rich foods indicate that they have acted on nutrition education. The level of awareness of nutritional materials and the importance of nutrition education are discussed later.

Phosphorus

The mean daily phosphorus intake of subjects was higher than the recommendations set by both Korea and NZ. While the calcium intake was higher in subjects compared to women in Korea, the phosphorus intake of subjects was similar to that of their Korean counterparts. This resulted in a better Ca:P ratio in study subjects

compared to women in Korea. However, the Ca:P ratio of subjects is still close to 1:2 and lower than their NZ counterparts which further suggests a need to increase calcium intake among subjects.

Sodium intake

Sodium is a nutrient in which the consumption far exceeds the needs of an individual. The estimated level of safe minimum intake is 500mg a day (National Research Council, 1989). In fact, only about 115mg of sodium per day is required to meet the physiological needs.

The mean daily sodium intake of subjects was up to 4-fold higher than the Australian RDI/NZ recommendation. This is also higher, by approximately 35%, than the Ministry of Health target of 2760mg per day (Ministry of Health, 1998). Although the dietary sodium intake was not included in the 1997 National Nutrition Survey, a regional study in NZ found that a mean sodium intake of New Zealanders was about 3473mg per day (Thomson & Colls, 1998). This is slightly lower than the level reported in Korean New Zealanders from the present study.

Only a small amount of sodium is present in natural foodstuffs and the majority of sodium intake comes from foods with high salt content. Foods in the spices category include salt, soy sauce and Korean indigenous fermented foods such as soybean paste, and red pepper soybean paste. These foods are generally high in sodium content, contributing significant amounts of sodium to the Korean diet. Popular Korean foods such as *kimchi* and thick stew (soybean paste and or red pepper soybean paste are used in thick stews) are also very high in sodium. In fact, it has been found that cabbage *kimchi* (21.2%), salt (16.4%) and soybean paste (8.6%) were the top three dietary sources of sodium for Korean women (South Korean Ministry of Health and Welfare, 2002). In the Western diet, bread and cereals are the major contributors of sodium, probably because of the quantities eaten.

Kimchi was the principal source of sodium in subjects that contributed 27% of sodium to diet. *Kimchi* was also the top source of sodium in the diet of Korean Americans (Cross et al., 2002). Despite much lower intakes of sodium reported in subjects compared to their Korean counterparts, the amount of *kimchi*, which is the principal source of sodium in Koreans, consumed per day was similar between subjects (84.7g) and Korean women (83.9g). However, subjects consumed much lower amounts of spices than women in Korea. On the other hand, it is possible that increased consumption of bread reported in subjects may have added further sodium to the diet.

Because the bread intake was not quantified separately in this study, the amount of sodium contributed from bread is not known. However, it is thought that this presumably had contributed relatively little sodium as bread was consumed in relatively small quantities compared to other cereal products such as rice. These findings collectively suggest that the sodium intake of subjects that is almost 30% lower than that of their Korean counterparts appears to be due to less use of salt and other spices, including less use of salt in preparing *kimchi*. This may support the well known notion that people adapt to changes in sodium content of the diet.

It is difficult to assess salt intake in an individual. Discretionary salt intake accounts for 27% of total salt intake in Korean dietary custom (Kim & Paik, 1987). Oh (1991) further suggested that the sodium intake estimated from the food composition table tended to be lower than the actual intake measured by instrumental analysis after collection of food duplicates in Korean foods. Hence, the intake of sodium may be underestimated in this study.

Although no association was found between sodium intake and blood pressure in this study, sodium intake is known to be strongly related to blood pressure. Even moderate restrictions of salt were found to decrease systolic and diastolic pressure in both hypertensive and normotensive patients (Cutler, Follmann, & Allender, 1997). Hypertension was found to be highly prevalent among Koreans. Further efforts should be directed towards reducing dietary sodium in Koreans.

Potassium

The mean daily potassium intake of subjects accounted for 58% to 162% of the Australian RDI. One in five women in this study failed to meet the estimated minimum requirement for adults, of 2g per day, recommended by the National Research Council (National Research Council, 1989).

Potassium is reported to have beneficial effects in the prevention and treatment of hypertension (Suter, 1998). Fruit and vegetables are good sources of potassium. It has been shown that consumption of fruit and vegetables lowers blood pressure where much of this blood pressure lowering effect is mediated via potassium (Law & Morris, 1998). Considering the high sodium intake and high prevalence of hypertension amongst Koreans, plenty of fruit and vegetables in the diet should be recommended for Korean migrants to increase potassium intake in conjunction with advice to decrease sodium intake.

Iron

The mean daily iron intake of subjects accounted for 80%-107% of the Korean and NZ recommendations. However, the source of iron in the diet must be taken into account as the absorption of iron depends on the content and type of available iron where haem iron, from meat, poultry and fish, is better absorbed than non-haem iron, from vegetables and cereals. In Korea, it has been estimated that approximately 28.6% and 71.4% of iron were from haem and non-haem iron, respectively (South Korean Ministry of Health and Welfare, 1999). The picture appears to be similar in NZ that just under 1/3 of the total iron was from haem iron and approximately 2/3 was estimated to be from non-haem iron (Russell et al., 1999).

Subjects in this study had similar intakes of protein compared to NZ women, and the contribution of haem iron in the diet may also be similar in the two cohorts. However, diets rich in plant foods may in part explain the slightly higher total intake of iron observed in subjects than their NZ counterparts. Although the iron content of some of the green leafy vegetables is very high, thereby positively contributing to the total iron intake, the presence of inhibiting compounds, such as phytates and phenolic compounds, lowers its absorption.

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

Zinc

The mean daily zinc intake of subjects was below the recommendations set by both Korea and NZ, only accounting for 83% and 70% of these recommendations, respectively. Of the subjects, 68% of the subjects did not meet the Korean recommendations, while 82% of subjects did not meet the NZ recommendations. Along with calcium, zinc was one of the two nutrients where there is greatest risk of deficiency in this population.

Zinc is found abundantly in animal foods, such as red meat and some seafood. Because of the quantities consumed, cereals and legumes are also good sources of zinc in the diet. However, these foods are low in bioavailability due to the presence of phytate which reduces zinc absorption.

A recent Korean study reported that the mean daily intake of Korean adult women was 7.5mg and that 83% of them were below the Korean RDA (Joung et al., 2004). The principal source of zinc in the Korean diet was cereals and grains (Joung et al., 2004)

whereas beef and veal were the principal sources of zinc in the NZ diet (LINZ Research Unit, 1999).

The zinc intake of subjects was slightly higher than the level reported by women in Korea and lower than that of NZ women. Diets based on fish or vegetarian diets based on polished rice and vegetables typically give a lower zinc intake (Garrow, James, & Ralph, 2000). This may in part explain the lower intake of zinc in subjects than NZ women.

4.3.3.3 Overall patterns of dietary acculturation

There were no significant differences in food (except for animal fats and oils) and nutrient intakes between the short and long residence groups. Further, no relationship was established between length of residence and food and nutrient intakes in subjects. However, overall, immigrant subjects had intermediate nutrient intakes between those of Koreans living in Korea and New Zealanders. This suggests that dietary acculturation of migrant Koreans probably has taken place somewhere between 0-5 years of residence in New Zealand and that much of their traditional dietary habits are still retained.

4.4 Anthropometric Characteristics of Subjects

It is likely that the changes in the dietary intakes discussed above have affected the anthropometric characteristics and may influence the health outcomes of these women. Data from 2001 Korean National Health and Nutrition Survey and 1997 NZ National Nutrition Survey were used to compare the anthropometric characteristics of the study subjects, Korean women living in Korea and New Zealand women. The results are summarised in Table 4.2.

Table 4.2 The comparisons of anthropometric characteristics of study subjects, Korean women in Korea and NZ women.

Measurements	**Study Subjects**			**NZ Survey**[1]		**KoreanSurvey**[2]
	Mean	40-44 yrs women	45-55 yrs women	25-44 yrs women	45-64 yrs women	> 20 yrs women
	n=50	n=16	n=34			n=3,708
Weight (kg)	57.3	56.6	57.7	68.6	72.7	57.2
Height (cm)	157.3	158.1	156.9	163.6	161.5	156.3
BMI (kg/m^2)	23.3	22.9	23.5	25.7	27.9	23.4
Circumference						
Waist (cm)	75.2	-	-	-	-	78.8
WHR	0.81	0.79	0.81	0.77	0.80	-
Skinfolds						
Triceps (mm)	23.5[†]	23.7	23.4[‡]	25.2	28.4	-
Subscapular (mm)	21.6[†]	20.1	22.4[‡]	23.0	27.0	-
Blood pressure						
Systolic (mmHg)	114	108	116	117	136	122[*]
Diastolic (mmHg)	72	70	72	75	80	76[*]

[1] Data are from National Nutrition Survey 1997 (Russell et al., 1999)
[2] Data are from Korean National Health and Nutrition Survey 2001 (South Korean Ministry of Health and Welfare, 2002)
[†] Data are based on 49 subjects
[‡] Data are based on 33 subjects
[*] Data are based on women >30 years old

4.4.1 Weight and Height

Subjects were shorter and lighter than NZ women. In particular, older subjects (aged between 45-55 years) were 15kg lighter than older NZ women (aged 45-64 years). Similar results have been observed in Tan's study of Chinese migrants in NZ (Tan, 2001). Despite the fact that the majority of subjects claimed to have increased weight and that those who reported perceived weight gain had a higher average weight than those who did not, the body weight of subjects were similar to that of Korean women in Korea. This may be due to age. The subjects have been living in NZ for at least 5 years or longer and therefore they were at least 5 years younger compared to when they were in Korea. As people generally tend to gain weight as they age, the perceived weight gain reported by most subjects may in fact be aged-related weight gain and that it may not necessarily be a consequence of immigration to a new environment. In fact, there was no difference in body weight between the shorter and longer resident groups ($P>0.05$).

It is obvious that height was also similar in subjects compared to their Korean counterparts as all subjects already reached their full height before immigration to New Zealand.

4.4.2 Body Mass Index (BMI)

As presented in section 3.2.2, the New Zealand and Korean classifications yielded significantly different BMI profiles of the study subjects (P=0.005). In particular, subjects were 14 times more likely to be classified as obese by the Korean standard as the New Zealand.

Subjects had lower BMI levels compared to NZ women, but the mean BMI of subjects was similar to that reported from their Korean counterparts (Table 4.2). The mean BMI of subjects was also similar to that of Korean women (aged between 40 and 69 years) living in Chicago (23.7kg/m^2) (Kim, Yu et al., 2000) but was slightly higher than that reported from the study of Lee et al. (2000) (21.4kg/m^2). The lower level of BMI observed in that study may in part be due to the wide age range of respondents (between 17 and 90 years) as the study was conducted at a national level in the USA.

Due to changes in lifestyle, including diet and physical activity, there is a tendency towards increased overweight and obesity among Asian migrants (McGill, 2002). This tendency is also associated with the acculturation of migrants in that Asians born in America had higher BMIs than Asians born in Asia (Gomez, Kelsey, Glaser, Lee, & Sidney, 2004). The BMIs were reported to be lowest in traditional, intermediate in bicultural and highest in acculturated Korean Americans as reported by Lee et al. (23.4kg/m^2 vs 24.0kg/m^2 vs 25.1kg/m^2) and Song et al. (24.2kg/m^2 vs 24.4kg/m^2 vs 24.9kg/m^2), though the findings were only significant for males. Similarly, the proportion of Korean Americans who are categorised as obese were lowest in traditional, intermediate in bicultural and highest in acculturated Korean Americans in these studies (Lee et al., 2000; Song et al., 2004). Given that the length of residence in the host country is a commonly used measure of acculturation, the BMI did not appear to be related to the acculturation among study subjects as the BMI of the longer and shorter resident subjects were not significantly different.

The mean BMI of subjects, of 23.3kg/m^2, was in the range of overweight according to the Korean standard. Studies have shown that risk of non-fatal events, including incidence of diabetes mellitus, high blood pressure, and ischaemic heart disease begin to increase from a BMI well below 25kg/m^2 (Colditz, Willett, Rotnitzky,

& Manson, 1995; Rimm et al., 1995; Willett et al., 1995). Although the mean BMI of subjects was similar to that of Korean women in Korea, acculturation is positively correlated with BMI in migrant populations as discussed above. Hence, it is important that migrant Koreans should be encouraged not to gain any further weight.

4.4.3 Skinfold thickness

The study subjects had lower mean triceps and subscapular skinfold thickness compared to NZ women in both age groups (Table 4.2). The difference was larger in the older group. The ratio of the subscapular to triceps skinfold thickness is a measure of the distribution of subcutaneous fat between the peripheral and central regions. Although skinfold thickness measurements generally provide consistent and meaningful information with regards to body fat and its distribution (Hayes, Sowood, Belyavin, Cohen, & Smith, 1988), studies have shown that there is an ethnic difference in subcutaneous fat distribution. For example, more central subcutaneous fat and less peripheral fat were found in the Polynesian population compared to the European population (Rush, Plank, Laulu, & Robinson, 1997). A difference in location of adipose tissue stores has also been reported between American whites and blacks where black women had greater upper body obesity (Zillikens & Conway, 1990). However, no such difference was observed in present study in that subjects and NZ women both had more peripheral fat than central subcutaneous fat.

Body fat and its distribution are also affected by age. In younger adults, approximately a half of the body's total fat is laid at subcutaneous sites with the other half at internal. On the other hand, there is a tendency to lay proportionately greater amount internal fat as visceral and organ fat with advancing age (Going, Williams, & Lohman, 1995). This difference in fat distribution pattern among different age groups was demonstrated in present study with women in older group having higher subscapular fat than the women in younger group. The difference also existed amongst NZ women with greater difference in subscapular fat between the younger and older women (Table 4.2). This is probably due to greater age gap in two age groups.

4.4.4 Waist Circumferences

Increased waist circumference is independently associated with increased risk of metabolic disease (WHO, 1997a). Compared to the WHR, waist circumference provides a more accurate indirect measure of visceral fat (Han, McNeill, Seidell, & Lean, 1997).

In fact, abdominal obesity was found to be a better indicator of metabolic and cardiovascular disease risk factors particularly in women than men (Haffner, Mitchell, Hazuda, & Stern, 1991). It has been proposed that a waist circumference greater than 88cm is associated with an increased risk of type 2 diabetes and cardiovascular disease in women (WHO, 1997a). However, as with the BMI, a lower waist circumference of ≤80cm is recommended for Asian women by the WHO (International Obesity Task Force, 1998).

Although the BMI was similar between subjects and Korean women in Korea, the mean waist circumference of subjects was lower than that of Korean women in Korea. The mean waist circumference of subjects was lower than both the global and Asian standard.

4.4.5 Waist to Hip Ratio (WHR)

The WHR was introduced by Krotkiewski et al. (1983) as an alternative way to assess health risks besides the waist measurement. These researchers demonstrated that increased WHR was closely linked to developing metabolic complications of obesity. The WHR is still a widely used indicator of central adiposity where a high WHR refers to accumulation of excess fat in the abdominal area and a low WHR more fat in the gluteal-femoral regions.

It is interesting to note that while only 8% (according to the global standard) and 24% (according to the Asian standard) of subjects were considered 'at risk' for waist circumference measurements, almost a half (44%) of study population fell into the 'at risk' group for WHR. This is likely due to subjects having smaller hip circumferences. In other words, subjects may have more body fat in upper body in relation to their body size. The findings from present study are in line with the study by Wang et al. (1994) that Asians had more upper body subcutaneous fat than Caucasians. This points out the limitations of the use of WHR arising from ethnic differences. Greater WHR for a given amount of abdominal fat has also been evidenced in African-Americans compared to their Caucasian-American counterparts (as cited in Marcus et al., 1998). Furthermore, despite the fact that all other anthropometric measurements were higher in NZ women than subjects, the WHR of subjects were higher than their NZ counterparts (Table 4.2). Thus, ethnic specific risk criteria by WHR are needed to account for the ethnic differences.

The WHR data on Korean women in Korea are not available; therefore whether

or not the WHR in subjects changed after immigration to New Zealand cannot be assessed. Further research is needed to investigate the influences of diet and environment on WHR and its impact on cardiovascular risk and incidence and development of cardiovascular disease in the Korean population in New Zealand.

4.4.6 Elbow breadth and frame size

Most studies on frame size have been carried out on Caucasian subjects and the concept of frame size has not been thoroughly examined in non-Caucasian populations (Himes, 1991). Considering the small body sizes of Asians compared to Caucasians, it is not surprising that all women were classified as having either small or medium frame size since the classification was for Caucasian individuals. Because of their smaller frames and lower bone mass coupled with lower intake of calcium, Asian American women are found to be at particularly high risk of developing osteoporosis compared to other population groups according to the US Department of Health and Human Services (as cited in Ministry of Health, 2003). A thorough ethnic specific evaluation of frame size and its prognostic value in terms of health status would be an avenue for future research.

4.4.7 Body Composition by BIA

While 24% (according to NZ standard) and 46% (according to Korean standard) of subjects had BMI's over the normal range, the majority (86%) of subjects had body fat percentage over the normal range. This further supports the tendency of having higher body fat at a lower BMI in Asians. However, ethnic differences in body composition for the same BMI are not known because no longitudinal study is available. The prevalence of high fat percentage among subjects suggests that subjects should increase physical activity to decrease body fat levels.

4.5 Blood Measurements

4.5.1 Blood pressure

The mean systolic and diastolic blood pressures of subjects were lower than those

of NZ women in both age groups (Table 4.2). The blood pressure profile of the subjects was also generally better compared to their NZ counterparts upon the stratification of the blood pressures according to health risk, particularly in the older group. The distribution of subjects and NZ women in different blood pressure categories are summarised in Table 4.3.

Table 4.3 Distribution of subjects and NZ women in different blood pressure categories

Cohorts	Age group years	Normotensive[1] %	Borderline[2] %	Hypertensive[3] %
Subjects (n=16)	40-44	93.7	0	6.3
NZ women	25-44	90.1	6.9	3.1
Subjects (n=34)	45-55	82.4	14.7	2.9
NZ women	45-64	57.1	26.1	16.8

[1]Normotensive: systolic <140mmHg and diastolic <90mmHg
[2]Borderline: 140mmHg ≤ systolic < 160mmHg, and/or 90mmHg ≤ diastolic < 95mmHg
[3]Hypertensive: systolic ≥160mmHg and diastolic ≥95mmHg

Compared to the women in Korea, the mean systolic and diastolic blood pressures of subjects were also lower (Table 4.2). While 26.5% of women in Korea were hypertensive according to the latest Korean National Health and Nutrition Survey; hypertension was classified as having either systolic pressure of ≥140mmHg and diastolic pressure of ≥90mmHg, only 14% of subjects were hypertensive in this study according to this categorisation. However, the age range of the two cohorts was different in that Korean women in Korea are those who are over 30 years old.

This contrasts to the findings from the cross-sectional epidemiological study of high blood pressure prevalence among Korean Americans. In this study, the researchers found that the prevalence of high blood pressure (systolic pressure of ≥140mmHg and/or diastolic pressure of ≥90mmHg or receiving high blood pressure medication) in Korean Americans (32%) was much higher than in other Americans (24%) and in their counterparts in Korea (22%) (Kim, Kim, Juon, & Hill, 2000). In fact, a study of blood pressure on immigrant population indicates that the prevalence of high blood pressure generally increases upon migration (He et al., 1991). It is hypothesised that the stresses related to acculturation and changes in diet and lifestyle are the factors which adversely affect blood pressure levels of migrants (Kim, Juon, Hill, Post, & Kim, 2001). However, blood pressure was not associated with length of residence in NZ, nutrient intake or physical activity levels in the present study.

Hypertension is a well-known risk factor for CVD. A previous study reported that hypertension awareness, treatment and control rates have been relatively low in Korea (Jones, Kim, Kim, & Hong, 1996). Further, it has been found that new Asian immigrants are less aware of CVD (Chen, Kuun, Guthrie, Li, & Zaharlick, 1991). These suggest that culturally appropriate health education strategies targeted at the growing diverse Asian population would be necessary. Meanwhile, a reduction in salt intake and increased physical activity should be recommended to this population because these appear to be some of the most practical interventions for decreasing risk factors for hypertension.

4.5.2 Blood glucose

One of the exclusion criteria of the present study was a diabetic condition. Nonetheless, more than a quarter of subjects (16%) were deemed to be possibly glucose intolerant. In fact, people are often unaware that they have diabetes for a long period of time because type II diabetes may be asymptomatic for many years (Simmons, 1996). This suggests that the prevalence of diabetes in this population may be high. Diabetes mellitus is one of the major health problems in many parts of the world which consequently can result in serious complications (Simmons, 1996). Culturally appropriate health education strategies may be needed to reduce the disease burden.

4.6 Nutrient Intakes and Implications for Health

A high salt diet can be identified as one of the main nutritional problems for Koreans. A diet that is high in salt is not only strongly related to stomach cancer and cerebrovascular disease (including hypertension), but also to an increase in obligatory calcium loss, which may contribute to bone demineralisation. Long term adaptation to high salt intakes makes a compensatory increase in absorption of dietary calcium necessary. This is because it is very likely that high salt intakes accelerate negative calcium balance and bone loss whenever dietary calcium is inadequate to meet calcium needs (Goulding, 1990). This, coupled with the generally low intake of dairy products in Koreans, may further increase the risk for osteoporosis. However, a trend towards increased intakes of dairy products reported in study subjects is of importance in Korean migrants in New Zealand.

On the other hand, one of the healthful dietary behaviours that can be learned from Koreans is a high vegetable intake. Vegetables are rich in various physiologically active components, including vitamins and minerals, which provide a range of health benefits (Milner, 1998). Hence, high intake of vegetables should continue to be encouraged to Korean migrants, particularly in those individuals who may have insufficient intakes. Also, exposure to Korean cuisine for New Zealanders may further make increased intakes of vegetables possible for New Zealanders.

CHAPTER 5.

CONCLUSIONS AND RECOMMENDATIONS

Migration to a new country presents many lifestyle challenges that may influence future health outcomes. In particular, eating patterns may be altered due to the lack of availability or expense of foods typical of the immigrant's usual diet and the relative abundance of unfamiliar, locally produced foods. As a pilot study, the purpose of this study was to assess dietary intake and other health related measures in a sample of 50 middle-aged (40-55 years) Korean women who have lived in New Zealand for at least 5 years. The findings from this study indicate the trends of dietary acculturation and the related factors. Areas of concern and the need for further research have also been identified.

The study subjects were highly educated. Most of them were married and lived with their family. A pattern of underemployment (in both subjects and their husband) was observed and this appeared to have been reflected in the income level. The prevalence of smoking was very low, but dietary supplement usage was very high in this population. The physical activity level of these women appeared to be low and needed improvement. Increasing physical activity may benefit Korean migrants by preventing them from being overweight and thus predisposed to chronic diseases.

Breakfast was the most westernised meal and dinner remained as the most traditional meal. While individuals with longer residence in New Zealand tended to have lower intakes of plant foods than those with shorter residence and vice versa for the intakes of animal foods, the difference was not statistically significant (except animal fats and oils). Compared to the women in Korea, subjects had greater intakes of pulses and pulse products, eggs, and dairy products; and lower intakes of cereals and cereal products, vegetables and marine vegetables and spices.

The nutrient intakes of subjects were found to be generally adequate and the

proportions of energy derived from macronutrients were also considered to be in the adequate range. However, low intakes of calcium and zinc were identified as the main nutritional problems in this population. The nutrient intakes of longer residence immigrants and shorter residence immigrants were not statistically different. The carbohydrate intake was the highest in Korean women living in Korea, the lowest in New Zealand women and study subjects intermediate. The opposite pattern was observed in fat intake. While intakes of other nutrients were similar to each other in all three cohorts, subjects had intermediate calcium intakes between those of Korean and New Zealand counterparts (New Zealand women> subjects> Korean women).

The findings from this study indicate that Korean migrants have not changed their traditional dietary habit very much and that rice and *kimchi* still hold the prominent place in their diet. The findings further suggest that the dietary acculturation of migrant Koreans probably has taken place somewhere between 0-5 years of residence in New Zealand. However, systematic analysis of the effects of sociodemographic differences on food habits and dietary intakes was difficult in this study because of the small sample size. A future study with greater number of subjects, both men and women, is probably needed to better assess the nutritional intakes and health indicators of Korean migrants in New Zealand. This would also be needed to better understand the process and dynamics of dietary acculturation of the growing migrant Korean population in New Zealand because starting health and nutrition surveillance from an early stage of adaptation is important.

Personal preferences and skills, such as 'Taste' and 'Korean food cooking method is more familiar', were found to be stronger determining factors for migrant Koreans in maintaining the Korean diet than psychosocial factors, such as belief and attitude. However, a complex mechanism of food choice appeared to exist as there were several factors that influence subjects to adopt a more Western diet. The awareness of nutritional materials among subjects was not high and less than a half of subjects used nutrition labels when purchasing food items. The subjects strongly believed the relationship between diet and health and that the Korean diet is healthier than a Western diet. Acculturation is a long term process. The findings from this study strongly suggest that nutrition education is necessary in this migrant population to optimally blend the two dietary cultures by retaining the beneficial aspects of the traditional diet and only

adopting the desirable aspects of the host culture diet.

The subjects had same prevalence of overweight (22%) measured by the BMI in both New Zealand and Korean classification. However, the subjects had a much lower prevalence of obesity according to the New Zealand (2%) compared to the Korean classification (24%) (P=0.005). Similarly, the subjects had a lower prevalence of increased disease risk measured by the waist circumference according to the global classification (8%) compared to the Asian classification (24%) (P=0.029). While less than a quarter of subjects were considered 'at risk' for waist circumference measurements (in both New Zealand and Korean classifications), almost half the subjects (44%) fell into the 'at risk' group for WHR suggesting that subjects may have more body fat in upper body in relation to their body size. This is in line with another study (Wang et al., 1994) that Asians had more upper body subcutaneous fat than did whites. These findings suggest that appropriate ethnic specific obesity indicators need to be developed to monitor anthropometric changes in migrant populations. The majority of subjects (86%) fell into the normal blood pressure range with only two hypertensive women in the study group.

Despite the reported tendency towards increased overweight and obesity among Asian migrants, which is due to changes in lifestyle including diet and physical activity, the mean BMI of subjects was similar to that reported from their Korean counterparts. When compared to New Zealand women, subjects had lower BMI, and a more favourable blood pressure. However, subjects had higher upper body obesity, i.e. higher WHR, than their New Zealand counterparts.

Fifteen subjects responded to the advertisements about this research and contacted the researcher directly. The rest of the subjects were recruited by 'word of mouth' and were friends of the subjects already in the study. Even though some of them had already heard about the study through the publicity, it was not until their friends' invitation that they decided to volunteer. The strong sense of community between Koreans helped reassure those who were unsure or embarrassed about volunteering at first. In addition, a strong interest in health and nutrition has given them further motivation to participate in the study.

This is a pilot study and was conducted in a relatively small number of women in order to obtain an indication of the nutritional issues in this population. However, as with all pilot studies, these results cannot be generalised to the Korean New Zealand population. The fact that many subjects were recruited by personal contact via friends who had already agreed to participate in the study may have introduced some selection bias. The subjects of this cohort were therefore not randomly selected and their shared sociodemographic characteristics may have affected their experience of acculturation, e.g., less variable food patterns among study subjects. This affects the generalisability of the findings of this study. Nonetheless, the study was still useful in that it highlights the important nutritional and related health issues for middle-aged Korean women immigrants in New Zealand. Moreover, the fact that women traditionally have the principal responsibility for feeding the family and the behaviour of women is particularly important for the diet and health of the family unit as primary caregivers amongst Koreans, the current study may also give an insight to the dietary acculturation of the Korean families in New Zealand.

A random selection of participants in a larger number is suggested for a future study of the Korean migrants as this may be the best way to reduce any selection bias and ensure a representative sample of the Korean migrants. Furthermore, future study including different age and gender would be required to examine whether these issues and/or trends raised in the present study apply to other groups of immigrant Koreans in New Zealand.

The results from the current study suggest that increasing calcium and zinc intake and decreasing salt intake as well as increasing physical activity may be important goals for the health of middle-aged female Korean migrants. Monitoring the relationship between changing dietary patterns, physical activity patterns and consequently the changing prevalence of chronic disease in this population would also be necessary. Furthermore, the results of this study can be used to develop culturally appropriate nutrition education materials and programmes for the growing Korean population in New Zealand.

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APPENDIX 1

Map of Korea


RUSSIA
CHINA
HAMGYONG BUK-DO
Ch'ongjin
HAMGYONGNAM-DO
P'YONG-ANBUK-DO
Sinuiju
Hamhung
P'YONG-AN NAM-DO
P'YONGYANG
EAST SEA
HWANGHAE-DO
Haeju
KANGWON-DO
KYONGGI-DO
Ch'unch'on
SEOUL
INCH'ON
KOREA
Ullungdo
Suwon
Tokdo
CH'UNG CH'ONG BUK-DO
CH'UNG CH'ONG NAM-DO
Ch'ongju
KYONGSANG BUK-DO
YELLOW SEA
TAEJON
Chonju
TAEGU
CHOLLA BUK-DO
Ulsan
KYONGSANG NAM-DO
KWANGJU
Ch'angwon
PUSAN
CHOLLA NAM-DO
STRAIT
CHEJU-DO
Cheju
KOREA
JAPAN

APPENDIX 2

Letter of Approval from the Human Ethics Committee

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

28 May 2003

Michelle Kim
C/o Dr Pauline Ashfield-Watt
Institute of Food Nutrition and Human Health
Massey University
Albany

Dear Michelle

HUMAN ETHICS APPROVAL APPLICATION – MUAHEC 03/030
"An Investigation of the Dietary Intake and Nutritional Status of Korean Migrants in New Zealand."

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 Dr Pauline Ashfield-Watt
Institute of Food Nutrition and Human Health

APPENDIX 3

Advertisements

(English and Korean)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

The first ever investigation of nutritional status of Koreans living in NZ!!

One of the major factors in longevity is a balanced diet!!

Have you been in NZ for at least 5 years ?

Are you a woman aged between 40 and 55?

If yes, we would like *YOU* to take part in this important study!

This project has been reviewed and approved by the Massey University Human Ethics Committee, ALB Protocol 03/030 .

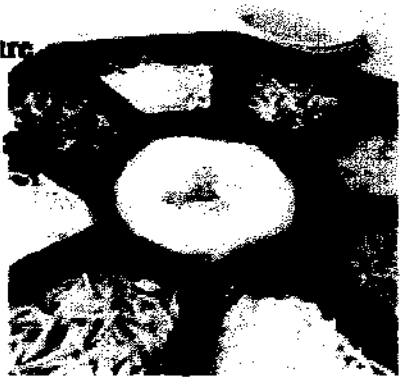
Here is the background to our research:

Eating is an indispensable part of an existence and life of humans. In particular, dietary habits have a major influence on health status. Since the start off of the official immigration for Koreans in 1989, Korean has become one of the fastest growing migrant ethnic groups in multi-ethnic society of NZ. However, unlike European, Maori, South-pacific Islands and Chinese migrants, there has been no similar study done about dietary intakes of Koreans to date. Therefore, we are inviting you to participate in the first ever investigation of nutritional status of Koreans living in NZ. Any female who has lived in NZ for 5 years or more and is aged between 40 and 55 is welcome to join our study. We would like to know about changes to your eating patterns since coming to NZ. If you would like to take part or would like some more information please send your name and contact number to me at:

Michelle Kim c/o Dr Pauline Ashfield-Watt
Massey University
Institute for Food, Nutrition and Human Health
Albany Campus,
Private Bag 102 904, North Shore Mail Centre

OR contact me by phone or em

[redacted]



Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

뉴질랜드 최초의 한국인 영양실태 조사연구 !!

무병장수의 가장 큰 비결은 균형잡힌 식생활입니다 !

뉴질랜드에 거주하신지 만 5년이 넘으셨습니까 ?

만 40세부터 만 55세의 여성이십니까 ?

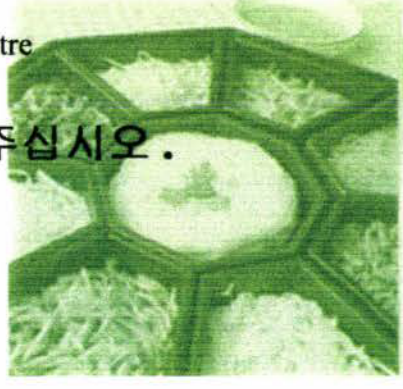
만약 그렇다면 이 의미있는 연구에 참여 하십시요 !

본 연구는 매시대학 인간윤리심의위원회의 검토를 거쳐 승인을 받았습니다
ALB Protocol 03/030

아래는 본 연구의 연구 배경입니다 :

인간의 생존과 삶에 절대적 요소인 먹는일 , 그 중에서도 식습관은 인체의 건강에 가장 큰 영향을 미치는 요소입니다 . 우리나라 사람에게는 공식적인 이민의 길이 열린 1989년 이래로 한국인은 다민족의 뉴질랜드 사회에서 급증하는 이민자 인종그룹이 되었음에도 불구하고 유럽인 , 마오리인 , 남태평양 군도인 및 중국인들을 포함한 타 민족들의 식품섭취에 관한 연구는 이미 이루어졌음에 비하여 한국인에 대한 동일한 연구는 아직까지 전혀 이루어지지 않고 있는 실정입니다 . 따라서 NZ에 거주하는 한국인들의 영양상태에 관하여 실시하는 NZ 최초의 이 연구조사에 뜻 있는 교민들께서는 기꺼이 동참하여 주실 것을 요청합니다 . 만 40세부터 만 55세까지의 여성으로 NZ에 거주 하신지가 만 5년이 넘으면 누구나 자유롭게 참여하실 수 있습니다 . 뉴질랜드 이주 후 귀하의 식생활 변화에 대한 정보를 얻고자 하오니 , 본 연구에 동참을 희망하시거나 또는 이 조사연구에 대하여 보다 더 자세한 정보를 얻기 원하시는 분들은 아래의 주소로 연락 주시기 바랍니다 .

Michelle Kim c/o Dr Pauline Ashfield-Watt
Massey University
Institute for Food, Nutrition and Human Health
Albany Campus,
Private Bag 102 904, North Shore Mail Centre



혹은 전화나 이메일로 연락 주십시오 .

Michelle Kim (김정하) [redacted]

APPENDIX 4

Information Sheets

(English and Korean)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

An Investigation of Dietary Intake and Nutritional Status of Korean Migrants in New Zealand

Information sheet

Researcher Background

This study is being conducted by Michelle Kim, a Master's student at Massey University. She has a Bachelor's degree of Science in Pharmacology from the University of Auckland. This work will contribute to her Master in Nutritional Sciences degree. Her supervisor is Dr Pauline Ashfield-Watt, a nutritionist and lecturer in Human Nutrition in the Institute of Food, Nutrition and Human Health of Massey University at the Albany Campus.

Outline of the Study

Immigration into a new country often results in many lifestyle changes, particularly new dietary habits. It is now well established that diet is one of the most significant factors that influences chronic diseases. Patterns of disease in migrants are influenced by adaptations to the host country's environment. Depending on the sorts of changes made, this can have either positive or negative effects. This study will investigate the dietary intake and overall nutritional status of middle aged female Koreans (aged 40-55 years) who have lived in New Zealand for at least 5 years. The results of this research will be used to determine factors which influence dietary patterns in Korean families and to identify specific healthy and unhealthy eating behaviours of Korean immigrants.

Please note: Women with medical conditions which might affect their diet may not be suitable for our study. (Please contact us for more detail.)

What do I have to do?

- We would like to collect information on what you usually eat. This will involve telling us what you have eaten on 3 separate days (two weekdays and one weekend day).
- We will measure your height and weight and take some other simple measurements to help us assess your body energy stores.
- Test your blood glucose level using a finger prick test.
- We'll ask you some simple questions about your eating habits, leisure activities, food purchases and demographic factors.
- There will be three visits of approximately one hour each.

What will I receive for taking part?

- A simple breakdown of your nutritional intake
- An description of your body measurements
- Blood pressure and blood glucose results

Rights of volunteers

- On receiving this information sheet you may decline to take part in the study.
- You may refuse to answer any question or to have any of the body measurements taken, including the blood glucose test.
- You can withdraw from the study at any time up to completion of data collection.
- Once all data collection is completed, volunteers will not be able to withdraw their data from the study
- You can ask questions about the study at any time during the study.
- All volunteers provide information on the understanding that their name will not be mentioned in any report of the study.
- All volunteers will be given access to a summary of the findings of the study and their individual health assessment upon completion of the study.

All information is necessary for the study and will be kept confidential.

Confidentiality

The results of this study will of course be CONFIDENTIAL. Anything a volunteer tells the researcher will be anonymous and remain confidential. Each volunteer will be identified by code number only, not by name, in the collection and analysis of information. All data collected will be filed in a locked cabinet in a locked and alarmed room. A master list of the names, address and code numbers will be kept by the project supervisor under lock and key in a separate location. 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 written up in a thesis, presented to peers and colleagues and submitted for publication in a scientific paper.

Study schedule

You will be visited at your home, or wherever it is most convenient for you, on three occasions.

First Visit (requires around one hour)

- A general questionnaire to determine your dietary and physical activity patterns will be administered by the researcher.
- The researcher will carry out a 24-hour recall interview on your dietary intake

Second Visit (requires around one hour)

- The researcher will carry out a second 24-hour recall interview on your dietary intake.
- The following body measurements will be taken:
  1. Body Height
  2. Body Weight
  3. Skinfolds at the following sites:
     - Triceps; Back of upper arm
     - Subscapular; Below the bottom tip of scapular

     -. The researcher will use special calipers to measure the width of a fold of skin.

     -. This produces a feeling of slight pressure, but no pain.

     -. The measurements will be taken on your right side of the body
  4. Circumference at the following sites:
     - Upperarm
     - Waist
     - Hip
  5. Elbow breadth
  6. Blood pressure

     -. Blood pressure will be measured twice during the visit.
  7. Bioelectrical Impedance Analysis (BIA)

     -. BIA is used to measure percentage body fat. 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 far percentage. You will not feel anything and is not harmful to your body.

Note: You will be asked to wear the T-shirt and loose pants or shorts for the body measurement.

Third Visit (requires around one hour)

- The researcher will carry out a third 24-hour recall interview on your dietary intake.
- A general questionnaire to determine your demographic and medical details will be administered by the researcher.
- A drop of blood will be taken from your fingertips as a sample for testing your blood glucose level. You will only feel a prick at your fingertip. This will be a brief process and not be harmful for your health. This test will help us examining your blood glucose level.

The contact details of the researcher and the supervisor are:

Researcher:
Michelle Kim
[redacted]

Supervisor:
Dr Pauline Ashfield-Watt
Massey University
Institute for Food, Nutrition and Human Health
Albany Campus
Private Bag 102 904
North Shore Mail Centre
North Shore City
Phone: (09) 443 9874
Facsimile: (09) 443 9640
Email: P.Ashfield-Watt@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee, ALB Protocol 03/030. If you have any concerns about the conduct of this research, please contact Associate Professor Kerry P Chamberlain, Chair, Massey University Campus Human Ethics Committee: Albany, telephone 09 443 9700 x9078, email K.Chamberlain@massey.ac.nz.

Massey University
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Albany Campus

뉴질랜드 한국 이민자들의 식품섭취 및 영양상태에 대한 조사연구

안내자료

연구자 배경

본 조사연구는 매시대학에서 석사과정을 밟고 있는 김정하 학생이 합니다. 김정하 학생은 이미 오클랜드 대학 학부에서 약리학을 전공하였습니다. 본 연구는 영양과학 석사학위를 받는데 쓰이게 됩니다. 지도교수는 Pauline Ashfield-Watt 박사님으로 영양학자이며 매시대학 알바니 캠퍼스의 식품, 영양 및 인간건강학과의 인간영양학 교수님이십니다.

연구 개요

새로운 나라에서의 이민은 여러가지 생활습관의 변화를 수반하는데 특히 식습관이 그러합니다. 그리고 식습관이 만성질환에 가장 중요한 영향을 미치는 요소중의 하나라는 것은 이미 널리 알려져 있는 사실입니다. 이민자들의 질병 패턴은 이주한 나라의 현지 환경의 적응에 따라 영향을 받습니다. 이것은 변화의 종류에 따라 좋은영향으로 혹은 나쁜영향으로 작용하기도 합니다. 본 연구는 뉴질랜드에 5 년 이상 거주한 한국 중년 (나이 40-55 세) 여성들의 식품 섭취와 이와 관련된 전반적인 영양 실태에 관하여 조사를 하게 됩니다. 연구결과는 한국인 가정의 식이 패턴에 영향을 미치는 요소 및 한국인 이민자들의 건강에 유익하거나 해로운 식습관을 측정하는데 쓰이게 됩니다.

주의: 신체의 특수상황으로 식생활에 영향을 미치는 여성분들은 본 연구에 적합하지 않을 수 있습니다. (더 자세한 정보를 위하여 연구자에게 연락 주시기 바랍니다.)

무엇을 해야합니까?

- 귀하의 평소 음식섭취에 대한 정보를 얻고자 합니다. 이를 위해 각각 다른 3 일간 (주중 이틀과 주말 하루)의 음식섭취 내용을 알려주시면 됩니다.
- 체내 열량 저장량을 평가하기 위해 키와 몸무게 및 몇가지 간단한 치수를 측정합니다.
- 혈당측정기를 사용하여 혈당치를 측정합니다.
- 식습관, 레저활동, 식품구매 및 인구통계적 요인에 대한 간단한 질문을 하게 됩니다.
- 각각 대략 1 시간 가량 소요되는 세번의 방문을 하게 됩니다.

연구에 참가하면 무엇을 얻나요?

- 귀하의 영양섭취에 대한 간단한 분석
- 귀하의 신체지수에 대한 분석
- 귀하의 혈압 및 혈당 검사 결과를 얻으실 수 있습니다.

지원자의 권리

- 본 안내문을 받아 보시고 본 연구에 참여하시는 것을 거절하셔도 됩니다.
- 원하시면 어떠한 설문조사 또는, 혈당검사를 포함한, 신체지수 측정에 응하지 않으셔도 무방합니다.
- 데이터 수집종결 전에는 어떠한 시점에서라도 연구에서 탈퇴하실 수 있습니다.
- 단, 데이터 수집이 종결된 후에는 연구에서 데이터를 회수하실 수 없습니다.
- 본 연구에 대하여 문의 사항이 있으시면 연구 중 언제든지 질문/질의하실 수 있습니다.
- 연구의 어떠한 보고서에도 자원자의 실명이 노출되지 않는다는 조건하에 지원자는 정보를 제공합니다.
- 연구를 마치면 모든 지원자는 본 연구 결과 및 개개인의 건강진단에 대한 내용요약의 입수가 가능 합니다.

모든 정보는 본 연구에 필수적이며 모든 비밀은 보장됩니다.

비밀유지

이 연구에 관련된 모든 비밀은 철저히 보장됩니다. 지원자가 연구자에게 제공하는 모든 정보는 익명으로 처리되며 비밀이 보장됩니다. 정보 수집 및 분석시 각 자원자는 이름이 아닌 코드 번호로만 확인됩니다. 수집된 모든

데이터는 철하여져서 경보장치가 되어있고 시건이 된 방에 있는 시건된 철재함(캐비닛)에 보관됩니다. 또한 이름, 주소 및 코드 번호가 기재되어있는 전체명단(마스터명단)은 본 연구의 지도교수가 완벽하게 시건이 되어있는 별도의 장소에 따로 보관합니다. 정보 분석은 개인이 아닌 집단에 초점을 두어 이루어집니다.

결과의 발표

본 연구의 결과는 논문으로 씌여지며 연구 분야의 동료들에게 발표되고 과학 학술지에의 출판을 위하여 제출하게 됩니다.

연구 스케줄

귀하의 자택 또는 귀하께서 원하시는 편리한 장소로 세 번의 방문을 합니다.

첫번째 방문 (약 1 시간 소요)

- 귀하의 식생활 및 운동 패턴 측정을 위하여 연구자가 전반적인 설문조사를 실시합니다.
- 24 시간 회상법으로 귀하의 음식 섭취에 대한 인터뷰를 합니다.

두번째 방문 (약 1 시간 소요)

- 24 시간 회상법으로 귀하의 음식 섭취에 대한 인터뷰를 합니다.
- 다음과 같은 신체지수 측정을 합니다:
  1. 신장
  2. 체중
  3. 피하지방 두께법(피지후법)으로 다음과 같은 부위의 측정을 합니다:
     - 상완삼두근; 상완 뒤 부분
     - 견갑골하반부; 견갑골 하각의 아래 부분

     -. 신체측정용 특수도구(캐리퍼)를 사용하여 연구자가 귀하의 피부두께 너비를 측정합니다.

     -. 통증은 전혀 없으며 약간의 압력만을 느끼게 됩니다.

     -. 모든 측정은 몸 우측에서 합니다.
  4. 다음과 같은 부위의 둘레를 측정 합니다.
     - 상완부
     - 허리
     - 대퇴부
  5. 팔꿈치 너비
  6. 혈압

-. 혈압은 두번 측정 합니다.

7. 생체전기 임피던스 분석
   -. 생체전기 임피던스법은 신체 지방의 백분율을 측정할 때 쓰이는 방법으로 신체에 적은 전류를 흘렸을 때 측정한 저항을 이용하여 체지방율을 평가합니다. 아무 느낌이 없을 뿐 아니라 비침습적이며 몸에 해롭지 않습니다.

주의: 신체지수 측정시에는 티셔츠와 헐렁한 바지 또는 반바지를 입으셔야 합니다.

세번째 방문 (약 1 시간 소요)

- 24 시간 회상법으로 귀하의 음식 섭취에 대한 인터뷰를 합니다.
- 귀하의 인구통계 및 의학적 자료를 얻기 위하여 연구자가 전반적 설문조사를 합니다.
- 혈당 측정을 위해 손가락 끝에서 피한방울을 채혈합니다. 손가락 끝에서 잠깐 따끔함을 느낄 뿐 간단하며 신체에 해롭지 않습니다. 이 검사는 귀하의 혈당치를 측정하는데 쓰이게 됩니다.

연구자와 지도교수의 연락처는 아래와 같습니다:

연구자:
김정하
[redacted]

지도교수:
Dr Pauline Ashfield-Watt
Massey University
Institute for Food, Nutrition and Human Health
Albany Campus
Private Bag 102 904
North Shore Mail Centre
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Phone: (09) 443 9874
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본 연구는 매시대학 인간윤리심의위원회의 검토를 거쳐 승인을 받았습니다, ALB Protocol 03/030. 본 연구의 운영에 관하여 문의사항이 있으시면 매시대학 알바니 캠퍼스 인간윤리심의위원회의 회장이신 Kerry P Chamberlain 교수님: 전화 09 443 9700 교환 9078, 이메일 K.Chamberlain@massey.ac.nz. 로 문의 하시기 바랍니다.

APPENDIX 5

Consent Forms

(English and Korean)

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

An Investigation of Dietary Intake and Nutritional Status of Korean Migrants in New Zealand

Consent Form (In English)

THIS CONSENT FORM WILL BE HELD FOR A PERIOD OF FIVE (5) YEARS

- I have been given, and I have read and understood a written explanation of what is asked of me in the study that I have been invited to take part in.
- 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 up until the point which all data relevant to study has been collected from me and have the right to decline to answer any particular questions.
- I agree to provide information to the researcher on the understanding that I will not be individually identified in any report of the study.
- I agree to take part as a subject in this study, under the conditions set out in the information sheet.

Subject:

(Given Name)	(Surname)
(Signature)	(Date)

Researcher:

Michelle Kim
[redacted]

(Signature)	(Date)

Supervisor:

Dr Pauline Ashfield-Watt
Massey University
Institute for Food, Nutrition and Human Health
Albany Campus
Private Bag 102 904
North Shore Mail Centre
North Shore City
Phone: (09) 443 9874
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Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

뉴질랜드 한국 이민자들의 식품섭취 및 영양상태에 대한 조사연구

동의서 (한글)

본 동의서는 5 년간 보관이 됩니다.

- 나에게는 본 연구 참여시 나에게 요구되는 사항에 대한 서면 설명서가 주어졌으며 나는 이를 읽고 이해하였습니다.
- 나는 질문을 할 기회와 질문에 대한 답을 얻을 수 있는 기회가 있었으며 언제라도 질문을 할 수 있음을 인지합니다.
- 나는 데이터 수집종결 전에는 어떠한 시점에서라도 연구에서 탈퇴할 수 있으며 어떠한 질문에도 응하지 않을 수 있는 권리가 있음을 인지합니다.
- 나는 연구의 어떠한 보고서에도 개인으로 노출되지 않는다는 조건 하에 나에 대한 정보를 제공하는 것에 동의합니다.
- 안내자료에 명시된 조건에 한하여 본 연구에 참여하는 것에 동의합니다.

참가자:

_____ _____

(이름) (성)

_____ _____

(서명) (날짜)

연구자:

김정하
[redacted]

_____ _____

(서명) (날짜)

지도교수:

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Phone: (09) 443 9874
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APPENDIX 6

Data Collection Sheets

-. Questionnaire One
-. Body Measurements
-. Questionnaire Two

Massey University
COLLEGE OF SCIENCES

Institute for Food, Nutrition and Human Health
Albany Campus

An Investigation of Dietary Intake and Nutritional status of Korean Migrants in New Zealand

Visit One

-. *Questionnaire One*

(Dietary and Physical Activity Pattern)

-. *24-Hour Dietary Recall*

Code Number of Subject: | | | | |

Date of Interview: | | | | | | | | |

Day Month Year

Time of Interview: | | | | |

Hour Minute

Nutrition

1. On average, how many meals do you have a day?

   a. 1
   b. 2
   c. 3
   d. More than 3 meals

1. Meals per day

1=a
2=b
3=c
4=d
8=NA
9=Don't know

2. How many between meal snacks do you have during the day?

   a. None
   b. 1
   c. 2
   d. More than 3

2. Snacks per day

1=a
2=b
3=c
4=d
8=NA
9=Don't know

3. How often do you have breakfast?

   a. Never or seldom
   b. Less than once a week
   c. Once a week
   d. A few times a week
   e. Everyday

3. Breakfast

1=a
2=b
3=c
4=d
5=e
8=NA
9=Don't know

4. How often do you eat away from home?

   a. Never or seldom
   b. Less than once a week
   c. Once a week
   d. A few times a week
   e. Once a day

4.Eat away

1=a
2=b
3=c
4=d
5=e
8=NA
9=Don't know

5. Where do you usually dine out? (Choose all that apply.)

   a. Fast-food restaurants (such as McDonalds and KFC)
   b. Western style cuisine restaurants
   c. Korean restaurants
   d. Other Asian restaurants (such as Japanese or Chinese)
   e. Other

5. Dining out places

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐

6. On average, how often do you have rice, ready to eat cereals, pasta or bread?

   a. I don't eat cereal food
   b. Less than once a week
   c. Once a week
   d. A few times a week
   e. Once a day
   f. More than once a day
   g. Nearly every meal

6. Cereals ☐

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

7. On average, how often do you have starchy food, such as potato or kumara?

   a. I don't eat starch food
   b. Less than once a week
   c. Once a week
   d. A few times a week
   e. Once a day
   f. More than once a day
   g. Nearly every meal

7. Starchy food ☐

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

8. On average, how often do you have meat (not lean), such as samgeubsal (pork belly), pork chops and chadolbakie (part of brisket)?

a. I don't eat meat that is not lean
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

8. Meat not lean

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

9. On average, how often do you have lean meat or poultry?

a. I don't eat lean meat or poultry
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

9. Lean meat

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

10. On average, how often do you have dairy products, such as milk, cheese and yoghurts?

a. I don't eat dairy products
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

10. Dairy products

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

11. On average, how often do you drink milk?

a. I don't drink milk
b. Less than 1 glass a week
c. 1 glass a week
d. A few glasses a week
e. 1 glass a day
f. 2 or more glasses a day

11. Milk

1=a
2=b
3=c
4=d
5=e
6=f
8=NA
9=Don't know

12. On average, how often do you have fish?

a. I don't eat fish
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

12. Fish

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

13. On average, how often do you have bony fish, such as anchovy, do you have a week?

a. I don't eat bony fish
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

13. Bony fish

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

14. On average, how often do you have marine vegetables, such as laver or sea mustard?

a. I don't eat marine vegetables
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

14. Marine vegetables

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

15. On average, how often do you have soy products, such as bean and tofu?

a. I don't eat soy products
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

15. Soy products

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

16. On average, how often do you have vegetables?

a. I don't eat vegetables
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

16. Vegetables

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

17. How do you usually have your vegetables? (Choose all that apply.)

a. Fresh
b. Boiled
c. Steamed
d. Pickled
e. Stir-fried

17. Vegetable cooking

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐

18. On average, how often do you have *Kimchi*?

a. I don't eat *Kimchi*
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

18. *Kimchi*

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

☐

19. Is your *Kimchi*

a. Mostly bought?
b. Mostly home made?
c. 50:50?

19. *Kimchi* preparation

1=a
2=b
3=c
8=NA
9=Don't know

☐

20. On average, how often do you have fruits?

a. I don't eat fruits
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

20. Fruits

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

21. On average, how often do you have stews, such as soybean thick stew and Kimchi stew?

a. I don't eat stews
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

21. Stews

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

22. On average, how often do you drink alcoholic beverages, such as beer, wine or soju?

a. I don't drink alcoholic beverages
b. Less than once a week
c. Once a week
d. A few times a week
e. Once a day
f. More than once a day
g. Nearly every meal

22. Alcohols

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

23. How do you remove fat when cooking or eating meat dishes?

a. I don't remove any and eat it as it is
b. I just remove the biggest lump
c. I remove as much as I can
d. I don't eat any visible fat

23. Fat removal ☐

1=a
2=b
3=c
4=d
8=NA
9=Don't know

Physical activity

24. On average, how much time do you spend walking a day (this includes walking to and from work, school, and shopping but does not include for sport, exercise or pleasure)?

_____ minutes

24. Walk ☐☐☐ minutes

❖ 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

❖ Moderate activates include:

- Carrying light loads – carrying baby
- Continuous walking – shopping
- Heavy cleaning – mopping, sweeping, vacuuming, laundry, cleaning windows
- Gardening – planting, weeding
- Car washing
- Painting

❖ Heavy activates include:

- Carrying moderate to heavy loads (more than 10 kg)
- Gardening- digging, mowing ranking
- Chopping, sawing wood

25. Which of the following best describes your general activity level?

a. Sedentary
b. Light activity
c. Moderate activity
d. Heavy activity

25. General activity level ☐

1=a
2=b
3=c
4=d
8=NA
9=Don't know

26. On an average day, how much time do you spend on light activities?

_____ minutes

26. Light activities

☐☐☐ minutes

27. On an average day, how much time do you spend on moderate activities?

_____ minutes

27. Moderate activities

☐☐☐ minutes

28. On an average day, how much time do you spend on heavy activities?

_____ minutes

28. Heavy activities

☐☐☐ minutes

29. Outside of your daily responsibilities, how often do you do exercise that raises your heart rate and makes you sweat, for at least 30 minutes? (e.g. brisk walking, swimming, jogging)

a. Seldom or never
b. Less than once a week
c. 1-2 times a week
d. 3-5 times a week
e. 6 or more times a week

29. Exercise frequency

☐

1=a
2=b
3=c
4=d
5=e
8=NA
9=Don't know

30. For how long have you exercised or played sports regularly? (Regular exercise means exercise or sport with minimum duration of 30 minutes for more than 3 times a week)

a. Seldom or never
b. Less than 3 month
c. 4-12 month
d. 1-3 years
e. More than 3 years

30. Regular exercise

☐

1=a
2=b
3=c
4=d
5=e
8=NA
9=Don't know

31. What is your main form of exercise? (Choose all that apply.)

a. Going to Fitness centre
b. Aerobics
c. Yoga
d. Tennis
e. Golf
f. Swimming
g. Jogging
h. Brisk walk
i. Other, Please specify

_____

31. Exercise form

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐
g ☐
h ☐
i ☐

_____

32. What is your main reason for playing sports/exercise? (Choose all that apply.)

a. For fitness and health
b. To improve medical conditions (e.g. high blood pressure etc)
c. To lose weight
d. For pleasure
e. No particular reason
f. Other – Please specify

_____

32. Exercise reason

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐

_____

33. On average, how many hours of sleep do you have a night?

a. Less than 6 hours
b. 7-8 hours
c. More than 9 hours

33. Sleep ☐

1=a
2=b
3=c
8=NA
9=Don't know

34. What is your smoking habit?

a. Never smoked
b. Used to smoke
c. Still smoke

34. Smoking ☐

1=a
2=b
3=c
8=NA
9=Don't know

35. Which of the following best describes your lifestyle change since arriving in NZ? (Choose all that apply.)

a. Less opportunity to walk
b. More sedentary lifestyle
c. Less opportunity to play sport/exercise
d. Less stressful lifestyle
e. More opportunity to walk
f. More active lifestyle
g. More opportunity to play sport/exercise
h. More stressful lifestyle
i. More leisure activity
j. None of these

35. Lifestyle change reason

1=Yes
2=No
9=Don't Know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐
g ☐
h ☐
i ☐
j ☐

24-Hour Dietary recall (Visit one)

Date_____ Page No. ___ Code No. _____

Eating Time	Meal Type	Food and Beverage Name, Brand, Description, Preparation ie boiling, frying, microwave etc, and Recipe if necessary	Amount or Volume Consumed

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An Investigation of Dietary Intake and Nutritional status of Korean Migrants in New Zealand

Visit Two

-. *24-Hour Dietary Recall*

-. *Body measurements*

Code Number of Subject: | | | | |

Date of Interview: | | | | | | |

Day Month Year

Time of Interview: | | | | |

Hour Minute

24-Hour Dietary recall (Visit two)

Date_____ Page No. ___ Code No. _____

Eating Time	Meal Type	Food and Beverage Name, Brand, Description, Preparation ie boiling, frying, microwave etc, and Recipe if necessary	Amount or Volume Consumed

Body Measurement

		1st Measurement	2nd Measurement	3rd Measurement	***Mean Value***
Body Weight (kg)					
Body Height (cm)					
Skinfolds (mm)	*Triceps				
	*Subscapular				
Humerous width (cm)					
Circumferences (cm)	Upperarm				
	Waist				
	Hip				

** The measurements are made on the right side of the body*

• Blood Pressure

	1st Measurement	2nd Measurement	***Mean Value***
Systolic (mmHg)			
Diastolic (mmHg)			

• BIA (Bioelectrical Impedence Analysis)

- Fat Mass _____; % Fat _____
- FFM (Fat Free Mass) _____; %FFM _____

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Visit Three

-. *Questionnaire Two*

(Demographic and medical questions)

-. *24-Hour Dietary Recall*

Code Number of Subject: | | | | |

Date of Interview: | | | | | | |

Day Month Year

Time of Interview: | | | | |

Hour Minute

1. What is your date of birth?

_____ / _____ / _____

1. Date of Birth

☐☐ ☐☐ ☐☐

2. How long have you been living in NZ?

_____ years

2. Year in NZ

☐☐ years

3. What is your marital status?

a. Married and living with spouse
b. Married and living apart from spouse
c. Single
d. Other

3. Marital status

1=a
2=b
3=c
4=d
8=NA
9=Don't know

☐

4. Who else lives with you? (Choose all that apply.)

a. I live on my own
b. With spouse
c. With children
d. With adult children
e. With parents (including in-laws)
f. Others

4. Living

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐

5. Do you live in an Asian/Korean neighbourhood?

a. Yes
b. No
c. Don't know

5. Korean neighbourhood

1=a
2=b
3=c
8=NA
9=Don't know

6. Which of the following best describes your weight change since your arrival in NZ?

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
h. Other, Please specify,

_____

6. Weight change

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know
0=h

7. Have you been trying to lose weight?

a. Yes
b. No

7. Weight control

1=a
2=b
8=NA
9=Don't know

8. How much do you think your dietary habits have changed since you came to NZ?

a. Not changed at all
b. Changed a little
c. Somewhat changed
d. Changed very much
e. Totally changed

8. Dietary habit change

1=a
2=b
3=c
4=d
5=e
8=NA
9=Don't know

9. If your diet changed, please state how your intake has changed. (Chose all that apply.)

a. Meat and meat products
b. Dairy products
c. Vegetables
d. Fruits
e. Sugary snacks
f. Salt intake

9. Dietary habit change detail

1=Less
2=Same
3=More
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐

10. Please explain the sorts of changes you have made in your own words, based on these food groups.

_____

10. Dietary habit change detail

_____

11. Please rank the following factors in order of importance for you in maintaining traditional Korean diet in NZ. (1=Most important, 5=Least important)

a. Because of taste (tastes better, familiar taste)
b. Because Korean food is healthier than Western style food
c. Because it is important to keep traditional cuisine
d. Because I am more used to Korean cooking
e. Because of elderly family member who prefers Korean food

11. Maintaining Korean diet

1-5
8=NA
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐

12. Which of these factors hinder you from having Korean diet?

a. Poor availability of Korean food
b. Less variety of Korean food
c. Convenience, as it is easier to prepare Western style food than Korean food which is more troublesome to prepare
d. Higher cost of Korean food
e. Poorer quality of Korean food
f. Because my children prefer Western style food

12.Factor hindering Korean diet

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐

13. Which of these factors influence you to change your diet to Western (Kiwi) diet?

a. Better availability
b. More variety
c. Convenience (more convenient)
d. Cheaper cost
e. Better quality
f. Family influence
g. Don't know

13. Change to Kiwi diet

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐
g ☐

14. Traditional Korean diet is healthier than a Western diet. Do you

a. Strongly disagree
b. Disagree
c. Somewhat disagree
d. Somewhat agree
e. Agree
f. Strongly agree
g. Don't know

14. Healthy diet, Korean vs Western ☐

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

15. Diet is important in maintaining health. Do you

a. Strongly disagree
b. Disagree
c. Somewhat disagree
d. Somewhat agree
e. Agree
f. Strongly agree
g. Don't know

15. Diet in maintaining health

1=a
2=b
3=c
4=d
5=e
6=f
7=g
8=NA
9=Don't know

16. Are you aware of nutritional materials from the New Zealand government, such as 5-a-day, heart foundation tick, and food pyramid?

a. Yes
b. No
c. Don't know

16. Nutritional materials

1=a
2=b
3=c
8=NA
9=Don't know

17. Do you read nutritional labels when buying food items?

a. Yes
b. No
c. Don't know

17. Nutritional labels

1=a
2=b
3=c
8=NA
9=Don't know

18. If not, what is the main reason for not utilising nutrition labels?

a. I don't understand the information provided
b. I can't be bothered
c. I don't have time
d. I don't care about such information
e. I am not comfortable with English
f. Other

18. Reason not using labels

1=a
2=b
3=c
4=d
5=e
6=f
8=NA
9=Don't know

☐

19. Where do you get health and nutrition advice? (Choose all that apply.)

a. Doctor
b. Friends
c. Family
d. Health and Fitness centre
e. English media
f. Korean media
g. Other

19. Health and nutrition advice

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐
g ☐

20. What kind of supplements are you currently taking?

a. None
b. Vitamins/Multivitamin
c. Mineral Supplements
d. Nutritional Supplements
e. Invigorant (Hangbang)
f. Other, Please specify,

_____

20. Supplements

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐

_____

21. What is the main reason for taking any health supplements?

a. Doctor's recommendation
b. Family and friend's recommendation
c. Self decision (to improve health)
d. Advertisement
e. Other

21. Reason taking supplements

1=a
2=b
3=c
4=d
5=e
8=NA
9=Don't know

☐

22. Have you ever been told by your GP or other health practitioner that you have any of the following?

a. High blood pressure
b. High cholesterol
c. Diabetes

22. Medical condition

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐

23. Have you experienced menopause?

a. Yes
b. No

23. Menopause

1=a
2=b
8=NA
9=Don't know

☐

24. Are you currently taking any medicines for any of the following health conditions? (Choose all that apply.)

a. High blood pressure
b. High cholesterol
c. Diabetes
d. Hormone Replacement Therapy

24. Menopause

1=Yes
2=No
9=Don't know

a ☐
b ☐
c ☐
d ☐

25. How comfortable are you with reading English?

a. Very uncomfortable
b. Somewhat comfortable
c. Very comfortable
d. Don't know

25. Reading English

1=a
2=b
3=c
4=d
8=NA
9=Don't know

26. How comfortable are you with speaking English?

a. Very uncomfortable
b. Somewhat comfortable
c. Very comfortable
d. Don't know

26. Speaking English

1=a
2=b
3=c
4=d
8=NA
9=Don't know

27. What is your highest school education?

a. Primary school graduation
b. Intermediate school graduation
c. High school graduation
d. Tertiary school graduation

27. Education

1=a
2=b
3=c
4=d
8=NA
9=Don't know

28. What is your highest tertiary education qualification?

a. Certificate
b. Diploma
c. Bachelor degree
d. Master degree
e. PhD
f. Not applicable

28. Tertiary education

1=a
2=b
3=c
4=d
5=e
6=f
8=NA
9=Don't know

29. What is your current employment status? (Choose all that apply.)

a. A full-time worker
b. A part-time worker
c. A wage or salary earner
d. Housewife/Homemaker
e. Self-employed
f. Unemployed
g. Other

29. Employment status

1=Yes
2=No
8=NA

a ☐
b ☐
c ☐
d ☐
e ☐
f ☐

30. If you work, what is your current occupation in NZ?

_____

30. Occupation NZ

☐☐

1=Legislators, senior officials, mangers
2=Professionals
3=Technicians and Associat professional
4=Clerks
5=Service, sop, 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

31. Was this the same in Korea?

a. Yes
b. No, please specify _____

31. Occupation Korea

1=a
2=b
8=NA
9=Don't know

_____

32. What is yours husband's current occupation in NZ?

_____

32. Husband occupation NZ

1=Legislators, senior officials, mangers
2=Professionals
3=Technicians and Associat professional
4=Clerks
5=Service, sop, 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

33. Was this the same in Korea?

a. Yes
b. No, please specify _____

33. Husband occupation Korea

1=a
2=b
8=NA
9=Don't know

_____

34. What is the type of your housing?

a. Own
b. Rent
c. Other

34. Housing

1=a
2=b
3=c
8=NA
9=Don't know

35. What is your and your household's total average income in NZ per year including all benefits, before tax?

a. Less than $20,000
b. $20,000 - $38,000
c. $38,000 - $60,000
d. More than $60,000

35. Income

1=a
2=b
3=c
4=d
8=NA
9=Don't know

Blood glucose level _____

24-Hour Dietary recall (Visit three)

Date_____ Page No. ___ Code No. _____

Eating Time	Meal Type	Food and Beverage Name, Brand, Description, Preparation ie boiling, frying, microwave etc, and Recipe if necessary	Amount or Volume Consumed

APPENDIX 7

Feedback Information Sheets

(English and Korean)

Massey University
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Institute for Food, Nutrition and Human Health
Albany Campus

An Investigation of Dietary Intake and Nutritional Status of Korean Migrants in New Zealand

Feedback Form

Dear _____

Thank you very much for taking part in our research of the Dietary Intake and Nutritional and Health status of Korean migrants in New Zealand. Your participation and assistance in the data collection is greatly appreciated. Without this, it would not have been possible to carry out the research.

Please find attached a report of your individual results. The report includes a summary of your nutrient intake. This has been calculated from the 24-hour recalls taken at each of three visits. The results of your body measurements are also included along with explanations of the normal range of each. Furthermore, your blood pressure and blood glucose levels are provided where any results outside the normal range are indicated.

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 me on [redacted]

Kind regards

Michelle Kim

Nutrition Analysis

1. Energy intake; Total intake _____ Kcal

	% of Energy	NZ RDA	Korean RDA
From Carbohydrate		50-55%	65%
Fibre intake	g	25-30g/day	20-25g/day
From Protein		0.8-1.6g/Kg body wt	55g
From Fat		30-33%	20%
Dietary cholesterol	mg	300 mg or less	300 mg or less

Comment:

☞ *Carbohydrate*: Koreans traditionally had a diet that is relatively high in carbohydrates. While intakes of complex carbohydrates such as those from starchy foods like cereals and potatoes are encouraged to comprise most of carbohydrate intake, high sugar intakes such as those from table sugars and sugary snacks should be avoided. Many studies have confirmed the importance of fibre in preventing cardiovascular disease, cancers, diabetes, and other gastrointestinal diseases. In addition, high fibre intakes also prevent constipation.

☞ *Protein*: In NZ, it is suggested that 12-15% of total energy should come from protein. One of the important functions of protein includes provision of essential amino acids required for muscles, enzymes, hormones and immunity.

☞ *Fat*: Koreans have traditionally adapted to a diet that is relatively low in fat, hence a lower intake level is recommended in Korea than in Western counties including NZ. In both Korea and NZ, it is recommended that dietary cholesterol level should be kept 300 mg or less per day to prevent development of coronary heat disease.

2. Fruit and vegetable intake: _____ mg

3. Vitamin and Mineral intake

Nutrient	Your intake	NZ RDA	Korean RDA	Comment
Vitamin C (mg/day)				High in fruit in vegetables.
Calcium (mg/day)				A nutrient that is easy to be deficient in Korean and Asian dietary patterns. It can be improved by eating foods rich in calcium such as milk and bony fish.
Iron (mg/day)				Adequate iron intake is important for menstruating women.

4. Sodium intake: _____ mg

Comment: By eating rice as a staple, Koreans have developed dietary habits that are high in salt to disguise the plain taste of rice. This is reflected by a high prevalence of high blood pressure among Koreans. Salt is the main source of sodium in the diet. To reduce your intake of sodium, you could decrease your intake of *chang* and MSGs. The

RDA for sodium is 920-2300 mg/day and 2400mg/day for NZ and Korea respectively. This is about 6g of salt.

Body Measurement Analysis

1. Height, Weight and BMI

Body Measures	Your measures	Comments
Height (cm)		
Weight (Kg)		
Body Mass Index (BMI)		

Note: BMI is calculated by calculating individual's weight (Kg) by the square of the height (m). In New Zealand, <20, Thin; 20-24, Desirable; 25-29, Overweight; >30, Obese. In Korea, <18.5, Underweight; 18.5-22.9, Normal weight; 23-24.9, Overweight; >25, Obese.

2. Skinfolds and Circumference

	Sites	Your measurements	Comments
Skinfolds (mm)	Triceps		
	Subscapular		
Circumference (cm)	Upperarm		
	Waist		
	Hip		
Waist to Hip Ratio			

Note: Waist to Hip ratio has been used as a measure of fat distribution. Recent studies provide evidence that increased W/H ratio (greater than 0.8) is associated with higher risk of cardiovascular disease. Also a waist circumference of 88 cm or wider is reported to be associated with significantly increased metabolic disease risk.

3. Body Percentage Fat; _____ %
Comment: ≤8%; at risk (for disease and disporders associated with malnutrition), 9-22%; below average, 23%; average, 24-31%; above average, ≥32%; at risk (for diseases associated with obesity).

4. Blood Pressure; _____ mmHg
Comment: In general, normal blood pressure is blood pressure lower than 140/90 mmHg. If your blood pressure is greater than this, we suggest you consult your GP.

5. Blood glucose level; _____ mg/dl
Comment: A normal blood glucose level is less than 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 GP.

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뉴질랜드 한국 이민자들의 식품섭취 및 영양상태에 대한 조사연구

결과보고 요약

_____ 님 귀하

뉴질랜드 한국인 이민자들의 음식 섭취와 영양 실태에 관한 연구에 참여하여 주셔서 대단히 감사합니다. 귀하의 참여와 도움은 데이터 수집에 절대적 기여가 되었을 뿐 아니라, 귀하의 참여와 도움이 없었다면 본 연구는 가능하지 않았을 것입니다.

귀하의 검사결과를 첨부하였습니다. 결과보고서에는 귀하의 영양섭취에 대한 내용요약을 포함하고 있습니다. 이는 각 세번의 방문시 24 시간 회상법을 통하여 얻어진 자료로 계산되어진 것입니다. 귀하의 신체지수 측정결과도 각각 정상 범위와 그에 대한 설명을 포함하여 함께 보내드립니다. 귀하의 혈당치도 역시 보내드리는데 이상범위의 수치는 지적하였습니다.

혹 검사 결과가 명시되어 있지 않다면 이는 귀하께서 그 부분은 참여하시지 않으셨기 때문입니다.

의문사항이 있으시거나 귀하의 결과에 대하여 더 자세히 의논하시고 싶으신 분은 021-154-0087 로 연락하여 주시면 성의껏 응하여 드리겠습니다.

귀하의 참여와 협조에 다시한번 감사드립니다.

김정하

영양 분석

1. 열량섭취; 총 열량섭취량 _____ Kcal

	총열량에 대한 백분율	NZ 1 일 영양권장량	한국인 1 일 영양권장량
탄수화물 섭취비율		50-55%	65%
식이섬유질	g	25-30g/day	20-25g/day
단백질 섭취비율		0.8-1.6g/Kg 체중	55g
지방 섭취비율		30-33%	20%
콜레스테롤	mg	300 mg 미만	300 mg 미만

코멘트:

☞ *탄수화물*: 전통적으로 한국인들은 당질의 섭취가 높은 식사를 해왔습니다. 곡류 및 감자등의 복합당질에서 오는 탄수화물의 섭취는 권장되는 반면 단과자나 설탕등의 단순당질에서 오는 탄수화물의 섭취는 가급적 피하는 것이 좋습니다. 심혈관계질환, 암, 당료병, 및 기타 소화기계질환의 예방에 미치는 식이섬유소의 중요성은 많은 연구를 통해 이미 확인된바 있습니다. 식이섬유소는 변비예방에 또한 좋은 효과가 있습니다.

☞ *단백질*: 뉴질랜드에서는 단백질 에너지 비율을 12-15%로 권하고 있습니다. 단백질의 주 기능은 필수미노산을 공급하며 근육, 효소, 호르몬 및 항체의 기능에 필요합니다.

☞ *지방*: 한국인들은 전통적으로 지방함량이 낮은 식사에 익숙해져 있어 뉴질랜드를 포함한 타 서구권 나라들에 비해 지방권장양이 다소 낮습니다. 관상동맥심질환 예방을 위하여 뉴질랜드와 한국 두 나라 모두 콜레스테롤 섭취를 1 일 300mg 미만으로 권장하고 있습니다.

2. 야채 및 과일 섭취량: _____ mg

3. 비타민 및 무기질 섭취

영양소	섭취량	NZ 권장량	한국권장량	코멘트
비타민C (mg/day)				야채 및 과일에 함유량이 높습니다.
칼슘 (mg/day)				한국 및 동양권의 식이패턴에서 부족되기 쉬운 영양소입니다. 우유 및 뼈째 먹는 생선 등 칼슘 함량이 높은 음식의 섭취로 칼슘섭취를 높일 수 있습니다.
철 (mg/day)				월경혈의 손실이 있는 여성에게 적절한 철섭취는 중요합니다.

4. 나트륨 섭취량: _____ mg

코멘트: 쌀을 주식으로 하는 한국인들은 짜게 먹는 식습관을 형성해 왔습니다. 이는 한국인들에게 고혈압 발생빈도가 높다는 사실과 밀접한 관계가 있습니다. 나트륨의 주요급원은 식염이며 나트륨 섭취를 줄이려면 장(된장,간장 등)의 소비를 줄이고

화학조미료의 무절제한 사용을 줄여야 합니다. 뉴질랜드와 한국의 나트륨 권장량은 각각 1 일 920-2300mg 및 2400mg 입니다. 이는 식염 6g 에 해당됩니다.

신체지수 분석

1. 신장, 체중 및 신체질량지수

신체지수	귀하의 치수	코멘트
신장 (cm)		
체중 (Kg)		
신체질량지수 (BMI)		

해설: 신체질량지수는 체중(Kg)을 신장(m 기준)의 제곱으로 나눈 수치로 표시합니다. 뉴질랜드에서는 20 미만, 저체중; 20-24, 적정; 25-29, 과체중; 30 이상, 비만 으로 분류하며 한국에서는 18.5 미만, 저체중; 18.5-22.9, 적정; 23-24.9, 과체중; 25 이상, 비만 으로 분류합니다.

2. 피하지방두께 및 둘레

	부위	귀하의 치수	코멘트
피하지방두께 (mm)	상완삼두근		
	견갑골하반부		
둘레 (cm)	상완부		
	허리		
	대퇴부		
허리 엉덩이 둘레비			

해설: 허리 엉덩이 둘레비(허리둘레를 엉덩이둘레로 나눈 수치)는 지방 분포도 측정시 사용합니다. 최근의 여러 연구에서 높은 허리/엉덩이 둘레비(0.8 이상)는 높은 심혈관질환의 높은 발병율과 관련이 있음을 제시하고 있습니다. 또한 허리 둘레치 88cm 이상은 극도로 높은 대사질환의 위험과 관련이 있다고 보고하고 있습니다.

3. 체지방; _____ %
코멘트: ≤8%; 위험 (영양불량에 관련된 질환), 9-22%; 정상이하, 23%; 정상, 24-31%; 정상이상, 32%; 위험 (비만에 관련된 질환)

4. 혈압; _____ mmHg
코멘트: 일반적으로 정상혈압은 140/90 미만입니다. 귀하의 혈압이 이 수치 이상이라면 귀하의 가정의와 면담해 보시기 바랍니다.

5. 혈당치; _____ mg/dl
코멘트: 정상적인 혈당치는 7.0mmol/l 미만입니다. 만약 귀하의 혈당치가 정상범위 이상이라면 혈당조절에 문제가 있음을 암시할 수 있습니다. 귀하의 가정의와 면담해 보시기 바랍니다.

APPENDIX 8

Korean Foods Added to the Food Composition Database

Code Number	Food	Energy (Kcals)	Protien (g)	Fat (g)	Carbohydrate (g)	Water %
Cereal and products						
1012	Buckwheat noodle, dry form, dried	318.0	10.2	1.5	65.9	10.50
1014	Buckwheat vermicelli	350.0	1.1	1.6	72.3	8.80
1036	So-myon, dried	354.0	10.2	1.0	74.2	10.60
1051	Tcha jang myon, inst	382.0	9.0	14.4	60.7	12.60
1058	Bread, dock marked	376.0	8.8	13.2	56.1	20.50
1106	Yak-kwa	452.0	4.2	20.6	63.9	10.90
1148	Small red bean-jam bread	293.0	7.6	6.1	51.6	33.00
1223	Rice cakes, ka rae ddok, plain (plain rod shaped)	239.0	4.1	0.8	52.5	41.90
1226	Rice cakes, paek sol ki (plain steamed rice bread)	234.0	3.5	0.8	51.8	43.00
1231	Rice cakes, shi ru ddok (steamed rice bread with shreded red bean)	205.0	5.7	0.8	42.8	48.80
1229	Rice cakes, song pyun (pine flavoured rice pastry), with sesame	212.0	3.5	1.4	45.3	48.70
1241	In jeol mi	217.0	4.9	1.7	44.5	47.40
Starch and products						
2042	Starch vermicelli	349.0	0.1	0.2	86.0	13.30
Sugar and products						
3015	Starch syrup	293.0	0.1	-	75.7	24.20
Legumes and products						
4023	Soybean curd, not pressed	47.0	4.7	3.2	1.0	90.40
4032	Soybean, boiled with soya sauce	170.0	18.0	1.1	21.9	47.10
4049	Small red bean, dried	312.0	21.1	1.4	55.8	13.40
Nuts and products						
5006	Acorn starch jelly	43.0	0.2	0.2	10.1	89.30
Vegetables						
6021	Bracken, boiled	21.0	3.2	0.3	3.0	91.80
6023	Pepper, green young	20.0	1.9	0.4	3.3	91.70
6046	Kimchi, mustard leaves	41.0	3.9	0.9	6.8	83.20
6048	Kimchi, kkak du ki	33.0	1.6	0.3	6.7	88.40
6050	Kimchi, dong chi mi	11.0	0.7	0.1	2.5	94.20
6052	Kimchi, Korean cabbage	18.0	2.0	0.5	2.6	90.80

Code Number	Food	Fibre (g)	Cholesterol (mg)	Vit B1 (mg)	Vit B2 (mg)	Niacin (mg)
Cereal and products						
1012	Buckwheat noodle, dry form, dried	2.50	-	0.260	0.080	1.2
1014	Buckwheat vermicelli	0.60	-	0.270	0.030	2.0
1036	So-myon, dried	0.10	-	0.120	0.020	0.9
1051	Tcha jang myon, inst	0.40	2.00	0.13	0.03	1.00
1058	Bread, dock marked	0.40	27.00	0.140	0.060	1.3
1106	Yak-kwa	0.01	71.00	0.090	0.010	0.4
1148	Small red bean-jam bread	0.90	4.00	0.090	0.060	0.8
1223	Rice cakes, ka rae ddok, plain (plain rod shaped)	-	-	0.020	0.010	1.8
1226	Rice cakes, paek sol ki (plain steamed rice bread)	0.10	-	0.010	0.010	0.7
1231	Rice cakes, shi ru ddok (steamed rice bread with shreded red bean)	0.80	-	0.030	0.020	0.7
1229	Rice cakes, song pyun (pine flavoured rice pastry), with sesame	0.30	-	0.040	0.010	0.4
1241	In jeol mi	0.30	-	0.070	0.030	0.7
Starch and products						
2042	Starch vermicelli	0.10	-	0.010	-	-
Sugar and products						
3015	Starch syrup	-	-	-	-	-
Legumes and products						
4023	Soybean curd, not pressed	0.10	-	0.020	0.020	0.2
4032	Soybean, boiled with soya sauce	8.20	-	1.360	0.100	1.8
4049	Small red bean, dried	4.00	-	0.400	0.140	2.3
Nuts and products						
5006	Acorn starch jelly	0.10	-	0.010	0.020	-
Vegetables						
6021	Bracken, boiled	1.40	-	-	0.020	-
6023	Pepper, green young	2.10	-	0.080	0.040	1.3
6046	Kimchi, mustard leaves	1.70	-	0.150	0.140	1.3
6048	Kimchi, kkak du ki	0.70	-	0.140	0.050	0.5
6050	Kimchi, dong chi mi	0.50	-	0.020	0.020	0.2
6052	Kimchi, Korean cabbage	1.30	-	0.060	0.060	0.8

Code Number	Food	Vit C (mg)	Vit E (mg)	Vit B6 (mg)	Folate (ug)	B Carotene (ug)
Cereal and products						
1012	Buckwheat noodle, dry form, dried	-	0.32	0.23	57.6	-
1014	Buckwheat vermicelli	2.0	3.20	0.23	57.6	-
1036	So-myon, dried	-	0.40	0.05	13.4	-
1051	Tcha jang myon, inst	-	0.40	0.90	17.60	4.00
1058	Bread, dock marked	-	1.65	0.10	30.0	45.0
1106	Yak-kwa	-	2.87	0.04	6.1	-
1148	Small red bean-jam bread	-	6.00	0.03	30.0	14.0
1223	Rice cakes, ka rae ddok, plain (plain rod shaped)	-	0.09	0.30	0.7	-
1226	Rice cakes, paek sol ki (plain steamed rice bread)	-	0.09	0.30	0.7	-
1231	Rice cakes, shi ru ddok (steamed rice bread with shreded red bean)	-	0.09	0.30	0.7	-
1229	Rice cakes, song pyun (pine flavoured rice pastry), with sesame	-	0.09	0.30	0.7	-
1241	In jeol mi	-	0.09	0.30	0.7	-
Starch and products						
2042	Starch vermicelli	-	-	-	-	-
Sugar and products						
3015	Starch syrup	-	-	0.72	-	-
Legumes and products						
4023	Soybean curd, not pressed	-	0.52	0.05	15.0	-
4032	Soybean, boiled with soya sauce	-	2.69	0.20	129.3	-
4049	Small red bean, dried	-	1.00	0.37	422.9	-
Nuts and products						
5006	Acorn starch jelly	-	-	0.06	9.4	-
Vegetables						
6021	Bracken, boiled	-	2.74	0.14	3.2	41.0
6023	Pepper, green young	67.0	0.69	0.27	15.8	772.0
6046	Kimchi, mustard leaves	48.0	2.30	1.20	370.0	2,342.0
6048	Kimchi, kkak du ki	19.0	0.50	0.06	6.0	226.0
6050	Kimchi, dong chi mi	9.0	0.50	0.06	6.0	88.0
6052	Kimchi, Korean cabbage	14.0	0.12	0.15	46.1	290.0

Code Number	Food	Retinol (ug)	Vit A (mg)	Na (mg)	K (mg)	Ca (mg)	P (mg)
Cereal and products							
1012	Buckwheat noodle, dry form, dried	-	-	891.0	111.0	169.0	240.0
1014	Buckwheat vermicelli	-	-	1,007.0	183.0	12.0	170.0
1036	So-myon, dried	-	-	1,648.0	120.0	20.0	77.0
1051	Tcha jang myon, inst	-	1.00	711.00	192.00	19.0	134.0
1058	Bread, dock marked	21.0	29.0	231.0	131.0	36.0	98.0
1106	Yak-kwa	-	-	44.0	59.0	13.0	61.0
1148	Small red bean-jam bread	11.0	6.0	168.0	75.0	31.0	90.0
1223	Rice cakes, ka rae ddok, plain (plain rod shaped)	-	-	178.0	26.0	4.0	53.0
1226	Rice cakes, paek sol ki (plain steamed rice bread)	-	-	234.0	39.0	6.0	36.0
1231	Rice cakes, shi ru ddok (steamed rice bread with shreded red bean)	-	-	210.0	136.0	19.0	65.0
1229	Rice cakes, song pyun (pine flavoured rice pastry), with sesame	-	-	215.0	36.0	19.0	52.0
1241	In jeol mi	-	-	347.0	88.0	19.0	50.0
Starch and products							
2042	Starch vermicelli	-	-	4.0	5.0	47.0	26.0
Sugar and products							
3015	Starch syrup	-	-	2.0	4.0	1.0	1.0
Legumes and products							
4023	Soybean curd, not pressed	-	-	6.0	95.0	48.0	67.0
4032	Soybean, boiled with soya sauce	-	-	1,094.0	635.0	41.0	236.0
4049	Small red bean, dried	-	-	2.0	1,520.0	128.0	424.0
Nuts and products							
5006	Acorn starch jelly	-	-	55.0	8.0	6.0	26.0
Vegetables							
6021	Bracken, boiled	-	7.0	5.0	185.0	15.0	40.0
6023	Pepper, green young	-	129.0	11.0	163.0	15.0	43.0
6046	Kimchi, mustard leaves	-	390.0	911.0	361.0	118.0	64.0
6048	Kimchi, kkak du ki	-	38.0	596.0	400.0	37.0	40.0
6050	Kimchi, dong chi mi	-	15.0	609.0	120.0	18.0	17.0
6052	Kimchi, Korean cabbage	-	48.0	1,146.0	300.0	47.0	58.0

Code Number	Food	Fe (mg)	Zn (mg)	Ash (g)	Refuse (%)
Cereal and products					
1012	Buckwheat noodle, dry form, dried	3.00	1.64	9.4	-
1014	Buckwheat vermicelli	3.70	0.57	5.6	-
1036	So-myon, dried	1.90	0.43	3.1	-
1051	Tcha jang myon, inst	2.00	0.55	2.90	-
1058	Bread, dock marked	0.70	0.28	1.0	-
1106	Yak-kwa	0.90	0.38	0.3	-
1148	Small red bean-jam bread	1.30	0.43	0.8	-
1223	Rice cakes, ka rae ddok, plain (plain rod shaped)	0.50	0.37	0.7	-
1226	Rice cakes, paek sol ki (plain steamed rice bread)	0.50	3.03	0.8	-
1231	Rice cakes, shi ru ddok (steamed rice bread with shreded red bean)	3.30	0.70	1.1	-
1229	Rice cakes, song pyun (pine flavoured rice pastry), with sesame	1.10	0.55	0.8	-
1241	In jeol mi	1.40	0.52	1.2	-
Starch and products					
2042	Starch vermicelli	3.00	0.50	0.3	-
Sugar and products					
3015	Starch syrup	0.20	-	-	-
Legumes and products					
4023	Soybean curd, not pressed	0.80	0.34	0.6	-
4032	Soybean, boiled with soya sauce	3.50	1.43	3.7	-
4049	Small red bean, dried	5.20	4.99	4.0	-
Nuts and products					
5006	Acorn starch jelly	0.4	0.09	0.1	-
Vegetables					
6021	Bracken, boiled	1.40	0.10	0.3	-
6023	Pepper, green young	0.40	0.12	0.6	7.0
6046	Kimchi, mustard leaves	1.30	1.05	3.5	-
6048	Kimchi, kkak du ki	0.40	0.21	2.3	-
6050	Kimchi, dong chi mi	0.20	0.05	20.0	-
6052	Kimchi, Korean cabbage	0.80	0.16	2.8	-

Code Number	Food	Energy (Kcals)	Protien (g)	Fat (g)	Carbohydrate (g)	Water %
6055	Kimchi, cucumber	17.0	1.7	0.4	2.7	91.60
6057	Kimchi, small radish	31.0	2.4	0.4	5.5	87.40
6058	Kimchi, Welsh onion	52.0	3.4	0.8	10.3	80.70
6082	Do ra ji, dried	283.0	2.4	0.1	62.9	24.20
6092	Perilla leaf, raw	29.0	3.9	0.5	4.4	87.60
6094	Perilla leaf, canned	57.0	4.7	1.7	8.9	77.70
6108	Garlic, pickled garlic	53.0	3.8	0.2	10.7	78.30
6109	Garlic, young stem, pickled	113.0	2.0	0.9	28.2	61.40
6134	Radishi, salted radish	15.0	0.9	0.1	2.2	89.70
6164	Leek, native	21.0	2.9	0.5	2.8	91.40
6178	Lettuce, native	18.0	1.4	0.2	3.5	92.90
6206	Crown daisy, raw	19.0	2.7	0.3	2.8	91.60
6257	Burdock, boiled	65.0	1.8	0.1	15.3	80.60
6285	Wild plant, chwi namul (Asterscaber), boiled	21.0	3.0	0.4	3.0	91.30
6292	Soybean sprout, raw	30.0	5.0	1.4	1.6	90.70
6298	Stem of taro,wet form, dry form, boiled	15.0	0.5	0.1	3.5	94.00
Mushroom						
7003	Oyster mushroom, dried	283.0	12.8	2.0	61.6	14.30
7016	Manna lichen, dried	279.0	4.4	1.8	70.8	15.10
7030	Lentinus edodes, dried	282.0	18.5	3.2	58.8	86.50
Fish						
11018	Flatfish, raw, flounder	129.0	22.1	3.7	0.3	72.30
11030	Hair Tail, raw	145.0	18.0	7.5	0.1	73.10
11054	Pacific saury, raw	262.0	20.2	19.4	0.1	59.00
11168	Anchovy boiled-dried, large anchovy	299.0	54.2	7.3	0.3	23.00
11169	Anchovy boiled-dried, medium anchovy	270.0	52.7	4.9	0.3	26.00
11170	Anchovy boiled-dried, small anchovy	238.0	44.6	5.3	-	34.50
11171	Anchovy, salt-fermented	113.0	13.5	5.9	0.5	59.30
11176	Alaska pollack, dried	347.0	74.0	3.4	-	16.80
11185	Alaska pollack, roe, salt-fermented	120.0	20.5	3.0	2.7	66.00
11186	Alaska pollack, viscera, salt-fermented	116.0	12.9	3.2	8.2	64.30
11398	Yellow croaker (jo-ki)	138.0	19.2	6.2	0.1	72.70
11407	File fish, fillet, dried	332.0	41.8	2.3	34.3	15.00

Code Number	Food	Fibre (g)	Cholesterol (mg)	Vit B1 (mg)	Vit B2 (mg)	Niacin (mg)
6055	Kimchi, cucumber	1.30	-	0.080	0.040	0.6
6057	Kimchi, small radish	1.40	-	0.030	0.070	0.8
6058	Kimchi, Welsh onion	1.50	-	0.140	0.140	0.9
6082	Do ra ji, dried	8.90	-	0.100	0.360	7.8
6092	Perilla leaf, raw	2.00	-	0.090	0.280	1.1
6094	Perilla leaf, canned	1.50	-	0.090	0.150	0.7
6108	Garlic, pickled garlic	0.80	-	0.090	0.050	0.3
6109	Garlic, young stem, pickled	2.20	-	0.140	0.060	0.8
6134	Radishi, salted radish	0.90	-	0.020	0.020	0.2
6164	Leek, native	1.10	-	0.110	0.180	0.8
6178	Lettuce, native	0.70	-	0.060	0.130	0.4
6206	Crown daisy, raw	0.90	-	0.110	0.230	0.6
6257	Burdock, boiled	1.40	-	0.060	0.040	0.2
6285	Wild plant, chwi namul (Asterscaber), boiled	1.60	-	0.030	0.050	0.4
6292	Soybean sprout, raw	0.60	-	0.090	0.100	0.7
6298	Stem of taro,wet form, dry form, boiled	1.40	-	-	-	-
Mushroom						
7003	Oyster mushroom, dried	5.30	-	0.500	0.800	10.0
7016	Manna lichen, dried	6.60	-	0.100	0.010	1.6
7030	Lentinus edodes, dried	5.20	-	0.420	1.100	20.0
Fish						
11018	Flatfish, raw, flounder	-	100.0	0.180	0.260	4.3
11030	Hair Tail, raw	-	84.0	0.110	0.100	3.1
11054	Pacific saury, raw	-	64.0	0.030	0.300	7.1
11168	Anchovy boiled-dried, large anchovy	-	418.0	0.140	0.120	16.7
11169	Anchovy boiled-dried, medium anchovy	-	494.0	0.150	0.180	11.6
11170	Anchovy boiled-dried, small anchovy	-	557.0	0.140	0.120	6.9
11171	Anchovy, salt-fermented	-	109.00	0.030	0.200	3.1
11176	Alaska pollack, dried	-	297.0	0.290	0.220	5.9
11185	Alaska pollack, roe, salt-fermented	-	250.0	0.480	0.520	8.9
11186	Alaska pollack, viscera, salt-fermented	-	165.0	0.130	0.200	3.3
11398	Yellow croaker (jo-ki)	-	87.00	0.060	0.230	1.0
11407	File fish, fillet, dried	-	201.0	0.060	0.050	2.3

Code Number	Food	Vit C (mg)	Vit E (mg)	Vit B6 (mg)	Folate (ug)	B Carotene (ug)
6055	Kimchi, cucumber	13.0	0.50	0.04		30
6057	Kimchi, small radish	24.0	0.50	0.06		35
6058	Kimchi, Welsh onion	19.0	0.20	0.07		36
6082	Do ra ji, dried	-	1.20	0.09		15
6092	Perilla leaf, raw	55.0	4.00	0.21		46
6094	Perilla leaf, canned	-	7.20	0.38		34
6108	Garlic, pickled garlic	-	0.40	0.96		
6109	Garlic, young stem, pickled	4.0	0.40	0.96		19
6134	Radishi, salted radish	-	0.40	0.06		49
6164	Leek, native	37.0	0.92	0.23		41
6178	Lettuce, native	17.0	0.44	0.20		
6206	Crown daisy, raw	15.0	1.60	0.24		
6257	Burdock, boiled		0.60	0.24		12
6285	Wild plant, chwi namul (Asterscaber), boiled	-	0.48	0.14		75
6292	Soybean sprout, raw	8.0	0.80	0.96	6292	
6298	Stem of taro,wet form, dry form, boiled	-	0.60	0.19		
Mushroom						
7003	Oyster mushroom, dried	-	-	0.12		
7016	Manna lichen, dried	-	1.43	1.25		
7030	Lentinus edodes, dried	-	-	0.08		42
Fish						
11018	Flatfish, raw, flounder	2.0	0.60	0.19		18
11030	Hair Tail, raw	1.0	1.10	0.24		23
11054	Pacific saury, raw	1.0	1.50	0.45		45
11168	Anchovy boiled-dried, large anchovy	-	5.50	0.68		5
11169	Anchovy boiled-dried, medium anchovy	-	5.50	0.68		6
11170	Anchovy boiled-dried, small anchovy	-	5.50	0.68		7
11171	Anchovy, salt-fermented	-	3.40	0.42		
11176	Alaska pollack, dried	-	3.70	0.22		2
11185	Alaska pollack, roe, salt-fermented	-	8.90	0.26		3
11186	Alaska pollack, viscera, salt-fermented	-	8.90	0.26		4
11398	Yellow croaker (jo-ki)	1.0	1.00	0.30		
11407	File fish, fillet, dried	-	8.90	1.62		17

Code Number	Food	Retinol (ug)	Vit A (mg)	Na (mg)	K (mg)	Ca (mg)	P (mg)
6055	Kimchi, cucumber	-	106.0	607.0	309.0	44.0	54.0
6057	Kimchi, small radish	-	126.0	716.0	274.0	55.0	48.0
6058	Kimchi, Welsh onion	-	352.0	876.0	336.0	70.0	55.0
6082	Do ra ji, dried	-	-	43.0	1,118.0	232.0	189.0
6092	Perilla leaf, raw	-	1,553.0	11.0	303.0	198.0	58.0
6094	Perilla leaf, canned	-	730.0	1,679.0	166.0	166.0	42.0
6108	Garlic, pickled garlic	-	-	2,269.0	323.0	32.0	110.0
6109	Garlic, young stem, pickled	-	149.0	1,809.0	193.0	24.0	36.0
6134	Radishi, salted radish	-	-	1,496.8	194.0	43.0	24.0
6164	Leek, native	-	516.0	5.0	446.0	47.0	34.0
6178	Lettuce, native	-	269.0	4.0	319.0	60.0	51.0
6206	Crown daisy, raw	-	458.0	58.0	449.0	94.0	43.0
6257	Burdock, boiled	-	-	6.0	338.0	60.0	62.0
6285	Wild plant, chwi namul (Asterscaber), boiled	-	339.0	7.0	149.0	48.0	46.0
6292	Soybean sprout, raw	-	-	3.0	217.0	31.0	62.0
6298	Stem of taro,wet form, dry form, boiled	-	-	2.0	240.0	270.0	19.0
Mushroom							
7003	Oyster mushroom, dried	-	-	2.0	340.0	16.0	220.0
7016	Manna lichen, dried	-	-	41.0	90.0	78.0	57.0
7030	Lentinus edodes, dried	-	-	20.0	2,172.0	13.0	296.0
Fish							
11018	Flatfish, raw, flounder	8.0	8.0	230.0	377.0	40.0	196.0
11030	Hair Tail, raw	24.0	24.0	141.0	268.0	16.0	189.0
11054	Pacific saury, raw	40.0	40.0	96.0	295.0	44.0	208.0
11168	Anchovy boiled-dried, large anchovy	-	-	2,812.0	2,254.0	1,977.0	1,494.0
11169	Anchovy boiled-dried, medium anchovy	-	-	2,350.0	2,065.0	1,825.0	1,478.0
11170	Anchovy boiled-dried, small anchovy	-	-	3,250.0	1,149.0	913.0	977.0
11171	Anchovy, salt-fermented	55.0	55.0	6,678.0	292.0	432.0	455.0
11176	Alaska pollack, dried	-	-	755.0	1,333.0	378.0	852.0
11185	Alaska pollack, roe, salt-fermented	66.0	66.0	3,531.0	410.0	28.0	249.0
11186	Alaska pollack, viscera, salt-fermented	6.0	6.0	3,394.0	340.0	99.0	109.0
11398	Yellow croaker (jo-ki)	15.0	15.0	373.0	254.0	77.0	196.0
11407	File fish, fillet, dried	-	-	1,504.0	503.0	126.0	235.0

Code Number	Food	Fe (mg)	Zn (mg)	Ash (g)	Refuse (%)
6055	Kimchi, cucumber	0.40	0.20	2.3	-
6057	Kimchi, small radish	0.80	0.30	2.9	-
6058	Kimchi, Welsh onion	0.90	0.32	3.3	-
6082	Do ra ji, dried	6.20	0.49	1.5	-
6092	Perilla leaf, raw	3.10	0.47	1.6	-
6094	Perilla leaf, canned	4.00	0.35	5.5	-
6108	Garlic, pickled garlic	0.80	1.16	6.2	60.00
6109	Garlic, young stem, pickled	0.90	0.90	5.3	-
6134	Radishi, salted radish	1.00	0.18	6.2	-
6164	Leek, native	2.10	0.34	1.3	11.0
6178	Lettuce, native	1.10	0.30	1.3	-
6206	Crown daisy, raw	1.90	0.18	1.7	7.00
6257	Burdock, boiled	1.10	0.27	0.8	-
6285	Wild plant, chwi namul (Asterscaber), boiled	2.00	0.03	0.7	-
6292	Soybean sprout, raw	0.60	0.49	0.7	-
6298	Stem of taro,wet form, dry form, boiled	1.30	0.23	0.5	-
Mushroom					
7003	Oyster mushroom, dried	3.70	6.30	4.0	
7016	Manna lichen, dried	54.60	2.06	1.3	-
7030	Lentinus edodes, dried	4.20	0.42	4.3	-
Fish					
11018	Flatfish, raw, flounder	0.70	0.48	1.6	45.0
11030	Hair Tail, raw	0.50	0.37	1.3	38.0
11054	Pacific saury, raw	1.50	0.74	1.3	34.0
11168	Anchovy boiled-dried, large anchovy	7.60	2.24	15.2	-
11169	Anchovy boiled-dried, medium anchovy	7.50	3.25	16.1	-
11170	Anchovy boiled-dried, small anchovy	6.70	1.30	15.3	-
11171	Anchovy, salt-fermented	2.30	0.07	20.8	-
11176	Alaska pollack, dried	2.50	0.38	5.8	33.0
11185	Alaska pollack, roe, salt-fermented	1.20	1.95	7.8	-
11186	Alaska pollack, viscera, salt-fermented	1.40	1.95	11.4	-
11398	Yellow croaker (jo-ki)	0.90	0.25	1.8	40.00
11407	File fish, fillet, dried	4.70	14.80	6.6	-

Code Number	Food	Energy (Kcals)	Protien (g)	Fat (g)	Carbohydrate (g)	Water %
11447	Fish paste, fish sausage	150.0	15.0	6.0	7.5	68.50
11548	Clam, meat, salt-fermented	67.0	10.0	1.1	3.5	69.60
11646	Shrimp, salt-fermented	49.0	8.2	1.1	1.0	66.20
11660	Common squid, salt-fermented, squid, spiced	122.0	12.3	2.3	12.7	64.80
11664	Common squid, fillet, seasoned	295.0	63.5	2.7	0.4	26.10
11678	Sea cucumber	15.0	2.5	0.1	0.8	93.30
11682	Jelly fish, salted	20.0	4.1	0.2	0.1	67.40
Sea Vegetable						
12005	Laver, dried	252.0	38.6	1.7	38.6	11.40
12011	Laver, seasoned, toasted	265.0	37.8	2.3	41.1	5.50
12017	Sea tangle, dried	189.0	7.4	1.1	41.1	12.30
12035	Sea mustard, dried	190.0	13.5	1.7	40.1	10.30
12039	Sea mustard, stem, dried	189.0	6.0	0.3	41.5	16.30
12058	Sea lettuce	19.0	3.1	0.5	1.9	89.50
Beverages						
15011	Sik-hye (sweet rice beverage)	104.0	2.4	0.1	22.7	74.00
15075	Green tea, leaves, dried, infusion	2.0	0.7	-	-	98.60
Spices						
16009	Red pepper powder	272.0	15.8	12.5	36.1	11.90
16010	Ko chu jang (fermented red pepper soybean paste)	217.0	5.9	2.4	43.0	38.50
16014	Ta shi da, Anchovy	213.0	10.0	0.6	41.7	2.50
16015	Ta shi da, Beef	281.0	15.1	10.9	30.3	3.40
16018	Soybean paste	161.0	11.9	4.7	17.8	50.20
Processed foods						
17066	Ramyun, Shin Ramen, Nongshim	439.0	8.9	17.5	55.6	7.70
17086	Dumplings, Kimchi mandu, frozen	186.0	7.8	5.3	28.0	55.30
17088	Dumpling, frozen	214.0	9.6	10.4	20.6	57.80

Code Number	Food	Fibre (g)	Cholesterol (mg)	Vit B1 (mg)	Vit B2 (mg)	Niacin (mg)
11447	Fish paste, fish sausage	-	30.00	0.300	0.800	5.0
11548	Clam, meat, salt-fermented	-	44.00	0.020	0.210	1.7
11646	Shrimp, salt-fermented	-	152.00	0.020	0.020	0.8
11660	Common squid, salt-fermented, squid, spiced	0.60	228.0	0.040	0.050	3.1
11664	Common squid, fillet, seasoned	-	385.0	0.060	0.030	1.3
11678	Sea cucumber	-	-	0.020	0.020	0.2
11682	Jelly fish, salted	-	239.0	-	-	-
Sea Vegetable						
12005	Laver, dried	1.70	-	1.200	2.950	10.4
12011	Laver, seasoned, toasted	1.80	-	0.960	2.800	8.3
12017	Sea tangle, dried	4.10	-	0.220	0.450	4.5
12035	Sea mustard, dried	2.50	-	0.250	1.050	8.0
12039	Sea mustard, stem, dried	6.70	-	0.070	0.190	3.5
12058	Sea lettuce	0.70	-	0.090	0.170	0.4
Beverages						
15011	Sik-hye (sweet rice beverage)	0.60	-	0.010	0.030	0.2
15075	Green tea, leaves, dried, infusion	-	-	0.010	0.060	0.3
Spices						
16009	Red pepper powder	18.40	-	0.420	1.200	14.1
16010	Ko chu jang (fermented red pepper soybean paste)	2.00	-	0.210	0.250	2.7
16014	Ta shi da, Anchovy	0.20	117.0	0.380	0.340	29.0
16015	Ta shi da, Beef	0.30	11.0	0.590	0.190	14.9
16018	Soybean paste	3.20	-	0.030	0.100	1.6
Processed foods						
17066	Ramyun, Shin Ramen, Nongshim	5.90	2.0	0.550	0.380	0.9
17086	Dumplings, Kimchi mandu, frozen	-	203.0	0.140	0.070	1.6
17088	Dumpling, frozen	0.30	203.0	0.210	0.090	0.9

Code Number	Food	Vit C (mg)	Vit E (mg)	Vit B6 (mg)	Folate (ug)	B Carotene (ug)
11447	Fish paste, fish sausage	-	0.20	0.27	1.9	
11548	Clam, meat, salt-fermented	-	2.40	0.06	16.0	43.0
11646	Shrimp, salt-fermented	-	0.82	0.17	1.8	-
11660	Common squid, salt-fermented, squid, spiced	1.0	3.40	0.07	12.5	467.0
11664	Common squid, fillet, seasoned	-	1.70	0.12	21.5	-
11678	Sea cucumber	3.0	2.60	0.07	12.5	-
11682	Jelly fish, salted	-	5.00	0.22	17.8	-
Sea Vegetable						
12005	Laver, dried	93.0	4.30	0.07	1,364.0	22,500.0
12011	Laver, seasoned, toasted	70.0	4.30	0.07	1,364.0	20,700.0
12017	Sea tangle, dried	18.0	4.30	0.01	1,364.0	576.0
12035	Sea mustard, dried	14.0	7.23	0.01	1,058.3	359.0
12039	Sea mustard, stem, dried	7.0	6.75	0.01	987.5	-
12058	Sea lettuce	13.0	1.00	0.12	146.3	2,244.0
Beverages						
15011	Sik-hye (sweet rice beverage)	-	0.12	0.03	1.1	-
15075	Green tea, leaves, dried, infusion	10.0	0.96	-	1.7	-
Spices						
16009	Red pepper powder	20.0	3.35	1.48	106.8	20,160.0
16010	Ko chu jang (fermented red pepper soybean paste)	-	2.34	1.03	74.6	2,333.0
16014	Ta shi da, Anchovy	2.0	8.00	1.01	48.0	
16015	Ta shi da, Beef	5.0	8.00	1.01	48.0	
16018	Soybean paste	-	1.08	0.22	33.0	-
Processed foods						
17066	Ramyun, Shin Ramen, Nongshim	-	0.40	0.10	17.6	413.0
17086	Dumplings, Kimchi mandu, frozen	4.8	0.76	1.47	4.0	-
17088	Dumpling, frozen	1.0	0.76	1.47	4.0	120.0

Code Number	Food	Retinol (ug)	Vit A (mg)	Na (mg)	K (mg)	Ca (mg)	P (mg)
11447	Fish paste, fish sausage		6.0	572.0	69.0	89.0	131.0
11548	Clam, meat, salt-fermented	-	7.0	5,376.0	359.0	119.0	158.0
11646	Shrimp, salt-fermented	54.0	54.0	6,475.0	539.0	361.0	145.0
11660	Common squid, salt-fermented, squid, spiced	1.0	79.0	2,374.0	301.0	30.0	165.0
11664	Common squid, fillet, seasoned	-	-	930.0	59.0	35.0	637.0
11678	Sea cucumber	-	-	843.0	83.0	124.0	33.0
11682	Jelly fish, salted	-	-	167.0	253.0	73.0	21.0
Sea Vegetable							
12005	Laver, dried	-	3,750.0	1,294.0	3,503.0	325.0	762.0
12011	Laver, seasoned, toasted	-	3,450.0	1,938.0	1,867.0	230.0	705.0
12017	Sea tangle, dried	-	96.0	3,100.0	7,500.0	708.0	186.0
12035	Sea mustard, dried	-	60.0	5,375.0	6,267.0	920.0	415.0
12039	Sea mustard, stem, dried	-	-	4,118.0	4,928.0	1,072.0	182.0
12058	Sea lettuce	-	374.0	635.0	678.0	85.0	43.0
Beverages							
15011	Sik-hye (sweet rice beverage)	-	-	2.0	10.0	75.0	25.0
15075	Green tea, leaves, dried, infusion	-	-	1.0	180.0	2.0	12.0
Spices							
16009	Red pepper powder	-	3,360.0	18.0	2,597.0	72.0	216.0
16010	Ko chu jang (fermented red pepper soybean paste)	-	389.0	2,510.0	406.0	55.0	145.0
16014	Ta shi da, Anchovy		40.0	14,809.0	316.0	412.0	77.0
16015	Ta shi da, Beef		19.0	14,855.0	286.0	20.0	72.0
16018	Soybean paste	-	-	4,020.0	403.0	53.0	181.0
Processed foods							
17066	Ramyun, Shin Ramen, Nongshim	-	43.0	2,108.0	263.0	28.0	91.0
17086	Dumplings, Kimchi mandu, frozen	-	24.2	-	-	33.1	49.7
17088	Dumpling, frozen	16.0	36.0	272.0	77.0	31.0	83.0

Code Number	Food	Fe (mg)	Zn (mg)	Ash (g)	Refuse (%)
11447	Fish paste, fish sausage	4.20	0.40	3.0	-
11548	Clam, meat, salt-fermented	7.50	1.37	15.8	-
11646	Shrimp, salt-fermented	1.90	1.56	23.1	-
11660	Common squid, salt-fermented, squid, spiced	1.10	1.30	7.3	-
11664	Common squid, fillet, seasoned	3.00	2.91	7.3	-
11678	Sea cucumber	0.30	0.21	3.3	-
11682	Jelly fish, salted	1.11	1.56	28.3	-
Sea Vegetable					
12005	Laver, dried	17.60	5.10	8.0	-
12011	Laver, seasoned, toasted	18.00	0.66	11.5	-
12017	Sea tangle, dried	6.30	0.40	34.0	-
12035	Sea mustard, dried	7.60	5.10	31.9	-
12039	Sea mustard, stem, dried	20.00	1.73	29.2	-
12058	Sea lettuce	7.80	2.60	4.3	-
Beverages					
15011	Sik-hye (sweet rice beverage)	0.40	0.11	0.2	-
15075	Green tea, leaves, dried, infusion	0.10	0.05	0.3	-
Spices					
16009	Red pepper powder	8.10	1.31	5.3	-
16010	Ko chu jang (fermented red pepper soybean paste)	1.90	0.41	8.2	-
16014	Ta shi da, Anchovy	4.60	1.28	45.0	-
16015	Ta shi da, Beef	8.30	0.32	40.0	-
16018	Soybean paste	1.30	0.58	12.2	-
Processed foods					
17066	Ramyun, Shin Ramen, Nongshim	0.50	0.55	4.4	-
17086	Dumplings, Kimchi mandu, frozen	1.00	0.79	-	
17088	Dumpling, frozen	1.30	0.79	1.3	-