

Assessment of Dietary Patterns of Thais in Germany and Thailand

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ABSTRACT

This study was conducted to investigate the dietary patterns of Thais living in different cultures. Ninety-eight healthy Thai men and women aged 18-55 years were recruited from several regions of Germany, and compared with 100 healthy Thai men and women aged 17-56 years living in Thailand. A food frequency questionnaire (FFQ) with 85 food items and 24-h recall was used to assess the amounts and frequency of energy and nutrient intake especially fat. Body weight and height were measured to assess weight changes in the subjects. Socio-economic and health status information was gathered through interviews. The "Nutrisurvey" dietary analysis software was used to analyse the nutrient intakes of the subjects. Statistical analysis was done using Strata version 5.0. The results showed higher intakes of energy, protein and fat by the Thais living in Germany than those in Thailand. Rice was the staple food of both groups. The average age-adjusted BMI for Thais in Germany was 27.8 ± 0.7 kg/m² for men and 27.8 ± 1.1 kg/m² for women. There were no statistically significant differences in the BMI between the Thais in Germany and in Thailand for men and women. A high consumption of fat is associated with weight increase among the Thais in Germany. Dietary lifestyles in the Thai population in Thailand are also shifting towards increasing fat consumption. Nutrition education is important to reduce the continued rise of obesity among Thai adults.

INTRODUCTION

The last few decades have seen a dramatic increase in the rate of immigration from developing countries to industrial countries (Uppaluri, 2002; Wiecha *et al.*, 2001). Thai people move to Western countries for many reasons, such as marriage, study, employment and business. Presently, there are nearly 50,000

Thai residents in Germany (Statistisches Bundesamt, 2004). Migrants might experience a shift in their lifestyles as part of the acculturation process. Acculturation is a multidimensional process of overall adaptation of groups and individuals to a new society, with cultural, psychological, social, economic and political changes (Lee, Sobal & Frongillo, 1999).

Lifestyles, including the dietary patterns, of migrants change. They adopt Western diets that tend to be higher in fat. Over-consumption of calorie-dense foods rich in saturated fats, sugars and starches, and under-consumption of antioxidant-rich fruits and vegetables, could place migrants at risk of non-communicable chronic diseases like cardiovascular disease (Jakobsen *et al.*, 2004; Richter, 2003; Huncharek & Kupelnick, 2001). Uppaluri (2002) highlighted the prevalence of coronary heart disease (CHD) in Asian-Indian communities abroad, and described the prevalence of the risk factors for coronary artery disease, specifically diet, cholesterol, and Type 2 diabetes, in Asian Indians. Ueshima *et al.* (2003) found that the levels of several CHD-risk factors, especially lipids, were generally lower in Japanese in Japan than in Japanese in Hawaii. This might partly explain the lower CHD incidence and mortality in Japan than in Western industrialised countries. Lv and Cason (2004) found that Chinese Americans who migrated to Pennsylvania had dietary changes such as skipping breakfast and increased frequency of consuming fats, sweets, and soft drinks.

There is a lack of data on the dietary behaviour or nutritional status of Thais who have migrated to Western countries. This preliminary study aims to assess the dietary patterns of Thais living in Germany, compared to Thais living in Thailand.

MATERIALS AND METHODS

The participants were recruited from Thais living in different cities in Germany including Hanover, Aachen, Bonn, Giessen, Stuttgart and Karlsruhe. The study group in Thailand came from the urban areas in Bangkok, Nakhon Nayok, Samut Prakan, Phitsanulok, and Samut Sakhon. Trained academic staff conducted

interviews with structured questionnaires to obtain detailed information on demographic characteristics, personal history, smoking and diet. Twenty-four hour recall was used to estimate the calorie and nutrient intake. The participants were interviewed on the types and quantity of food that they had eaten during the past 24 hours. The amounts eaten were estimated by equivalents to household measuring utensils. Nutrient intake was calculated using the computerised food programme Nutrisurvey (2002), and the food composition database provided by Bundeslebensmittelschuessel BLS II.3 (1999) and the Nutrition Division, Department of Health, Ministry of Public Health (2001). The subjects were also required to complete an 85-item food frequency questionnaire, which determines the average number of times specific food items are consumed each day, week, month or year. The weight and height of the participants were measured and the body mass index (BMI) of the participants was calculated. The Thais in Germany were asked to recall their body weight in the first year living in Germany. This information was used to calculate weight changes during the period they have resided in Germany.

RESULTS

The age range of the study group in Germany was 18-55 years, while that of the study group in Thailand was 17-56 years. Shown in Table 1, most of the subjects in Germany were students (84.7%), and the rest were employees (11.2%) and housewives (4.1%). The subjects in Thailand were students (56.0%), employees (41.0%), or had own small businesses (3%). Most of the participants had university degrees, with 84.7% in Germany, and 67.0% in Thailand. Both groups had no serious diseases and only a few were smokers, with 6.1% in Germany and 9% in Thailand. Approximately half in each

Table 1. Demographic data of the study groups

<i>Demographic data</i>	<i>Thais in Germany</i>		<i>Thais in Thailand</i>	
	<i>no.</i>	<i>%</i>	<i>no.</i>	<i>%</i>
Education				
University	83	84.7	67	67.0
High school/Trade school	6	6.1	25	25.0
Middle school	2	2.0	4	4.0
Primary school	7	7.1	4	4.0
n	98		100	
Occupation				
Student	83	84.7	56	56.0
Employee	11	11.2	41	41.0
Housewife	4	4.1	0	0
Business	0	0	3	3.0
n	98		100	
Cigarette smoking				
Yes	6	6.1	9	9.0
No	92	93.9	91	91.0
n	98		100	
Alcohol consumption				
Beer and/or wine	55	56.1	52	52.0
Do not drink alcohol	43	43.9	48	48.0
n	98		100	
Noticeable affliction				
Yes	18	18.4	13	13.0
No	80	81.6	87	87.0
n	98		100	
Sport activity				
Yes	45	45.9	71	71.0
No	51	52.0	29	29.0
n	96		100	

study group consumed beer and wine in small amounts and infrequently (56.1% in Germany and 52.0% in Thailand). Almost half (45.9%) of the study group in Germany played sports regularly, but the percentage was higher in Thailand (71.0%). The duration of residency in Germany ranged widely from 4 months to

28.7 years. The Thais in Thailand had not been abroad longer than one month in the past few years.

The energy and macronutrient intakes of the Thais in Germany were relatively high, with averages for daily energy, protein and fat exceeding the recommendations of the Thai DRI, 2003 (Nutrition

Division, Department of Health, Ministry of Public Health, 2003). Compared with the group in Thailand, the energy and macronutrient intakes of the Thais in Germany were significantly higher, except for carbohydrate. Carbohydrate intake, as percent of energy, of the subjects in Thailand was significantly higher than that of the group in Germany. The average fat intake of both male and female Thai emigrants exceeded the upper limit of the recommendations of the Thai DRI, 2003 (20-35% of energy intake/d), whereas those of the male and female Thais in Thailand were within the recommendations (Table 2).

Rice is the staple food and provides the major amount of energy for the two study groups. More than two-thirds (69.4%) of the Thais in Germany ate rice every day. There was no statistical difference in the frequency of rice consumption between the two groups ($p=0.080$). Just as the people in Germany and other Western countries, the Thai migrants consumed bread more frequently (white bread; $p=0.001$, whole-wheat bread; $p=0.030$) than the Thais in Thailand. The group in Thailand ate noodles more often ($p=0.000$), but less macaroni and spaghetti ($p=0.006$) than their counterparts in Germany. The consumption frequencies of pork ($p=0.060$), beef ($p=0.088$) and poultry ($p=0.162$) in the two study groups were not significantly different. The Thai emigrants ate fish ($p=0.000$), crab ($p=0.000$), shrimp ($p=0.000$), shellfish ($p=0.000$), and squid ($p=0.000$) less often than those in Thailand. This may be due to the availability of more choices of freshwater and seafoods in Thailand. In contrast, Thais in Germany ate sausages more frequently ($p=0.000$) probably because they are tasty and cheaper than in Thailand. Milk and milk product consumption of the Thai emigrants was significantly more frequent than the group in Thailand (whole milk, $p=0.000$; cheese, $p=0.000$; yogurt, $p=0.000$).

Most of the participants in Germany

consumed seasonal and local fruits and vegetables. Tropical fruits were available in Asian shops in Germany, but the prices were relatively high and hence they were not frequently taken. The average fruit and vegetable consumption of the Thai participants in Germany was 624.4 g/d (10.8% of total calorie intake), while that of the other Thai group was 355.4 g/d (9.8% of total calorie intake). It is observed that although the Thais in Germany consumed significantly more fruits and vegetables, there was no statistical difference between the two groups, when compared on the basis of total calorie intakes.

Vegetable fats and oils, meats and meat products, milk and milk products including baked goods were the major fat sources for male and female participants in Germany. Main sources of fats for male and female subjects in Thailand were vegetable fats and oils, milk and milk products (for males only), and meats and meat products (Table 3). For almost all the fat sources listed in the Table, the amount of fat consumed by the group in Germany was significantly higher than the levels taken by Thais in Thailand, for both male and female subjects. This includes fats from animal foods that provide saturated fatty acids, for example, meat and meat products, poultry and eggs and milk and milk products.

The age-adjusted mean BMI for the participants in Germany was 27.8 ± 0.7 kg/m² for men and 27.8 ± 1.1 kg/m² for the women. As for the subjects in Thailand, the age-adjusted mean BMI was 27.9 ± 1.1 kg/m² for men and 27.4 ± 0.94 kg/m² for women. There were no statistically significant differences in the BMI levels between the study groups, for both male and female subjects (Figure 1). It was found that 64.6% men and 84.0% women of the study group in Germany gained weight after migration, while 16.7% men and 4.0% women lost weight, and 18.7% men and 12.0% women had no weight change. Mean weight increase in the male subjects

Table 2. Comparison of average nutrient intakes of the Thai participants living in Germany and Thailand

	Male			Female		
	Thais in Germany (n = 48)	Thais in Thailand (n = 49)	<i>p</i> ¹	Thais in Germany (n = 50)	Thais in Thailand (n = 51)	<i>p</i> ¹
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Energy (kcal/d)	2513±1038	1727±782	0.000	2146±848	1375±508	0.000
Protein (g/d)	102.5±47.2	54.7±23.5	0.000	84.4±35.9	48.7±19.1	0.000
Fat (g/d)	109.8±57.7	50.3±34.0	0.000	90.7±45.3	45.2±25.6	0.000
(% of energy/d)	37.2±10.1	25.1±11.0	0.000	36.2±10.6	27.7±12.9	0.000
Carbohydrate (g/d)	275.0±115.4	257.8±124.8	0.481	252.6±112.1	205.0±94.6	0.023
(% of energy/d)	45.6±11.8	61.2±11.4	0.000	47.5±10.7	57.7±12.2	0.000
Dietary fibre (g/d)	18.2±10.5	4.3±3.7	0.000	18.1±15.8	4.2±4.0	0.000
Vitamin A (µg/d)	1609±1526	1759±1892	0.669	1190±1604	2124±2586	0.032
Vitamin B1 (mg/d)	1.4±0.78	0.8±0.4	0.000	1.2±0.8	0.8±0.4	0.021
Vitamin B2 (mg/d)	1.8±0.9	1.5±2.8	0.478	1.5±0.9	0.8±0.5	0.000
Vitamin B6 (mg/d)	1.6±0.8	0.006±0.003	0.000	1.4±0.9	0.002±0.0006	0.000
Vitamin C (mg/d)	208.5±189.0	165.9±170.6	0.246	176.8±187.2	178.3±147.8	0.965
Calcium (mg/d)	909.6±596.5	435.5±445.4	0.000	874.0±640.7	288.0±206.5	0.000
Iron (mg/d)	21.1±16.4	18.3±10.9	0.320	15.7±9.8	19.9±12.4	0.067

¹Test of significance according to t-test between Thais in Germany & Thais in Thailand

□ No significant difference □ *p*<0.05 □ *p*<0.001

Dietary Reference intake (DRI) for Thais 2003 recommended energy intake 2100 kcal/d for men; 1750 kcal/d for women, protein intake 57 g/d for men; 52 g/d for women, Fat intake 20-35% of energy intake/d (men =46.7-81.7 g/d, women =38.9-68.1g/d), Carbohydrate intake 45-65% of energy intake/d (men=236.3-341.2 g/d, women =196.9-284.4g/d), Dietary fibre intake 25 g/d, Vitamin A intake 700 µg/d for men; 600 µg/d for women, Vitamin B₁ intake 1.2 mg/d for men; 1.1 mg/d for women, Vitamin B₂ intake 1.3 mg/d for men; 1.1 mg/d for women, Vitamin B₆ intake 1.3 mg/d, Vitamin C intake 90 mg/d for men; 75 mg/d for women, Calcium intake 800 mg/d and Iron intake 10.4 mg/d for men; 24.7 mg/d for women

Table 3. Major fat sources of the Thai participants living in Germany and Thailand

Food items	Male			Female		
	fat consumption (g) of Thais in Germany (n = 48)	fat consumption (g) of Thais in Thailand (n = 49)	p ¹	fat consumption (g) of Thais in Germany (n = 50)	fat consumption (g) of Thais in Thailand (n = 51)	p ¹
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Meats and meat products	26.5±28.2	9.0 ±15.2	0.001	18.1±24.7	12.8±18.6	0.812
Poultry and eggs	11.5±12.9	4.8 ±6.2	0.000	8.2 ±11.8	3.3±4.0	0.002
Fish and seafoods	0.9±3.1	0.6 ±1.0	0.039	2.1±4.4	0.7±1.3	0.000
Milk and milk products	12.0±14.7	5.9 ±11.1	0.066	21.1±25.0	2.5±6.4	0.000
Nuts and seed	4.3 ±11.0	2.4 ±6.7	0.039	2.2 ±6.7	1.6±4.9	0.288
Coconut milk	5.8±13.4	5.0 ±7.0	0.041	4.3±11.2	4.9±8.1	0.499
Baked products	19.7±35.3	1.2 ±2.8	0.000	9.1±14.6	0.8±2.3	0.000
Vegetable fats and oils	23.7±19.2	16.7±15.7	0.124	22.0±17.5	15.9±13.6	0.043

¹Test of significance according to t-test between Thais in Germany & Thais in Thailand

□ No significant difference □ p<0.05 □ p<0.001

Table 4. Percentage and average weight change of Thai participants living in Germany

	Male	Female
No weight change (%)	18.7	12.0
Lost weight 1-8 kg (%)	16.7	4.0
Mean of weight lost (Mean± SD) (kg)	2.4±0.7	6.0±2.8
Gained weight		
1-5 kg (%)	52.0	60.0
5-10 kg (%)	6.3	18.0
10-20 kg (%)	6.3	0
>20 kg (%)	0	6.0
Mean of weight gain (Mean± SD) (kg)	3.6±4.3	5.4±8.1
Mean of weight change (Mean± SD) (kg)	+(2.7±4.6)	+(4.9±8.3)

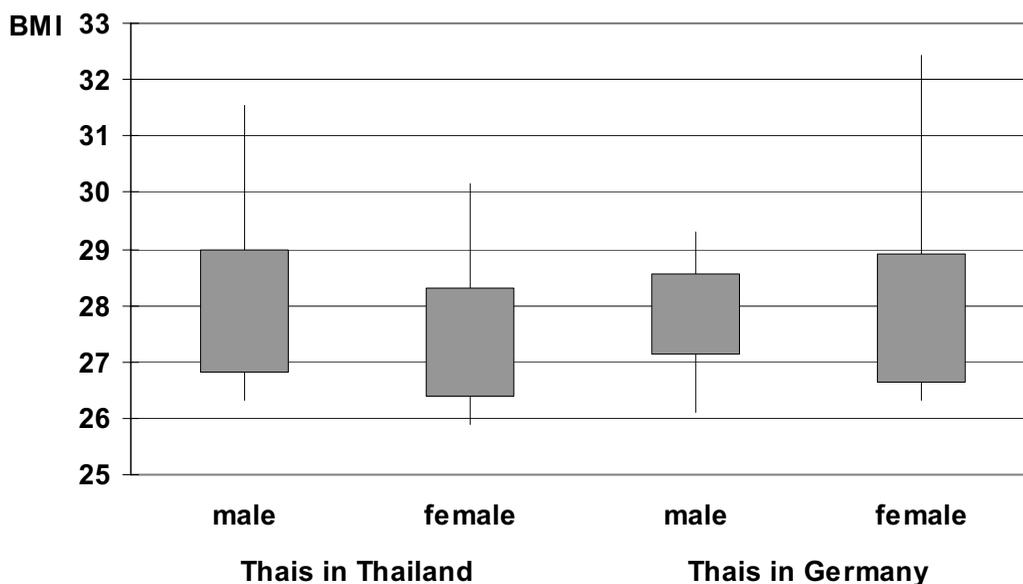


Figure 1. Age-adjusted mean BMI \pm SD (min-max) of the Thai participants living in Germany and in Thailand

was 2.7 ± 4.6 kg and 4.9 ± 8.3 kg for the women (Table 4). Weight gain correlated significantly with period of residence in Germany ($r=0.70$, $p=0.000$), and with participant's age ($r=0.32$, $p=0.002$). Sport activities showed no influence on the weight gain of the participants in Germany. The distribution of BMI of the two groups was not significantly different, but the percentage of underweight in the Thailand study group was higher. Majority of the subjects in Germany (91.7% male and 82.0% female) had BMI in the normal range (BMI=20.0-24.9 kg/m²), compared to 73.5% male and 66.7% female subjects in Thailand. It was also found that 4.2% male and 4.0% female Thais in Germany were underweight, while there were 10.2% male and 21.6% female Thais in Thailand who were underweight (BMI<18.5). Meanwhile 4.2% male and 12.0% female Thais in Germany were overweight, compared to 12.2% male and 11.8% female Thais in Thailand (BMI \geq 25kg/m²). A small proportion was found to be obese (BMI \geq 30 kg/m²), that is, 2%

female of Thais in Germany and 4.1% male Thais in Thailand (WHO, 1998).

DISCUSSION

Since acculturation may change lifestyles and food behaviours, the health aspects affected by the modified food patterns of Thais who have migrated to Western countries may be significant. The Thais living in Germany frequently consumed Thai foods prepared from raw materials sold in local supermarkets and condiments purchased from Asian food shops. Nonetheless, their fat intake was found to be high (109.8 g/d for male and 90.7 g/d for female), exceeding the recommendations of the Thai DRI, when compared to the study group living in Thailand. The average fat intake of the Thais in Germany was even higher than the average fat intakes of the control and overweight-to-obese groups (40.8 g/d and 54.3 g/d respectively), as reported in the Thai obesity study by Viroonudomphol (2002).

Obesity is rising in Europe, especially in Finland, Germany, Greece, the Netherlands, Spain, Sweden, and the United Kingdom. Within the European Union, the largest increase in obesity has been observed in the United Kingdom. In 2000, the fat consumption of Europeans ranged from 33-42% of total energy (van der Wilk & Jansen, 2005). The fat intake of the study group in Germany was 37.2 and 36.2% of total energy in male and female subjects respectively. The prevalence of obesity among the Thais in Germany is expected to rise, if they continue with their present dietary patterns including consuming high amounts of fat frequently.

The Thais in Germany derived their fat mainly from meat and meat products, poultry and eggs, fish and seafood, milk and milk products and baked goods. Their dietary patterns have changed towards the intake of more animal products with consequent increases in animal fats and protein, especially from red meat and sausage. The shift towards a diet higher in fat and meat was likely to be associated with the duration of residence in Germany. Pan *et al.* (1999) had observed changes in dietary habits of Asian students overseas related to length of stay abroad. One good outcome found in the food patterns of this emigrant group was a higher consumption of fruits and vegetables than the Thais in Thailand.

The association between total fat intake, obesity and chronic disease including certain types of cancers is well established. Recommendations to decrease red meat intake, particularly processed meat, may decrease the risk of colorectal and prostate cancer and may have beneficial effects on breast cancer (Stoekli & Keller, 2004). A rapid shift in the state of nutrition towards a pattern of degenerative disease is accelerating in many developing countries including Thailand. In Thailand, the percentage of overweight population is rising. National survey

records (Department of Health, 1995) showed that the overweight problem tended to increase in the Thai population aged 30-49 years and decreased in those aged 50-59 years. Prevalence of overweight was found in 20.4% of the population aged 20-29 years, 29.8% of the 30-39 years age group, 40.2% of 40-49 years, and 34.9% of the 50-59 age group.

The nutritional status of people in Thailand is currently in transition. While people in rural areas surveyed in the past used to consume diets low in fat of 7-15 g/d (Changbumrung *et al.*, 1989), the fat consumption in Thailand has risen, although not as high as the levels taken by the subjects in Germany. The participants in Thailand were from big cities where their lifestyles are being influenced by urbanization and they tend to increase in weight.

The results of this study should be interpreted with caution given its limitations. There was no information on the actual types of fats consumed, and only fats from animal foods were considered. Physical activity was not measured and it could be a major factor contributing to the differences in BMI between the study groups. Factors affecting food availability and accessibility that may contribute to the different types of foods consumed in the two groups were also not studied

CONCLUSION

Our findings showed that the lifestyles and food behaviours of Thai people residing in Germany have shifted to less-healthy patterns. Dietary intakes in Thailand also is in transition shifting from subsistence to lifestyles with increasing levels of fat consumption. Nutrition education and national dietary guidelines should be established for health promotion and the prevention of chronic degenerative diseases for all.

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REFERENCES

- Bundeslebensmittelschuessel (BLS II.3). (1999). The German food Code and Nutrient Data Base. Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV), Berlin.
- Changbunrung S, Tungtrongchitr R, Hongtong K, Supawan V, Kwanbunjan K, Prayurahong B, Sitabutra P, Srithip U, Theerachai A, Vudhivai N, Migasena P & Sornmani S (1989). Food patterns and habits of people in an endemic area of liver fluke infection. *J Nutr Assoc Thai* 23:133-146.
- Department of Health, Ministry of Public Health (1995). The Fourth National Nutrition Survey of Thailand, The Express Transportation Organization of Thailand Publishing, Bangkok.
- Huncharek M & Kupelnick B (2001). Dietary fat intake and risk of epithelial ovarian cancer: a meta-analysis of 6,689 subjects from 8 observational studies. *Nutr Cancer* 40:87-91.
- Jakobsen MU, Overvad K, Dyerberg J, Schroll M & Heitmann BL (2004). Dietary fat and risk of coronary heart disease: possible effect modification by gender and age. *Am J Epidemiol* 160:141-149.
- Lee SK, Sobal J & Frongillo EA (1999). Acculturation and dietary practices among Korean Americans. *J Am Diet Assoc* 99:1084-1089.
- Lv N & Cason KL (2004). Dietary pattern change and acculturation of Chinese Americans in Pennsylvania. *J Am Diet Assoc* 104:771-778.
- Nutrition Division, Department of Health, Ministry of Public Health (2001). Nutritive Values of Thai foods. The War Veterans Organization of Thailand Publishing, Bangkok.
- Nutrition Division, Department of Health, Ministry of Public Health (2003). Dietary Reference Intake for Thais. The Express Transportation Organization of Thailand Publishing, Bangkok.
- Pan YI, Dixon Z, Himburg S & Huffman F (1999). Asian students change their eating patterns after living in the United States. *J Am Diet Assoc* 99:54-57.
- Richter WO (2003). Fatty acids and breast cancer--is there a relationship? *Eur J Med Res* 8:373-380.
- Statistisches Bundesamt [Federal Statistics Office] (2004). Federal Statistics Press Office, Wiesbaden.
- Stoekli R & Keller U (2004). Nutritional fats and the risk of type 2 diabetes and cancer. *Physiol Behav* 83:611-615.
- Ueshima H, Okayama A, Saitoh S, Nakagawa H, Rodriguez B, Sakata K, Okuda N, Choudhury SR & Curb JD (2003). Differences in cardiovascular disease risk factors between Japanese in Japan and Japanese-Americans in Hawaii: the INTERLIPID study. *J Hum Hypertens* 17:631-639.
- Uppaluri CR (2002). Heart disease and its

- related risk factors in Asian Indians. *Ethn Dis* 12:45-53.
- Van der Wilk EA & Jansen J (2005). Lifestyle-related risks: are trends in Europe converging? *Public Health* 119:55-66.
- Viroonudomphol D (2002). Levels of antioxidants for health determination in overweight and obese Thai. A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy (Trop. Med.), Faculty of Tropical Medicine, Mahidol University, Thailand.
- Wiecha JM, Fink AK, Wiecha J & Herbert J (2001). Differences in dietary patterns of Vietnamese, White, African-American, and Hispanic adolescents in Worcester, Mass. *J Am Diet Assoc* 101:248-50.
- WHO (1998). Obesity-Preventing and managing the global epidemic. WHO/NUT/NCD/98.1. Geneva. WHO