

**PREVALENCE OF INSUFFICIENT FRUIT AND VEGETABLE  
INTAKE AND THE ASSOCIATED FACTORS IN OLDER  
ADULTS IN THAILAND**

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Thesis  
entitled

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OLDER ADULTS IN THAILAND**



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**PREVALENCE OF INSUFFICIENT FRUIT AND VEGETABLE INTAKE AND THE ASSOCIATED FACTORS IN OLDER ADULTS IN THAILAND****KANYAPAK SILARAK 5537727 ADPM/M****M.P.H.M.****THESIS ADVISORY COMMITTEE : JIRAPORN CHOMPIKUL, Ph.D.,  
AROONSRI MONGKOLCHATI, Ph.D.****ABSTRACT**

Nowadays older adults are the fastest growing segment of the world's population and this group has increasing chronic conditions such as diabetes, heart disease, cancer and specific geriatric problems. This study aimed to describe the prevalence of insufficient fruit and vegetable intake, and examine factors associated with insufficient fruit and vegetable intake in adults aged 50 years and older in Thailand; A cross-sectional study of 3,875 subjects in 16 districts from 14 provinces across different regions of Thailand were included through, multi-stage cluster sampling. The variables collected included socio-demographic factors, lifestyles factors, anthropometric factors, health related factors and fruit and vegetable intake. An electronic form was developed for data entering from all the study sites while a face to face interview method was used to fill up the electronic form of questionnaire and the participants interviewed by trained research assistants. Chi-square test and multiple logistic regression were performed to examine associations between the independent variables and insufficient fruit and vegetable intake. The results showed that a total of 3,875 of the subjects, and a total 3,787 (97.73%) completed questionnaires were included in the analysis and that the majority (72.9%) were 50 to 69 years old. Overall prevalence of insufficient fruit and vegetable intake were 77.4%, 78.3% among men and 76.9% among women. In multivariable analysis, current marital status, household monthly income, region, and tobacco used (Adj OR 1.36, 95% CI 1.04-1.78) were significantly associated with insufficient fruit and vegetable intake. After adjusting for other factors, older adults who used tobacco were 1.36 times more likely to have fruits and vegetable intake than those who did not use. In conclusion, the amount of fruits and vegetables intake by older adults in communities of Thailand, were considerably lower than current recommendations (daily intake of at least five servings or 400 g), and therefore the results suggested that public education and campaigns on adequate consumption of fruits and vegetable should be promoted targeting widowed/ divorced/separate marital status, low household monthly income, north eastern region, and tobacco use. Our findings could help in health promotion policy implementation to increase fruit and vegetable intake among this target group in Thailand.

**KEY WORDS: FRUITS / VEGETABLES / INSUFFICIENT INTAKE / RISK TORS  
/ OLDER ADULTS**

91 pages

ความชุกของการบริโภคผักและผลไม้ไม่เพียงพอและปัจจัยที่เกี่ยวข้องในผู้สูงอายุในประเทศไทย  
PREVALENCE OF INSUFFICIENT FRUIT AND VEGETABLE INTAKE AND THE ASSOCIATED FACTORS IN OLDER ADULTS IN THAILAND

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บทคัดย่อ

ปัจจุบันนี้ประชากรวัยผู้สูงอายุถือเป็นสัดส่วนที่เติบโตรวดเร็วเมื่อเปรียบเทียบกับประชากรกลุ่มวัยอื่นทั่วโลก เป็นสาเหตุของการเพิ่มขึ้นของโรคเรื้อรังด้วย เช่น โรคเบาหวาน, โรคหัวใจ, โรคเมเร็ง และปัญหาสุขภาพเฉพาะของผู้สูงอายุ จุดประสงค์ของการศึกษานี้เพื่ออธิบายสถานการณ์ความชุก และปัจจัยที่มีความสัมพันธ์กับการบริโภคผักและผลไม้ไม่เพียงพอในประชากรไทยที่มีอายุตั้งแต่ 50 ปีขึ้นไป เป็นการศึกษาภาคตัดขวาง ดำเนินงานกันยายน 2558 ถึงมีนาคม 2559 ทำการสุ่มตัวอย่างประชากร จำนวน 3,875 คน จาก 16 อำเภอ 14 จังหวัด ครอบคลุมทุกภูมิภาคของประเทศไทย ด้วยวิธีการสุ่มแบบหลายขั้นตอน ตัวแปรที่นำมาศึกษารวมถึง ปัจจัยด้านลักษณะประชากรและสังคม ปัจจัยด้านพฤติกรรมสุขภาพ ปัจจัยด้านการตรวจสมรรถภาพร่างกาย ปัจจัยด้านสภาวะโรคเรื้อรังและการบริโภคผักและผลไม้ ใช้วิธีการสัมภาษณ์แบบตัวต่อตัวโดยผู้สัมภาษณ์ที่ผ่านการอบรม และบันทึกรวบรวมผลผ่านระบบสารสนเทศอิเล็กทรอนิกส์ วิเคราะห์สถิติโดยพรรณาลักษณะตัวอย่างที่เป็นตัวแปรกลุ่ม ด้วยความถี่และร้อยละ การวิเคราะห์หาความสัมพันธ์ระหว่างการบริโภคผักและผลไม้ไม่เพียงพอกับปัจจัยเสี่ยงแต่ละตัวใช้สถิติไคสแควร์ และตัวแปรดอดยลอคอิสติกพหุคูณ กำหนดค่า adjusted Odds ratio และ 95% ช่วงความเชื่อมั่น ผลการศึกษามีประชากรเข้าร่วมการศึกษาทั้งหมด 3,875 คน การศึกษานี้มีผู้ตอบแบบสอบถามครบถ้วน จำนวน 3,787 คน คิดเป็นร้อยละ 97.73 พบว่า ประชากร ส่วนใหญ่มีอายุอยู่ในช่วง 50-59 ปี (72.9%) และความชุกของการบริโภคผักและผลไม้ไม่เพียงพอเท่ากับ 77.4%, 78.3% ในผู้ชาย และ 76.9% ในผู้หญิง ผลการวิเคราะห์หลายตัวแปร พบว่า สถานภาพสมรสปัจจุบัน รายได้ของครอบครัวต่อเดือน ภูมิภาค และการสูบบุหรี่ (Adj OR 1.36, 95% CI 1.04-1.78) เป็นปัจจัยที่มีความสัมพันธ์ต่อการบริโภค ผักและผลไม้ไม่เพียงพอ ในผู้สูงอายุที่สูบบุหรี่พบว่าน่าจะมีโอกาสบริโภคผักและผลไม้ไม่เพียงพอมากกว่าผู้สูงอายุที่ไม่สูบบุหรี่ถึง 1.37 เท่า บทสรุปพบว่าปริมาณการบริโภคผักและผลไม้ในผู้สูงอายุในประเทศไทยพบว่าต่ำกว่าคำแนะนำมาก (เท่ากับอย่างน้อย 5 ส่วนบริโภค หรือ 400 กรัมต่อวัน) ผลการศึกษานี้ได้ แนะนำว่าควรให้สุขภาพและรณรงค์ให้มีการบริโภคผักและผลไม้ให้เพียงพอในกลุ่มเป้าหมายดังกล่าว คือ กลุ่มหม้าย หย่าร้าง แยกกันอยู่, กลุ่มที่มีรายได้ของครอบครัวต่อเดือนต่ำ, คนที่อาศัยอยู่ภาคอีสาน และกลุ่มผู้สูบบุหรี่ การค้นพบนี้สามารถช่วยส่งเสริมนโยบายสุขภาพเพื่อนำสู่การปฏิบัติเพื่อเพิ่มการบริโภคผักและผลไม้ในกลุ่มเป้าหมาย ในประเทศไทย

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## LIST OF ABBREVIATIONS

FVI	Fruit and vegetable intake
WHO	World Health Organization
BMI	Body mass index
FV	Fruit and vegetable
NCDs	Non-communicable diseases
INDEPTH	International Network for the Demographic Evaluation of Populations and Their Health, in developing countries
NHESIII	The Thai National Health Examination Survey III
FAO	Food and Agriculture Organization of the United Nations
NHANES	The National Health and Nutrition Examination Survey
SAGE	The study on Global ageing
GPAQ	General Physical Activity Questionnaire
METs	Metabolic equivalents.
AIHD	ASEAN Institute for Health Development
SD	Standard deviation
QD	Quartile deviation
CVD	Cardio vascular disease

## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Rationale and Justification of the study**

Globally, the number of older persons is expected to more than double, from 841 million people in 2013 to more than 2 billion in 2050 (1). Because the older population in less developed regions is growing faster than in the more developed regions, the projections show that older persons will be increasingly concentrated in the less developed regions of the world. By 2050, nearly 8 in 10 of the world's older population will live in the less developed regions. In Asia, many countries have already become aged societies; these include Japan, Taiwan, South Korea, Singapore and Thailand (1). The population of Thailand have increased from the 62.2 million people in 2000 to 72.3 million in 2025 (1). The number of Thai older persons have increased rate from 10% in 2000 to 15% in 2025.

Developing and creating preparedness for an elderly population is an issue that has received attention in many countries. Of particular concern is the health of the elderly. Common health problems in the elderly and a major concern for a happy elderly life are diabetes, hypertension, chronic obstructive pulmonary disease, coronary heart disease, high cholesterol, stroke, arm weakness, joint pain, long-term pain, and falls and fractures (thigh bone), respectively. These are classified as chronic health problems and are very common affecting the economy and can be prevented. They also are the cause of death of up to 35 percent of total mortality in any given year (2).

Accumulated data from studies have shown a correlation between the consumption of fruits and vegetable and the reduction of chronic disease rates (3). Data show that consumption of fruits and vegetable 400 gram/day are useful in helping to prevent chronic diseases and also beneficial in the treatment of chronic diseases as well (4). Eating variety of fruits and vegetable are helpful in creating activities against chronic diseases. Such as dill, horseradish, tomatoes, berries, mango,

passion fruit and nuts, which are able to prevent stroke and neurological disease caused by the degeneration and death of nerve cells (4).

Inadequate fruits and vegetable intake (FVI) is a problem that burdens many countries, however the factors related to low FVI may differ by geographic regions and sub populations. World Health Organization (WHO) defines that inadequate FVI as eating less than 400 grams or 5 servings daily (4). And examined the global variability of fruits and vegetable consumption across 52 low and middle income countries and found that in most countries the adults population about 80% inadequate FVI (5). The review also found that urban living, age, sex and income were the most common factors associated with inadequate FVI. A similar consumption level in adults residing in more developed countries like the U.S. and Australia has also been found (6).

Every year many Thai population die from cancer, more than 50,000 cases of colon cancer ranks third behind lung and breast cancer. In addition, Thailand has many diabetics who number over 3 million subscribers and more than 10 million high-risk due to the excessive amount of sugar in the blood. These are serious risk that threatens the lives of people in Thailand. Mostly of diabetics were caused by environmental hazards, imbalanced diet; eating foods with starch, fat, sugar, and too much meat, fruits and vegetable intake is less (7-8). Inadequate nutrition, including poor consumption of fruits and vegetable, will automatically put an older adult at greater risk for short and long-term health problems. These include eating disorders, obesity, cardiovascular problems, diabetes, asthma, and joint problems (7-8).

The World Health Organization (WHO) recommends an intake of a minimum of 400 g or five servings of fruits and vegetable daily for the prevention of chronic diseases, such as heart diseases, cancer, diabetes, and obesity (4). The World Health Survey in 2002-2003 has shown that prevalence of inadequate fruits and vegetable consumption from 52 low- and middle-income countries are 77.6% men and 78.4% women (5). Also in Thailand the prevalence is 84% men, 79% women in (5).

Increased consumption of fruits and vegetable has been recommended as a key component of a healthy diet for the prevention of chronic diseases (8) . Factors that can reduce the occurrence of these diseases could contribute to important improvements in health and longevity. In recent years, there has been growing evidence that fruits and vegetable consumption is related to mortality, including mortality from cardiovascular disease and cancer (9-13). However, are not entirely consistent. The study show that no significant differences in risk of mortality were observed between vegetarians and non-vegetarians in a British population (14). There exists much uncertainty about the dose-response relation between consumption and the risk of mortality, especially for cancer, as recent large prospective studies have found no or minimal effects of consumption on overall cancer incidence or mortality (15-16).

It has also studied trends in four countries of Southeast Asia, including Thailand, Vietnam, Indonesia and the Philippines (17). The statistics in the past 10 years, and the trends of food consumption in the four countries are similar, similarities are eating fruits and vegetables, less obviously, from 2001 onwards, eating flour, sugar, fat, and meat also increased people diets (17). Thailand also followed a trend to eat more starchy foods like potatoes, so the amount of green leafy vegetables, fruit eaten each day decreased drastically (18).

The study by Thailand National Health Examination Survey III reported the population in Thailand is inadequate consumption of fruits and vegetable similar other countries (19-20). The previous study reveals that the majority of Thai population are inadequate consumption of fruits and vegetable daily. Only 36.5% of Thai population are adequate consumption of fruits and vegetable on a daily (20). In comparison with data obtained from Thailand National Health Examination Survey III and IV (19, 21), the current study showed that Thais have increased their fruits and vegetable intake slightly from Thailand National Health Examination Survey III. Food intake data collected using the weighing method and 24 hour dietary recall showed that Thais consumed 1.06, 1.33 and 2.40 servings daily for fruit, vegetables and fruit plus vegetables, respectively (19). Thailand National Health Examination Survey IV reported only 0.96 servings for fruit, 1.42 for vegetables and 2.38 for fruit plus vegetables consumed each day (21). This may indicated that

different strategies conducted in recent years are inefficient. Therefore, fruits and vegetable consumption habits of the people, has to be change in Thailand.

Inadequate of fruits and vegetable consumption in Thailand is cause of loss health and has an effect on the incidence of non-communicable diseases such as diabetes, cardiovascular disease and cancer, as multiple studies have shown (22). Fruit and vegetable intake of at least 400 grams daily can reduce the risk of heart disease and cancer are 33 and 50 percent, respectively, compared with those who consumed less fruits and vegetable (4).

Nowadays older adults are the fastest growing segment of the worlds population. And older adults are increased of chronic condition (such as diabetes, heart disease, and cancer) and specific geriatric condition (such as cognitive impairment, frailty, and fall.) (10). As above many study reveal that fruits and vegetable consumption can be help to reduce those disease, so the older adults are target population in this research. From the literature review only touches upon the complexity of older adults eating behavior, demographic factors, the household environment and personal characteristics all have an influence on older adults' consumption of FV, but there is a few research that determine socio-demographic factors, life style factors, anthropometric factors and health stage-related factors and risk factor to fruits and vegetable intake in older adults in Thailand.

The finding will be useful for public education and campaigns on adequate intake of fruits and vegetable, and also for planning and policies. And recommendation for practice and policy are discussed.

## **1.2 Research questions**

1.2.1 What is the prevalence of insufficient fruit and vegetable intake among adults aged 50 years and older in the communities of Thailand?

1.2.2 What are the factors associated with insufficient fruit and vegetable intake among adults aged 50 years and older in the communities of Thailand?

## **1.3 Research objectives**

### **1.3.1 General objectives**

To describe the prevalence of insufficient fruit and vegetable intake, and examine factors associated with insufficient fruit and vegetable intake among adults aged 50 years and older in the communities of Thailand.

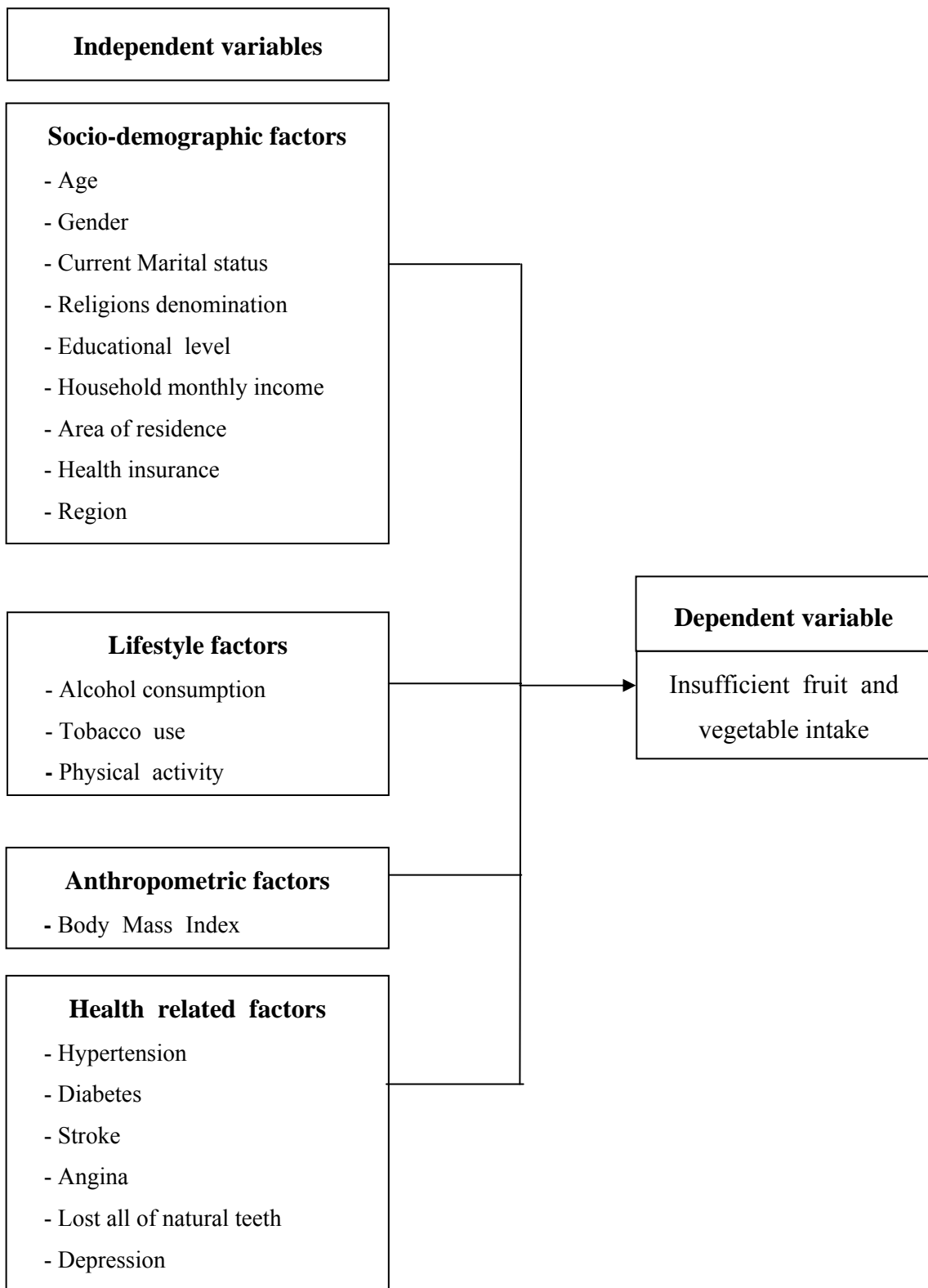
### **1.3.2 Specific objectives**

1.3.2.1 To describe the prevalence of insufficient fruit and vegetable intake among adults aged 50 years and older in the communities of Thailand.

1.3.2.2 To describe the socio-demographic factors, lifestyles factors, anthropometric factors, and health related factors to action regarding to fruit and vegetable intake among adults aged 50 years and older in the communities of Thailand.

1.3.2.3 To examine factors associated with insufficient fruit and vegetable intake among adults aged 50 years and older in the communities of Thailand.

## 1.4 Conceptual framework



**Figure 1.1:** Conceptual Framework based

## 1.5 Operational definitions

Based on the conceptual framework, the operational definitions of the variables are as follows:

### 1.5.1 Dependent variable

**Fruit and vegetable intake:** refers to the fruit and vegetable status among adult aged 50 years and older in community of Thailand who participated in the study in 2016. The questionnaire were asked about fruit and vegetable consumption was assessed using two questions ‘How many servings of fruit do you eat on a typical day?’ and ‘How many servings of vegetables do you eat on a typical day?’ using the 24 hour dietary recall data as the gold standard. Insufficient FV intake was defined as less than 5 serving or 400 grams of fruit and vegetable daily.

### 1.5.2 Independent variables

#### 1.5.2.1 Socio-demographic factors

**a. Age:** refers to the age in years at last birthday of the respondents.

**b. Gender:** refers to the respondents’ gender; male or female.

**c. Current Marital status:** refers to current marital status of the respondents; never married, currently married, cohabiting, separated/divorced or widowed.

**d. Religions denomination:** refers to religious denomination of the respondents.

**e. Education level:** refers to the highest level of education completed.

**f. Household income:** refers to total income from all people living in a respondent household. Income refer not only to the salaries and benefits received but refer to income from all sources include salary, bonuses, investment income, rents, royalties, etc.

**g. Area of residence:** refers to the type of resident that the respondents live in; inside or outside municipality.

**h. Health insurance:** refers to the main type of the health insurance coverage in Thailand health system that divided to universal coverage, social security, public welfare, and voluntary insurance.

**i. Region:** refers to current home land of people who are living in every part of Thailand.

#### **1.5.2.2 Lifestyles factors**

**a. Alcohol consumption:** refers to the alcohol use status. The questionnaires will be asked about alcohol consumption in the past 3 month only.

**b. Tobacco use :** refers to tobacco use status. The questionnaires will be asked about tobacco use in the past 3 month only.

**c. Physical activity :** refer to level of physical activities. This instrument gathers information on physical activity in three domains (activity at work, travel to and from places, and recreational activities), as well as time spent sitting. The questionnaire also assesses vigorous and moderate activities performed at work and for recreational activities. And to classify respondents into three categories of low, moderate ,and high level of physical activities.

**1.5.2.3 Anthropometric factors:** refers to the respondent's Body Mass Index (BMI), height and weight were measured.

**1.5.2.4 Health related factors:** refers to the chronic condition disease of respondents. The questionnaires will be asked about “ Have you ever been diagnosed with chronic condition ? ”. In this study, health-related factors include chronic condition (Diabetes, Hypertension, Stroke, Angina, Lost all of natural teeth and Depression) among the respondents that have been diagnosed.

## **CHAPTER II**

### **LITERATURE REVIEW**

The literature review will cover:

- 2.1 Global ageing
- 2.2 Overview fruit and vegetable intake
- 2.3 Health problems in elderly
- 2.4 Related studies
- 2.5 Summary

#### **2.1 Global ageing**

Ageing globally impacts all countries, previous global estimates of elderly people has shown that over 15% of the current global older population, and will increase to reach 23% in 2030 (23). Fruits and vegetables are important components of a healthy diet, since they have low energy density and are sources of micronutrients, fiber, and other components with functional properties (24). Increased fruit and vegetable consumption can also help displace food high in saturated fats, sugar or salt. Low fruit and vegetable intake is among the top 10 risk factors contributing to mortality. Up to 2.7 million lives could potentially be saved each year with sufficient global fruit and vegetable consumption (4). Increased fruit and vegetable intake as part of the daily diet, could help prevent major chronic non-communicable diseases (NCDs). Worldwide, low intake of fruit and vegetable is estimated to cause about 31% of ischemic heart disease, 11% of strokes, and about 19% of gastrointestinal cancer (3-4). Of the global disease burden attributed to low fruit and vegetable consumption, about 85% is due to cardiovascular diseases and 15% to cancer (3). The World Health Survey in 2002-2003 showed that over three-fourth of men and women from 52 low and middle-income countries consumed less than the minimum recommended 5 daily servings of fruit and vegetable (5).

## **2.2 Overview fruit and vegetable intake in older adults.**

### **2.2.1 Epidemiology of fruit and vegetable intake.**

Worldwide, low consumption of fruits and vegetables contributes significantly to the global disease burden, including cardiovascular diseases and cancer (3). The World Health Organization (WHO) (4) recommends an intake of a minimum of 400 g or five servings of FVs per day for the prevention of chronic diseases, such as heart diseases, cancer, diabetes, and obesity. The World Health Survey in 2002-2003 has shown that prevalence of inadequate fruits and vegetable consumption from 52 low and middle-income countries are 77.6% men and 78.4% women (5). In several Asian (INDEPTH, International Network for the Demographic Evaluation of Populations and Their Health, in developing countries) Health and Demographic Surveillance System sites, inadequate fruit and vegetable (FV) intake was found to be more than 89% in men and 96% in women in Bangladesh, 96% in men and 92% in women in Indonesia, and more than 84% in men and more than 79% in women in Thailand (25). However, little is known about the frequency, distribution, and determinants of fruit and vegetable (FV) consumption among older adults in South Africa. Previous studies among the adult population in South Africa in 2003 found that 72.2% of men and 66.7% of women had low FV consumption (25) and in a local study, 7% of the villagers and none of the semi-urban dwellers reported the recommended five or more fruit and vegetable FV servings per day (26). In a more recent study among adults (25-64 years) in Mozambique, less than 5% of the subjects reported an intake of five or more daily servings of fruits and vegetables (FVs) (27). In Iran, a middle-income country, low mean number of fruit and vegetable (FV) servings per day (1.76) among persons aged 60 and above were reported (28), while in some high-income countries, lower rates of fruit and vegetable (FV) intake was found among older adults, for example, 47% in Canada (29) and a mean consumption of 4.0 and 4.1 portions of fruits and vegetables (FVs) per weekday.

### **2.2.2 Fruit and vegetable intake in Thai people**

As indicated by Thailand National Health Examination Survey III and IV reports, the population in Thailand like in other countries consumes low amounts of fruit and vegetables (19,21). The Thai National Health Examination Survey III (NHESIII) is a nationally representative cross-sectional survey using multistage, stratified cluster sampling reveals that the majority of Thai individuals consumed less fruit and vegetables daily than the recommended intake levels. Only 36.5% and 68.0% of Thais ate fruit and vegetables on a daily basis (20). In comparison with data obtained from the Thai National Health Examination Survey III and IV(19,21) shows that Thais have increased their fruit and vegetable intake slightly. From the Thai National Health Examination Survey III, food intake data collected using the weighing method and 24 hour dietary recall showed that Thais consumed 1.06, 1.33 and 2.40 servings daily for fruit, vegetables and fruit plus vegetables, respectively (19). The Thai National Health Examination Survey IV reported only 0.96 servings for fruit, 1.42 for vegetables and 2.38 for fruit plus vegetables consumed each day (21).

### **2.2.3 Nutrition in older people**

Diet and nutrition are important factors in the promotion and maintenance of good health throughout the entire life course. Their role as determinants of chronic NCDs is well established and they therefore occupy a prominent position in prevention activities (4).

The burden of chronic diseases is rapidly increasing worldwide. It has been calculated that, in 2001, chronic diseases contributed approximately 60% of the 56.5 million total reported deaths in the world and approximately 46% of the global burden of disease (4). The proportion of the burden of NCDs is expected to increase to 57% by 2020. Almost half of the total chronic disease deaths are attributable to cardiovascular diseases; obesity and diabetes are also showing worrying trends, not only because they already affect a large proportion of the population, but also because they have started to appear earlier in life(4).

Diet has been known for many years to play a key role as a risk factor for chronic diseases(2). What is apparent at the global level is that great changes have

swept the entire world since the second half of the twentieth century, inducing major modifications in diet, first in industrial regions and more recently in developing countries (4). Traditional, largely plant based diets have been swiftly replaced by high-fat, energy-dense diets with a substantial content of animal-based foods. But diet, while critical to prevention, is just one risk factor. Physical inactivity, now recognized as an increasingly important determinant of health, is the result of a progressive shift of lifestyle towards more sedentary patterns, in developing countries as much as in industrialized ones(3). Recent data from Sa~o Paulo, Brazil, for example, indicate that 70-80% of the population are remarkably inactive (30). The combination of these and other risk factors, such as tobacco use, is likely to have an additive or even a multiplier effect, capable of accelerating the pace at which the chronic disease epidemic is emerging in the developing countries (30).

There are three critical aspects relating to chronic diseases in the later part of the life-cycle: (i) most chronic diseases will be manifested in this later stage of life; (ii) there is an absolute benefit for ageing individuals and populations in changing risk factors and adopting health-promoting behaviors such as exercise and healthy diets; and (iii) the need to maximize health by avoiding or delaying preventable disability. Along with the societal and disease transitions, there has been a major demographic shift. Although older people are currently defined as those aged 60 years and above (31), this definition of older people has a very different meaning from the middle of the last century, when 60 years of age and above often exceeded the average life expectancy, especially in industrialized countries. It is worth remembering, however, that the majority of elderly people will, in fact, be living in the developing world. Most chronic diseases are present at this period of life --- the result of interactions between multiple disease processes as well as more general losses in physiological functions (32). Cardiovascular disease peaks at this period, as does type 2 diabetes and some cancers. The main burden of chronic diseases is observed at this stage of life and, therefore, needs to be addressed. Changing behaviors in older people in the 1970s, it was thought that risks were not significantly increased after certain late ages and that there would be no benefit in changing habits, such as dietary habits, after 80 years old (33) as there was no epidemiological evidence that changing habits would affect mortality or even health conditions among older people. Liu et al. (34)

have reported an observed risk of disease among older women that was approximately 30% less in women who ate 5-10 servings of fruits and vegetables per day than in those who ate 2-5 servings per day. It seems that, as elderly patients have a higher cardiovascular risk, they are more likely to gain from risk factor modification (35). Although this age group has received relatively little attention as regards primary prevention, the acceleration in decline caused by external factors is generally believed to be reversible at any age (31). Interventions aimed at supporting the individual and promoting healthier environments will often lead to increased independence in older age.

#### **2.2.4 Health benefit of fruits and vegetables**

Diets high in fruits and vegetables are widely recommended for their health-promoting properties. Fruits and vegetables have historically held a place in dietary guidance because of their concentrations of vitamins, especially vitamins C and A; minerals, especially electrolytes; and more recently phytochemicals, especially antioxidants. Additionally, fruits and vegetables are recommended as a source of dietary fiber (36).

#### **2.2.5 Recommendation Fruit and Vegetable intake**

WHO/FAO recommends intake of a minimum of 400 grams or 5 servings of fruits and vegetables per day for the prevention of chronic diseases such as heart diseases, cancer, diabetes, and obesity. There is convincing evidence that consumption of fruits and vegetables decrease the risks of cardiovascular disease, obesity, and diabetes (4). In spite of the growing body of evidence which highlights the protective effect of fruits and vegetables.

### **2.3 Health outcomes associated with fruit and vegetable intake among older adults**

Most research studies offer support that a positive relationship exists between fruit and vegetable intake and health outcomes across the lifespan, including the prevention and management of chronic illnesses, disease-specific mortality, and

general mortality. However, the extent to which eating fruit and vegetables in elderly is associated with these health benefits has received much less attention. As older adults have unique social and health circumstances, more research is needed in this area generally to provide necessary evidence for lifestyle-based interventions among older adults. This section reviews the findings from research studies that examine the health-related benefits of fruit and vegetable intake among older adults (10).

### **2.3.1 Mortality**

Research has effectively linked fruit and vegetable intake to reduce risk of mortality among older adults. Studies have found that fruit and vegetable intake promotes a longer lifespan and reduce the risk of disease-specific and all-cause mortality, whether intake is measured by self-report, food frequency questionnaires, or serum carotenoid levels in the blood (12-13, 37-38). Fruit and vegetable intake is also predictive of disease-specific mortality, such as cancer-and cardiovascular-specific mortality (12).

### **2.3.2 Chronic diseases**

Nutrition is linked to the function and quality of life for older adults with chronic disease (39-41) Fruit and vegetable intake during older adulthood is associated with reduced likelihood of chronic disease (42). A number of studies offer support to the linkage between fruit and vegetable intake during older adulthood and cardiovascular health. These dietary characteristics are protective against hypertension (13, 42), coronary heart disease (42-44), atherosclerosis (45), and stroke among older adults. Research also suggests fruit and vegetable intake in older adulthood is protective against the development or exacerbation of several kinds of cancer for men and women (12, 46-49).

### **2.3.3 Geriatric conditions and functional impairments**

Emerging research suggests that fruit and vegetable intake in older adulthood can prevent against the onset or exacerbation of cognitive impairment, falls/walking disability, and other geriatric associated conditions. Research has begun to examine the role of fruit and vegetable consumption in the aging brain. Emerging

evidence indicates that fruit and vegetable intake is protective against cognitive decline and related conditions. Several prospective studies found that participants who consume greater levels of fruits and vegetables scored higher on cognitive and neuropsychological evaluations (50) and showed improvements in verbal fluency, memory, and rate of learning from such dietary changes (10). In addition, a Mediterranean-style diet that is rich in nuts, oils, fruits, and vegetables has also been shown to be predictive of good heart health and of cognitive benefit for risk reduction of Alzheimer's disease and dementia (51). Older adults who maintain physical function and avoid falls are less likely to be hospitalized or institutionalized and may have reduced risk of injury and mortality. While this field of research has only recently begun to emerge, studies have suggested that fruit and vegetable intake protects against physical decline and associated disability. Higher serum carotenoid levels predict improved muscle strength and bone density among older adults (52). Fruit and vegetable consumption has also been found to improve physical function and walking speed while reducing walking disability and frailty among elders (52-53).

Older adults who maintain physical function and avoid falls are less likely to be hospitalized or to require assisted living. There is evidence that fruit and vegetable consumption could protect against the onset or progression of other geriatric conditions. This is demonstrated by the discovery of a moderate association with a decrease in cataracts for older women (54). Increased intake has also been connected to increased vaccination antibody response (55) and may be a risk reduction factor for inflammation with specific regard to fruit and vegetable intake variety, rather than quantity (52, 56). Associated health outcomes of a diet rich in fruits and vegetables appear to be largely positive, though further research might be conducted to determine the effects of different fruit and vegetables on elders of various social and cultural backgrounds as a foundation for appropriate intervention strategies.

## **2.4 Related studies**

The purpose of this section discusses about the associated studies between independent and dependent variables. Therefore, in this section particularly, discusses about the variables in the conceptual framework which been addressed in literature.

### **2.4.1 Socio-demographic factors.**

Various socio-demographic factors from vary study designs have found to be associated with fruit and vegetable intake among elderly people including;

**Age** : Age was significantly associated with the prevalence of insufficient fruit and vegetable consumption. The research entitled “nutrition patterns of fruit and vegetable consumption and the influence of sex, age and socio-demographic factors” study which was conducted in elderly Canada (65 years and older) found that younger males to consume less fruit and vegetable than older males (29). Some studies conducted in elderly Iran found that the prevalence of low FV intake tended to increase with age (19-21, 28). However, a study reviewed from Europe showed that age also appears influencing fruit and vegetable intake. In

children and adolescents, FV consumption tends to decrease with age (57). In adults, the relation between age and FVI is inversed, intake levels increase with age.

**Gender**: Several studies to found that influence prevalence rate of insufficient fruits and vegetables consumption. A study conducted in older adults in South Africa revealed that prevalence of insufficient fruit and vegetable consumption was significantly lower in men than in women (male 64%,female 71.4%) (26). In general, girl and woman consume larger amounts of fruit and vegetables than do boys and men (57-60). Thailand National Health Examination Survey III, IV found that intake amounts of fruits, vegetables and fruit plus vegetables were lower among males (20).

**Current marital status** : Marriage is positively associated with fruit and vegetable intake among older men and older women. A study of the relationship between marriage and fruit and vegetable intake in Canada found that older adults who were married were most likely to achieve recommended portions (48%), followed by seniors who were widowed, divorced, or separated (46%), and by seniors who were single or in a cohabiting common-law relationship (43%) (61). Single men are at particularly high risk of low intake (62). Marriage is particularly beneficial for older mens' fruit and vegetable intake, and the presence of a woman in the household is associated with higher fruit and vegetable intake of male household members (62). However, the benefits of marriage for fruit and vegetable intake are difficult to separate from the benefits related to companionship and eating meals together (61).

The experience of widowhood heightens risk of inadequate diet for both men and women. Older women are more likely to confront different barriers than are older men following the death of a spouse. Widowers are at risk because they often lack skills in the process of choosing and preparing nutrient-rich foods if this was previously their spouse's domain (62). Following the death of a spouse, women are particularly socioeconomically vulnerable and at risk of social isolation. Older women, who might be more accustomed to cooking for others, are often less inclined to prepare food and cook complete meals for themselves a process that might be reserved for shared special occasions (63).

Four studies from Thailand, South Africa, Iran, and Canada focus that marital status were other important contributing factors for fruit and vegetable intake in the elderly (20, 26, 28, 29)

**Religion denomination:** There are differences in fruit and vegetable consumption across the lifespan by race/ ethnicity, as defined by respondents and according to U.S. census categories. In the United States, African Americans are less likely to meet recommended intake of fruits and vegetables than non-Hispanic whites and Hispanics/Latinos. On average, African American adults consume nearly one serving of fruits or vegetables less than do non-Hispanic whites or Hispanics/Latinos (64). These disparities continue in old age; older African Americans are at heightened risk of low fruit and vegetable intake. Racial/ethnic differences are partly due to individual and neighborhood-level socioeconomic status (64-66) however, research studies suggest that this relationship remains even after taking socioeconomic status into consideration (67-68).

**Education level:** There are many studies supporting a relation between education level and fruit and vegetable intake (25-26, 29, 62, 69-70). Better educated adults show higher vegetable consumption. Besides the financial aspect just mentioned higher education generally means higher income this could be related to greater knowledge and awareness of healthy eating habits in those with higher education levels. It is also likely that certain values, ideals and social influence linked to education and income levels influence eating behaviors, including fruit and vegetable consumption.

**Household monthly income:** Elders with lower individual and household educational attainment are at heightened risk of not eating daily recommended values. Individual and household income level also predicts intake. In a recent study on income differences in eating patterns among older adults, individuals in the low and medium household income groups ate significantly fewer fruits and vegetables than those in the higher income group (0–350% of poverty) to those in medium and higher income groups (above 350% of poverty). Fruit intake was progressively higher by income group as well (10). Income has been widely researched as a major determinant of dietary patterns. The majority of the studies included in this review were from Thailand, South Africa, Iran and Canada (20, 26, 28, 29).

**Area of residence:** Health disparities in the United States are at least partially explained by differences in food access by geographic location. Stark disparities exist in urban environments where access to fresh fruits and vegetables varies by neighborhood, with greater access in more affluent and predominantly white neighborhoods. Food stores in less affluent and in minority-segregated communities tend to have fewer fresh food options available (71). The physical environment and food culture influences consumption. For example, older adults eat more servings of fruit and vegetables in regions where the Mediterranean diet is predominant, particularly in Spain, Italy, and Greece. In contrast, older adults living in rural areas of the United States face unique challenges in accessing fruits and vegetables. If unable to drive, rural elders have limited transportation options to food stores, and greater distance to such stores has been found to result in lower fruit and vegetable intake among rural elders. Further, government programs that provide food to older adults have less reach in some rural areas due to lower tax bases and demanding transportation requirements for community volunteers. Therefore, older adults living in urban and rural settings confront unique, and different, barriers to fruit and vegetable consumption (10). The elderly live in a rural area was significantly associated to the prevalence of inadequate fruit and vegetable consumption (20, 26).

**Health insurance:** No research was found the relation between health insurance and fruit and vegetable intake.

**Region:** The rate of regular fruit and vegetable intake varied greatly between different regions of the country. It was highest in the state capitals in the

southern region (36.5%) and lowest in the state capitals of the northern region (11.9%). The city with the lowest frequency of consumption was Macapá (Amapá) (7.8%), while Porto Alegre (Rio Grande do Sul) presented the highest frequency (38.6%) (Despite the regional differences, only a small proportion of the population living in the Brazilian state capitals reported adequate fruit and vegetable intake, ranging from 2.4% in Rio Branco (Acre) to 10.5% in Porto Alegre (Rio Grande do Sul). The pattern of higher consumption among women was observed in most of the state capitals, especially in relation to regular consumption of both fruits and vegetables (10).

#### **2.4.2 Lifestyle factors**

Alcohol consumption, tobacco use, and physical activity, an individual's health status can be a consequence of his/her lifestyle, which also influences his/her food preferences. Female smokers consumed less fruit and vegetable, which may indicate that they place less value on their long-term health status. Healthy people try to eat more nutritious foods, which encourages fruit and vegetable consumption. Obese people tend to underestimate their food intake, including F&V consumption. However, optimistic bias-people believing they are less at risk than others for overeating, can also result in overestimation of fruit and vegetable consumption (72).

**Alcohol consumption :**In general, girls and younger consumed fruit more often and soft drinks less often. Significant between-school, between-country and between-region differences were found. Fruit consumption increased with family material wealth and higher parental occupational status. Soft drink consumption was lower among pupils of higher parental occupational status in Northern, Southern and Western European countries, but not in Central and Eastern European countries. Only in Central and Eastern European countries was a significant increase in soft drink consumption with increasing family affluence found. The country level of family affluence did not seem to have an effect on either outcome variable (73).

**Tobacco use:** The most consistent association of vegetable and fruit consumption has been observed with tobacco smoking. The above mentioned studies on lifestyle factors reported lower vegetable and fruit intake among smokers. A consistent pattern of greater intake of fruits and/or vegetable among non-smokers has

been also reported in the UK, the Netherlands, Spain, among Norwegian workers, and in the National Health and Nutrition Examination Survey (NHANES) II study for different age groups. In Spain (74) study the inverse association with smoking was only evident for fruits, with a remarkably low level of intake for current smokers. As far as vegetables are concerned, the main result is the increased level of consumption among ex-smokers. Most previous studies also showed greater differences for smokers for fruit rather than for vegetable intake. It seems that healthy and unhealthy habits tend to cluster; in particular, heavy smokers have shown the most unhealthy dietary profiles. It has been suggested that some physiological properties of tobacco smoking, affecting taste and smell, could modify food preferences (74). Alternatively, quitting smoking might go together with favorable changes in other lifestyle factors, including diet, because of an increase in health consciousness. The increased intake of vegetables in former smokers in this study, also observed in the Dutch study among women, points in this direction. However, a prospective study in the UK did not observe substantial changes in vegetable and fruit intake 1 year after cessation, compared with those who continued to smoke (74).

**Physical activity:** A conducted study in older New Zealand (75) demonstrates important associations between the selected measures of physical activity and demographic and lifestyle risk factors. Consistent with numerous other studies, women were less likely than men to take part in regular or vigorous activity, with a decline in physical activity in terms of all 4 measures across the age groups studied. Although not consistent across all 4 measures of activity investigated, the significantly higher rates of physical activity for nonsmokers, individuals of healthy weight, and those with sufficient intake of fruit and vegetables demonstrate a clustering of health behaviors in relation to a consistently positive association between lifestyle risk factors and physical activity (75).

### **2.4.3 Anthropometric factor:**

The purpose of Florida study was to compare body mass index (BMI), Intake of fruits and vegetables, smoking, and physical activity in residents of the 7 Florida counties with the highest reported BMI to residents of the 7 Florida counties with the lowest reported BMI utilizing 2002 data from the Florida Department of

Health Behavioral Risk Factor Surveillance System (76). Results showed that survey respondents in counties with the lowest mean BMI ( $>25\text{-}\leq 30$ ) consumed significantly more fruits and vegetables, compared to respondents in counties with the highest BMI (76). A positive relation between mean BMI and consumption of fruits and vegetables remained when controlled for physical activity, but not for smoking. Education about the importance of increased fruit and vegetable consumption, as well as physical activity, are important factors in the campaign against obesity. The overall findings indicated that respondents in the seven counties in Florida with the lowest mean BMI consumed significantly more fruits and vegetables than respondents in the seven Florida counties with the highest mean BMI,  $\chi^2 = 89.0$ ,  $p < .001$ . A positive relation between mean BMI and consumption of fruits and vegetables remained when controlled for physical activity, but not for smoking. This suggests that exercise and consumption of fruits and vegetables may positively affect weight, but smoking had a greater effect than consumption of fruits and vegetables. However, other risks associated with smoking must be considered in overall health (76).

#### **2.4.4 Health related factors.**

Older adults are at heightened risk of functional limitations, disability, and chronic disease onset and complications. While fruit and vegetable intake protects against the development and exacerbation of these conditions, ironically, being affected by these conditions makes accessibility, preparation, and consumption of these important nutrients problematic. Old age is often accompanied by changes in appetite, and compromised oral health could reduce fruit and vegetable intake. Appetite loss is influenced by changes in perception of hunger (77), taste acuity, and sense of smell (78). Older adults suffer from gum disease, tooth loss, decay, and mouth infections. Compromised oral and dental health is associated with decreased consumption of fruits and vegetables. Older adults typically eat fruit and vegetables in their whole form (40), and textures of these foods become difficult to bite, chew, swallow, and prepare, particularly among older adults who are missing posterior teeth and/or have dentures. In sum, older adults are particularly affected by certain physiological changes related to appetite and oral health, which in turn influence

nutrient intake. Older adults who have functional limitations and disabilities confront unique barriers in acquiring, preparing, and consuming foods. Mobility-impaired older adults, in particular, confront challenges in accessing fresh fruits and vegetables (29), and home-bound older adults who must rely on home-delivered meals or other assistance are particularly vulnerable to under-nutrition. Physical health decline is typically accompanied by a subsequent deterioration in dietary quality. This association is explained by reduced access to fruits and vegetables as well as more difficulty in preparing and eating nutrient-rich foods. For example, older adults with severe arthritis are confronted by challenges in the physical requirements of cooking as well as the effort required to take part in food related social activities. One possible exception is that adults-young and old tend to increase fruit and vegetable intake after diagnosis of cancer. Several studies have found that fruit and vegetable intake increases after diagnosis of breast, prostate, and colorectal cancer (48). Studies have found that these diet changes are often due to personal beliefs and preferences (such as having control over that aspect of their lives) rather than in response to a doctor or other provider's recommendation (10). Unlike some other studies, in South Africa study did not find low physical activity, alcohol use, weight status, diabetes, hypertension, depressive symptoms, and poor subjective health status to be associated with inadequate FV intake (26).

## **2.5 Summary**

Low fruit and vegetable consumption is an important risk factor for the burden of disease. From these literature reviews, several lessons have been learned about factor associated with insufficient of fruit and vegetable intake among older adults. The lesson learnt included:

The first, even though the prevalence of insufficient fruit and vegetable intake shows positive trend in global level including low and middle income countries. Fruit and vegetable in the elderly population worldwide trend is lower recommended. More research is needed to the find the effective interventions to promote FVI among elderly.

The second, literature reviews shows that inadequate fruit and vegetable intake is a significant and increasing risk factor for the global burden of mortality. It was known that inadequate fruit and vegetable intake was a major contributing factor in for the occurrence of non-communicated disease such as stroke, coronary heart disease, diabetes, and cancers. Numerous studies support the protective effect to high fruit and vegetable consumption on chronic disease risk, mainly against cancer and cardiovascular disease.

The third, the increasing of fruit and vegetable intake among older adult is affected by multiple factors. Further, many of literatures reviews that at positive fruit and vegetable intake was significant associated with socio-demographic factors such as age, gender, current marital status, religions domination, education level, household income, area of residence, health insurance and region, lifestyle factors include alcohol consumption, current tobacco use, physical activity, BMI, and health related factors. In Thailand, Predictors of being in included female gender, age groups, married, family factor, living in urban, high household income, high education level.

The Last, no single factor could explain the reason in behavior change. Thus in order to implement the effective approach for prevent low fruit and vegetable consumption among older adult in district health system of Thailand, it is very important to have reliable statistics about the situation and understand the factors influencing fruit and vegetable consumption in order to design appropriate interventions.

## CHAPTER III

### RESEARCH METHODOLOGY

#### 3.1 Study design

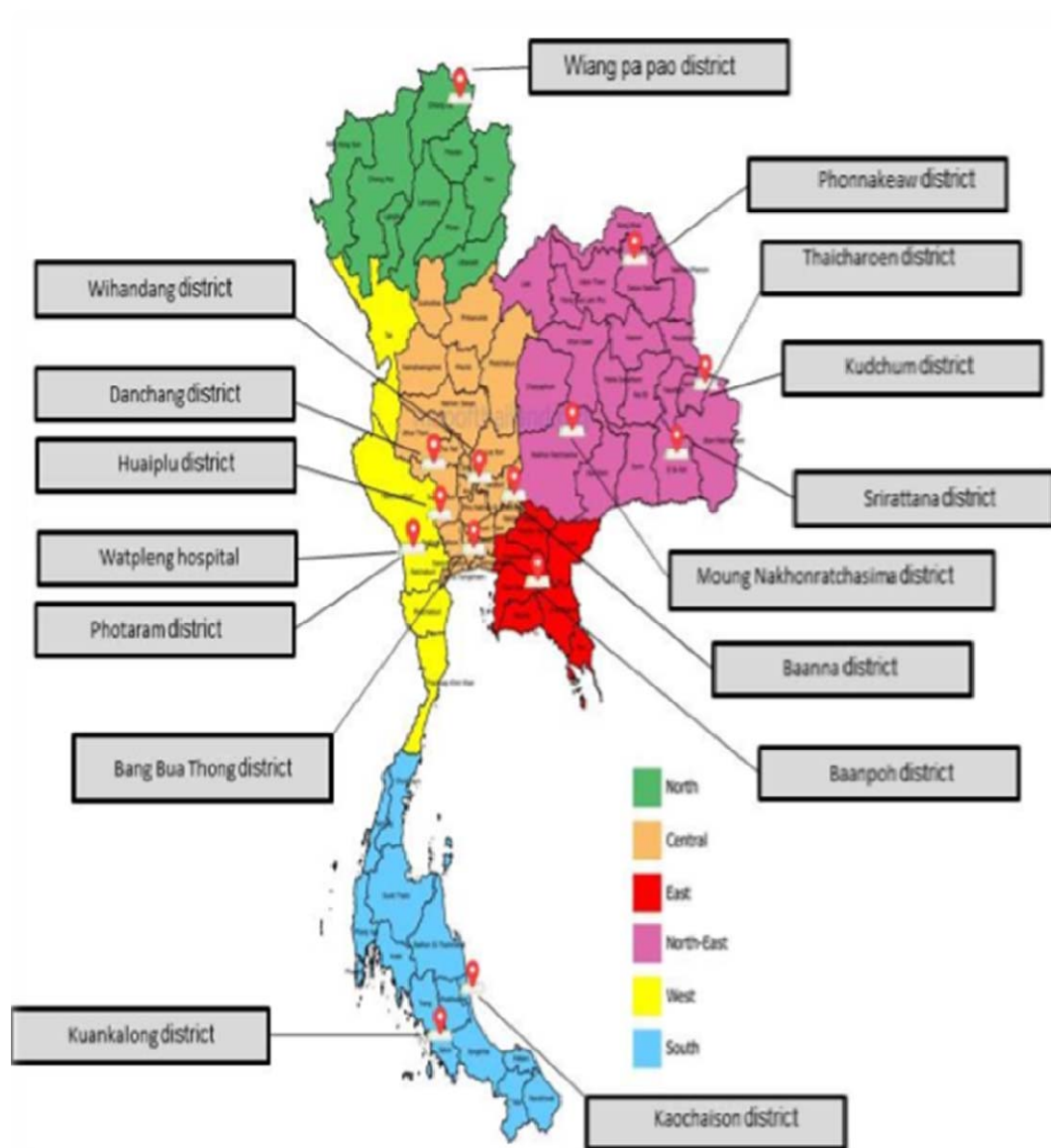
A cross-sectional survey study was conducted to describe the prevalence of insufficient fruits and vegetable intake and identify factors associated with insufficient fruit and vegetable intake among adult aged 50 years and older in the communities Thailand. The data was collected through a face to face interview using a structured questionnaire with permission of all respondents.

#### 3.2 Study area

Six-teen districts from fourteen provinces across different regions of Thailand were purposively selected which represented in table 3.1 below ;

**Table 3.1:** The study sites by regions of Thailand.

Region	Study area
Northern	Chiang rai province (Wiang pa pao district)
North Eastern	Nakhonratchasima province (moung district), Sisaket province (Srirattana district), Sakonnakorn province (Phonnakeaw district), Yasothon province (Thaicharoen district, Kudchum district)
Central	Nakhonpathom province (Huaiplu district), Nakhonnayok province (Baanna district), Nontaburi province (Bang Bua Thong district), Saraburi province (Wihandang district), Supanburi province (Danchang district)
Eastern	Chachoengsao province (Baanpoh district)
Western	Ratchaburi province (Photaram district, Watpleng district)
Southern	Pattalung province (Kaochaison district), Satul province (Kuankalong district)



**Figure 3.1:** Data collection sites, sixteen districts from fourteen provinces across different regions of Thailand.

### 3.3 Study population

The target population for this study is adults aged 50 years and older who have Thai citizen. The following statements describe the selection criteria.

#### 3.3.1 Inclusion Criteria

- 1) Thai citizen.
- 2) All persons aged 50 years and older who live in selected districts at least 6 months.
- 3) Respondents who were willing to participate the study.

#### 3.3.2 Exclusion Criteria

1. Respondents who could not be able to communicate.

### 3.4 Sample size determination

The sample size was calculated using fruit and vegetable intake prevalence of the older adults in Thailand were 79.2% (21), confidence interval of 95% and the acceptance error of 1.4% (Age between 60-69). The calculation of the sample size was described below.

$$n = \frac{Z^2 (p (1-p))}{d^2}$$

$$\text{Thus } n = \frac{1.96^2 (0.792)(1-0.792)}{0.014^2}$$

$$= 3229$$

Z = standard normal score, 1.96 in case of 95% confidence interval.

P = The prevalence of fruits and vegetable intake fruits in older adults in Thailand were 79.2 % (21)

d = precision error set at 0.014

Replacement procedure if subjects withdraw from the study 20% of the sample size was added into sample size since there is possibility that some participants would withdraw from this study. The sample size was increased to 3875 persons.

The required sample size of this study in the communities of Thailand is 3875 persons aged 50 years and older. All persons aged 50 years and older in the selected district was interviewed. In each of the 16 districts, 243 patients aged 50 years and older was recruited consecutively, as they are in the district .

### 3.5 Sampling technique

Multi-stage cluster sampling was applied to sixteen districts of Thailand which were represented below: (Figure 3.2)

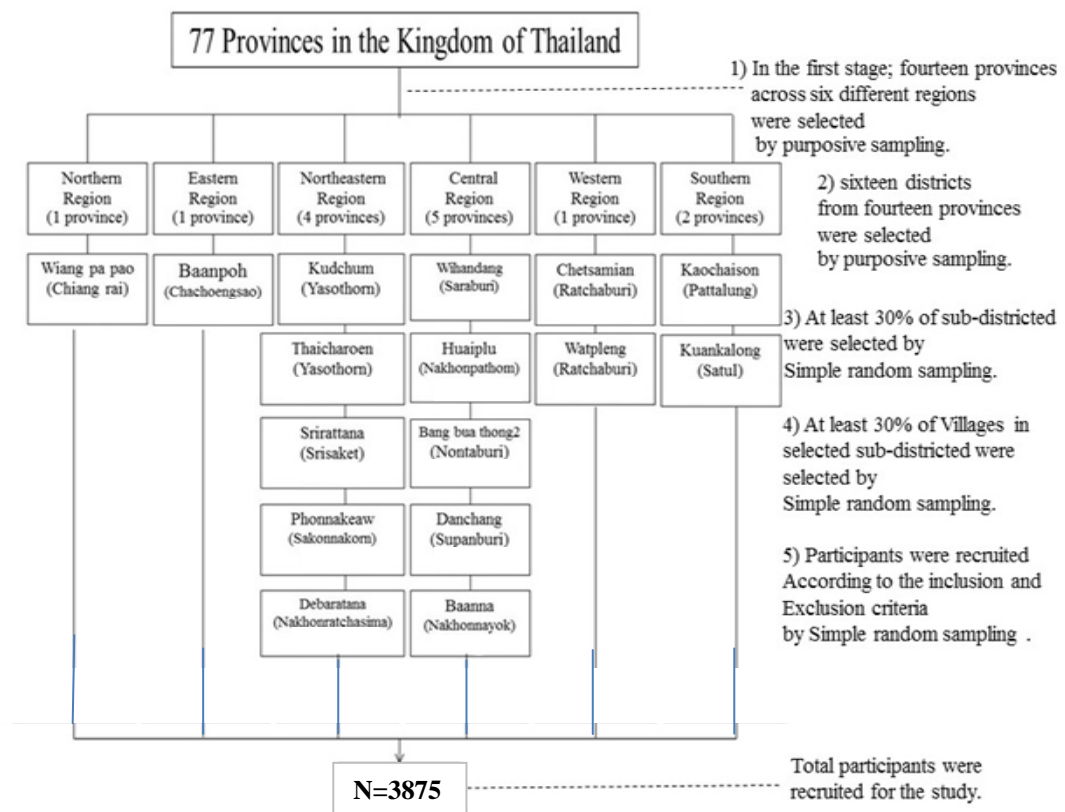


Figure 3.2 shows the multi-stage cluster sampling.

Firstly purposive sampling technique were used to select fourteen provinces across six different regions from the kingdom of Thailand. Secondly sixteen districts were selected by purposive sampling technique from the fourteen provinces. Third, at least 30% of sub-districted in hospital's catchment area were selected by simple random sampling. Fourth, at least 30% of villages in selected sub-districted were selected by simple random sampling. Lastly, simple random sampling were used to select the 243 participants aged 50 years and older from households. The participants were selected according to inclusion and exclusion criterias. Only one participant aged 50 years and older were selected from each household.

### 3.6 Study instruments

A face-to-face individual questionnaire was used to collect the data as a research instrument. In general, the questionnaire contains closed ended questions to generate quantitative data. Established questionnaire from the study on Global ageing (SAGE) was modified according to variable in the study. The questionnaire consists of 5 sections. There are socio-demographic factors, lifestyles factors, anthropometric factors, health related factors and fruit and vegetable intake. The details are given below:

**Section 1 : Socio-demographic factors:** This part were consisted of 8 questions regarding socio-demographic characteristics of the respondents, which included age, gender, current marital status, religious denomination, education level, household monthly income, area of residence, health insurance and region.

a. **Age:** were classified into the age in years at last birthday of the respondents.

b. **Gender:** were classified into male and female.

c. **Current marital status:** were classified into current marital status of the respondents; never married, currently married, cohabiting, separated/divorced or widowed. "with spouse" status has been given for those who have currently married, cohabiting, and "without spouse" status has been given for never married, separated/divorced, and widowed.

d. **Religious denomination:** were classified into religious denomination of the respondents; “Islam”, and “Non-Islam” that include buddism, christianity, and other.

e. **Education level:** were classified into the highest level of education completed; primary school completed and lower (never been to school, less than primary school), and more than primary school completed (secondary school completed, high school or equivalent completed, college/pre-university/university completed, and post graduate degree completed).

f. **Household monthly income:** will be categorized into 4 groups: less than 10000 baht/month, 10001-20000 baht/month, 20001-30000 baht/month, and more than 30000 baht/month.

g. **Area of residence:** were classified into the type of resident that the respondents live in; inside or outside municipality.

h. **Heath insurances:** were classified into the main type of the health insurance coverage in Thailand health system that divided to “universal coverage”, and “non-universal coverage” that include social security, public welfare, voluntary insurance, and none.

i. **Region:** were classified into 6 regions in Thailand as follows Northern, Central, North-eastern, Eastern, Western and Southern regions.

**Section 2: Lifestyles factors:** This section were consisted of 18 questions regarding lifestyles factors of the respondents, which included alcohol consumption, tobacco use and physical activity .

a. **Alcohol consumption:** Alcohol use was assessed with the question ‘Have you ever consumed a drink that contains alcohol in the past 3 month only (such as beer, wine, spirits, etc.)?’ Response options were ‘Yes’ or ‘No’.

b. **Tobacco use :** Tobacco used was assessed with the question ‘Have you used smokeless tobacco?’ (smoke, sniff, or chew) any tobacco products such as cigarettes, cigars, pipes, chewing tobacco, or snuff?’ The response options were ‘Yes’ or ‘No’ in the past 3 month only.

c. **Physical activity :** Physical activity was measured using the General Physical Activity Questionnaire (GPAQ). This instrument gathers information on physical activity in three domains (activity at work, travel to and from places,

and recreational activities), as well as time spent sitting. The questionnaire also assesses vigorous and moderate activities performed at work and for recreational activities. Information on the number of days in a week spent on different activities and time spent in a typical day for each activity was also recorded. For physical activity, in addition to the total minutes of activity, the activity volume was also computed by weighing each type of activity by its energy requirement in metabolic equivalents (METs). The number of days and total physical activity MET minutes per week were used to classify respondents into three categories of low, moderate, and high level of physical activities. High physical activity: a person reaching any of the following criteria is classified in this category: vigorous-intensity activity on at least 3 days achieving a minimum of at least 1,500 MET (metabolic equivalent)-minutes per week (OR); 7 or more days of any combination of walking, moderate or vigorous intensity activities achieving a minimum of at least 3,000 MET-minutes per week. Moderate physical activity: a person not meeting the criteria for the 'high' category but meeting any of the following criteria is classified in this category: 3 or more days of vigorous-intensity activity of at least 20 min per day OR; 5 or more days of moderate-intensity activity or walking of at least 30 min per day OR; 5 or more days of any combination of walking, moderate or vigorous intensity activities achieving a minimum of at least 600 MET-minutes per week. Low physical activity: a person not meeting any of the aforementioned criteria falls into this category. Physical inactivity was defined as those who had low levels of physical activity; moderate and high levels of physical activity were collapsed into further analysis. (Detail of the measure physical activity to see appendix C/page77-82)

**Section 3: Anthropometric factors :** This section involves the measurement of height and weight. Weight (without foot wear and any accessories) were measured by research assistants who were trained. Similarly, height was measured (without foot wear) by positioning the stadiometer on a firm surface against the wall. Body mass index (BMI) was calculated as weight in kg divided by height in metres squared. Overweight and/or obesity was defined as  $BMI \geq 25 \text{ kg/m}^2$ , normal as between  $\geq 18.5, < 25 \text{ kg/m}^2$ , and underweight as  $< 18.5 \text{ kg/m}^2$ .

**Section 4: Health related factors:** This section were consisted of 6 questions regarding to chronic condition of the respondents. To assess overall

questions were assess about chronic conditions of the respondents with the questions; “Have you ever been diagnosed with chronic condition ?” (Chronic condition include; hypertension, diabetes, stroke, angina, lost all of natural teeth and depression). Response items are: “Yes” or “No”.

**Section 5: Fruit and vegetable intake:** Dependent variable: Fruit and vegetable intake were assessed using 2 questions “How many serving of fruit do you eat on a typical day ? and “How many serving of vegetables do you eat on a typical day ? with in the 24 hour dietary recall data . Researchers were trained to show all respondents a nutrition risk factor card that indicates both in writing and pictorially general categories, amounts, and examples of fruit and vegetable in an attempt to standardize the serving size and number of servings reported. Furthermore, the nutrition card categorized one serving of fruit into one of two groups: (1) one medium-sized piece of fruit, such as an apple, big orange, 2 middle size orange or 1 small cultivated banana or ½ middle size Cavendish banana, 4 rambutans, papaya watermelon and pineapple is 6-8 piece; and (2) one-half cup of fruit juice, not artificially flavored. (Detail of the measure to see appendix C/page82-83). The standardize the serving size and number of servings reported. In the part of vegetables indicate standard serving of nutrition card categorized (scoop) for help the subjects estimate amount of vegetables correctly, one serving of vegetables into one of 4 groups: (1) one cup or two scoop of raw green leafy vegetables such as spinach, lettuce, chinese kale, caisim, morning glory or salad; (2) one half cup or one scoop of other vegetables cooked (3) one scoop of body/head/root such as tomato, carrot, pumpkin, corn ,cabbage ,yard long bean, onion and (4) one-half cup of vegetable juice. (Detail of the measure to see appendix C/page84). Insufficient FV consumption was defined as less than five servings or 400 gram of fruit and vegetable daily

### **3.7 Data collection procedures**

Before starting the collection of the data, identify and contact the study sites by a formal letter from the director of the AIHD was sent the request co-operation to the provincial health officer of selected provinces to obtain permission prior to collect the data in this study. Then, research assistants were recruited from

selected sixteen districts. They were trained to ensure the confident to fill the questionnaire and for the appropriate anthropometric measurements. One day training were organized to introduce the questionnaire, and ethical issues to them.

Data were collected by trained research assistants, after getting the permission from The Ethics committee of Mahidol University. It was started in September 2015 to March of 2016, with the collection period lasting a maximum of 6 months. Face-to-face interview method was used to fill up the electronic form of questionnaire.

Electronic form was developed for data entering from all study sites via on-line application (<http://ageingbackend.damasac.com>). Data were collected independently from the households of the selected community following the inclusion and exclusion criteria. The interviewers were explained the purpose of the research and make sure the respondents understood that the collected data were kept confidential. The respondents have the right to decline to answer or withdraw from participation in the study without any penalty.

A written informed consent form was gave to the respondents to read; the form was explained by research assistants before the respondents were asked to make any decision as to whether to participate in the study. However, for the face-to-face questionnaire, those individuals agreeing to participate in the study were asked to sign a formal written consent. For those who cannot wrote, their right thumbprint will take as a symbol that they agree to participate in the study. Approximately 30 minutes was taken to fill up the whole electronic questionnaire.

### **3.8 Validity and reliability of the instruments**

For validity and reliability, three experts from AIHD Mahidol University was examined the questionnaire. The researcher was revised and improved the weakness area regarding to these experts comments and inputs. After revised according to experts, the questionnaire was translated in “Thai” language. Before handling the research process, the Thai translation questionnaire was conducted to aged 50 years and older in selected communities Thailand. The purpose of conduct in

the pre-test was to detect any unclear statement, or misleading or highly sensitive questions in the research instrument before it were used on the target respondents.

### **3.9 Data management and statistical analysis**

The data were analyzed using SPSS version 16.0 for Windows. Data entry staff checked the missing and do consistency and range checks.

Firstly, descriptive statistics was used to calculate median, quartile deviation (QD), minimum and maximum, numbers and percentage. It was used to determine the prevalence of insufficient fruit and vegetable intake and describe each independent variable.

Secondly, Chi-square tests were used to identify an association between of insufficient fruit and vegetable intake and each independent variable. Crude OR was used to measure the strength of the association between of insufficient fruit and vegetable intake and each independent variable. The computed odds ratios were reported with 95% confidence intervals and a two-tailed significance level of 0.05 was used as the cut-off point for statistical significance.

Finally, multiple logistic regression analysis was used to determine the significant predictors of insufficient fruit and vegetable intake among adults aged 50 year and older in the communities of Thailand. All significant independent variables with a  $p\text{-value} < 0.05$  in the Chi-square test were included in the multiple logistic regression.

### **3.10 Ethical consideration**

Ethical issues of the survey instrument exist with regards to the nature of the questions, the timing of the survey, and its administration. The survey instrument has been pilot tested and preliminary analysis conducted to determine the extent of some of these ethical considerations and what modifications are necessary to improve the questions and instrument structure to obtain the best quality data while minimizing burden and discomfort to the respondent. In particular, interviewer

feedback on problematic areas from their experience implementing in the field have been considered.

Interviewers were trained to ensure to respondents the confidentiality of information, to help respondents feel at ease, and to communicate the respondents right not to answer questions they don't want to answer. Furthermore, interviewers were gave respondents the option of conducting the interview in private if they so wish, and if this was not feasible to return on a day it is. All these considerations were communicated in the informed consent form.

Similar issues exist with the performance measurements. Respondents may feel embarrassed, tired or physically uncomfortable with any of the measurements. Interviewers were trained extensively in the administration of each of the measures to minimize discomfort to respondents. Further, respondents were explained before signing the consent form, the details of the measures to be taken, any potential discomforts, any potential risks, as well as the benefits and the usefulness of the information obtained. They were also be told of their right to refuse to take any of the measures. No individual level identifiers were included in any public data set and no individual identifiers were sent to AIHD.

## **CHAPTER IV**

### **RESULTS**

This research was conducted to study prevalence of insufficient fruit and vegetable intake and to examine factors associated between independent variables and insufficient fruit and vegetable intake among Thai adults aged 50 years and older in the communities of Thailand. The data were collected from September 2015 to March 2016. A total of 3,875 subjects from sixteen districts were face-to-face interviewed by trained research assistants. This analysis focused on current fruit and vegetable intake in 24 hours prior the study, we therefore did not include the respondents who had missing data on key variables including fruit and vegetable intake and socio-demographic factors from the questionnaire. After all, total 3,787 completed questionnaires were included in the analysis.(details of data to see appendix B/page 75-76). The results summarized in frequency, percentage, median, QD, minimum, and maximum. Chi-square tests were used to identify the association between fruit and vegetable intake and each independent variable. Further, the independent variables with a  $p$ -value  $< 0.05$  in the bivariate analysis were included in the multivariate analysis to determine factors associated with insufficient fruit and vegetable intake. The research results are presented as follows.

#### **4.1 Socio-demographic factors**

The frequency and percentage distribution socio-demographic variables are shown in Table 4.1. There were 3,787 respondent, of those age was ranging from 50-97 years, with median age was 62 years.

Nearly two-thirds (62.9%) of respondents were female aged between 50-59 years, the maximum age was 97 years. Of those were married (70.5%), only a few were single (6.0%). Buddhism was the great majority of respondents (92.6%).

Regarding to their education, elementary education level was the highest (63.9%). Over half (53.1%) of them had household monthly income less than 10,000 baht, meanwhile 5.8 percent received their family monthly income greater than 30,000 baht.

The majority had been living in rural area (69.4%). Concerning to health insurance, the universal coverage was the largest percentage (84.4%). On the other hand, most of the respondents had been living in north eastern region (32.3%), followed by central, western, southern, northern and eastern (17.8 17.0, 16.3, 8.4 and 8.2 respectively).

**Table 4.1** Number and percentage of respondents by socio-demographic factors.

<b>Socio - demographic factors</b>	<b>Number</b>	<b>Percentage</b>
<b>Age group (years)</b>	<b>3787</b>	
50-59	1404	37.1
60-69	1354	35.8
70-79	745	19.7
80 and over	287	7.5
Median = 62 QD = 6.5, Min = 50, Max = 97		
<b>Gender</b>	<b>3787</b>	
Male	1404	37.1
Female	2383	62.9
<b>Current marital status</b>	<b>3787</b>	
Single	228	6.0
Married/Cohabiting	2669	70.5
Divorced, Separated and widowed	890	23.5
<b>Religions denomination</b>	<b>3787</b>	
None	11	0.3
Buddhism	3507	92.6
Christianity	81	2.1
Islam	188	5
<b>Educational levels</b>	<b>3787</b>	
No formal education	144	3.8
Lower Elementary school	613	16.2
Elementary school	2421	63.9
Junior high school	223	5.9
Secondary school	192	5.1
Vocational school/ University	194	5.1

**Table 4.1** Number and percentage of respondents by socio-demographic factor (cont.)

<b>Socio - demographic factors</b>	<b>Number</b>	<b>Percentage</b>
<b>Household monthly income (Baht/month)</b>	<b>3787</b>	
<10000	2011	53.1
10001-20000	1225	32.3
20001-30000	330	8.7
>30000	221	5.8
<b>Area of residence</b>	<b>3787</b>	
Urban	1159	30.6
Rural	2628	69.4
<b>Health insurance</b>	<b>3787</b>	
Universal coverage	3195	84.4
Social security	71	1.9
Public welfare	501	13.2
Voluntary insurance	9	0.2
None	11	0.3
<b>Region</b>	<b>3787</b>	
Northern	319	8.4
Central	674	17.8
North eastern	1123	32.3
Eastern	310	8.2
Western	645	17.0
Southern	616	16.3

## 4.2 Lifestyle factors

Table 4.2 displays number and percentage distribution of the respondents by lifestyle .There was 11.6 percent of those who had alcohol consumption, while tobacco using was only 10.9 percent. According to physical activity, nearly one-thirds (74.6%) of respondents had low physical activity, followed by 17.1 percent had moderate physical activity, only 8.3 percent had high physical activity.

**Table 4.2** Number and percentage of respondents by lifestyle factors

<b>Lifestyle factors</b>	<b>Number</b>	<b>Percentage</b>
<b>Alcohol consumption</b>	<b>3787</b>	
Yes	440	11.6
No	3345	88.4
<b>Tobacco use</b>	<b>3787</b>	
Yes	413	10.9
No	3374	89.1
<b>Physical activity</b>	<b>3787</b>	
Low Physical activity	2824	74.6
Moderate Physical activity	649	17.1
High Physical activity	314	8.3

### 4.3 Anthropometric factors

Table 4.3 displays number and percentage distribution of the respondents by anthropometric factors. Furthermore, most of respondents had normal (57.0%) in Body Mass Index, while overweight and underweight were 34.0 and 9.0 percent respectively.

**Table 4.3** Number and percentage of respondents by anthropometric factors

<b>Anthropometric factor</b>	<b>Number</b>	<b>Percentage</b>
Body mass index	<b>3787</b>	
Underweight	339	9.0
Normal	2160	57.0
Overweight	1288	34.0

#### 4.4 Health related factors

Table 4.4 shows number and percentage distribution of the respondents by health related factors. Nearly one-thirds (31.9%) of those had hypertension, while group diagnosed with diabetes was 17.8 percent. Regarding to another health status, only 3.3 percent had stroke, followed by angina 2.1 percent. Slightly two-thirds (68.0%), of respondents had lost all of your natural teeth, whereas depression was 2.6 percent.

**Table 4.4** Number and percentage of respondents by Health related factors

<b>Health related factors</b>	<b>Number</b>	<b>Percentage</b>
<b>Hypertension</b>	<b>3787</b>	
Yes	1208	31.9
No	2579	68.1
<b>Diabetes</b>	<b>3787</b>	
Yes	673	17.8
No	3114	82.2
<b>Stroke</b>	<b>3787</b>	
Yes	125	3.3
No	3662	96.7
<b>Angina</b>	<b>3787</b>	
Yes	79	2.1
No	3708	97.9
<b>Lost all of your natural teeth</b>	<b>3787</b>	
Yes	2577	68.0
No	1210	32.0
<b>Depression</b>	<b>3787</b>	
Yes	99	2.6
No	3688	97.4

## 4.5 Fruit and vegetable intake

Table 4.5 shows number and percentage distribution of the respondents by fruits and vegetable intake. Most of respondents (77.4%) had insufficient in fruits and vegetable intake, while sufficient in fruits and vegetable intake was only 22.6 percent.

Shows number and percentage of the respondents between insufficient fruit and vegetable by age, gender, and region, the result showed that aged between 70-79 years were the highest about insufficient in fruit and vegetable intake was 78.5. Gender, the result showed that male were the highest about insufficient fruit and vegetable intake 78.3 %. Region, there were classified into 6 regions, Northeastern had found the highest about insufficient fruit and vegetable intake 82.6% (details of data to see appendix B/page75-76).

**Table 4.5** Number and percentage of respondents by fruit and vegetable intake

<b>Fruits and vegetable intake</b>	<b>Number</b>	<b>Percentage</b>
<b>Fruit and vegetable intake</b>	<b>3787</b>	
Insufficient	2933	77.4
Sufficient	854	22.6

## 4.6 Association between socio-demographic factors and insufficient fruits and vegetable intake

The association between socio-demographic factors and insufficient fruits and vegetable intake among adult aged 50 years and older. There were 2 majors data analysis, firstly; a preliminary relationship analysis between independent variables and bivariate analysis, secondly; multivariate analysis by using multiple logistic regression technic.

Table 4.6 shows the result of analysis between socio-demographic factors and insufficient fruit and vegetable intake as bellow.

Regarding to age group, the age of respondents were classified into 4 groups, the result showed that there was no significantly associated with insufficient fruits and vegetable intake.

Gender, the result showed that male were the highest about insufficient fruit and vegetable intake (78.3%), however, there was no significantly associated with insufficient fruit and vegetable intake.

Current marital status, there was classified into 3 groups, the result revealed that there was significantly associated with insufficient fruit and vegetable intake, marital status (p-value=0.015).

Religions denomination, there were classified into 4 groups, the result showed that there was no significantly associated with insufficient fruit and vegetable intake .

Education level, there were classified into 3 groups, the result showed that there was no significantly associated with insufficient fruit and vegetable intake.

With regard to household monthly income, there was found significantly associated between household monthly income and insufficient fruit and vegetable intake (p-value=0.037).

Area of residence, the result showed that there was no significantly associated with insufficient fruit and vegetable intake .

Health insurance, there were classified into 2 groups, the result showed that there was significantly associated with insufficient fruit and vegetable intake (p-value=0.028).

Regions in Thailand, there were classified into 6 regions, North eastern had found the highest about insufficient fruit and vegetable intake (82.6%), however, region was another item of socio-demographics that revealed significantly associated with insufficient fruits and vegetable intake (p-value<0.001), while other independent variables of socio-demographics were not show association

**Table 4.6** Association between socio-demographic factors and insufficient fruit and vegetable intake

Socio-demographic factors	Insufficient fruit and vegetable intake				
	N	Yes (%)	No (%)	Crude OR (95% CI)	p-value
<b>Age group (years)</b>	<b>3787</b>				.735
50-59	1404	77.8	22.2	1.09(0.80-1.47)	.595
60-69	1354	76.7	23.3	1.01(0.75-1.37)	.927
70-79	745	78.5	21.5	1.13(0.82-1.56)	.465
80 and over	284	76.4	23.6	1	
<b>Gender</b>	<b>3787</b>				
Male	1404	78.3	21.7	1.09(0.93-1.27)	.310
Female	2383	76.9	23.1	1	
<b>Current marital status</b>	<b>3787</b>				.015
Single	228	69.7	30.3	0.63(0.46-0.87)	.005
Married/Cohabiting	2669	77.7	22.3	0.96(0.79-1.15)	.620
Divorced, Separate and Widowed	890	78.5	21.5	1	
<b>Religion denomination</b>	<b>3787</b>				.436
None	11	81.8	18.2	1.42(0.30-6.80)	.664
Buddhism	3507	77.7	22.3	1.10(0.78-1.55)	.606
Christianity	81	70.4	29.6	0.75(0.42-1.34)	.327
Islam	188	77.4	22.6	1	
<b>Educational levels</b>	<b>3787</b>				.598
No formal education /<Elementary school	757	76.9	23.1	1.04(0.81-1.34)	.764
Elementary school	2421	77.9	22.1	1.10(0.90-1.36)	.354
Junior high school/ Secondary school	609	76.2	23.8	1	
Vocational school/ University					

**Table 4.6** Association between socio-demographic factors and insufficient fruit and vegetable intake (con.)

Socio-demographic factors	Insufficient fruit and vegetable intake				
	N	Yes (%)	No (%)	Crude OR (95% CI)	p-value
<b>Household monthly income (Baht/month)</b>	<b>3787</b>				.037
<10000	2010	79.0	21.0	1.50(1.10-2.05)	.011
10001-20000	1226	76.2	23.8	1.26(0.93-1.76)	.137
20001-30000	330	76.7	23.3	1.31(0.89-1.93)	.172
>30000	221	71.5	28.5	1	
<b>Area of residence</b>	<b>3787</b>				
Urban	1159	77.4	22.6	1.00(0.84-1.17)	.957
Rural	2628	77.5	22.5	1	
<b>Health Insurance coverage</b>	<b>3787</b>				
Universal coverage	3195	78.1	21.9	1.25(1.02-1.53)	.028
Non-Universal coverage	592	74.0	26.0	1	
<b>Region</b>	<b>3787</b>				<.001
Northern	319	71.8	28.2	0.80(0.59-1.08)	.148
Central	674	73.9	26.1	0.89(0.69-1.14)	.352
North eastern	1123	82.6	17.4	1.49(1.17-1.88)	.001
Eastern	310	80.6	19.4	1.31(0.93-1.83)	.121
Western	645	74.0	26.0	0.89(0.69-1.15)	.371
Southern	616	76.1	23.9	1	

#### 4.7 Association between lifestyle factors and insufficient fruit and vegetable intake.

Table 4.7 shows the result of analysis between lifestyle and insufficient fruit and vegetable intake as bellow.

Alcohol consumption, the result showed that 76.1 percent of those who answered “yes” in alcohol consumption likely had high insufficient fruit and vegetable intake. However, there was no significantly associated with insufficient fruits and vegetable intake .

Tobacco use, the result showed that 82.3 percent of those who answered “yes” in tobacco use likely had high insufficient fruit and vegetable intake. And, there was significantly associated with insufficient fruits and vegetable intake (p-value=0.012).

Physical activity, there was classified into 3 groups, the result revealed that there was no significantly associated with insufficient fruit and vegetable intake .

**Table 4.7** Association between lifestyle factors and insufficient fruit and vegetable intake.

Life style factors	Insufficient fruit and vegetable intake				
	n	Yes (%)	No (%)	Crude OR (95% CI)	p-value
<b>Alcohol consumption</b>	<b>3787</b>				
Yes	440	76.1	23.9	0.92(0.73-1.16)	.483
No	3347	77.6	22.4	1	
<b>Tobacco use</b>	<b>3787</b>				
Yes	413	82.3	17.7	1.40(1.08-1.83)	.012
No	3374	76.9	23.1	1	
<b>Physical activity</b>	<b>3787</b>				.404
Low Physical activity	2824	76.9	23.1	0.94(0.71-1.25)	.667
Moderate Physical activity	649	79.4	20.6	1.08(0.78-1.50)	.636
High Physical activity	314	78.0	22.0	1	

#### 4.8 Association between anthropometric factors and insufficient fruit and vegetable intake.

Table 4.8 shows the result of analysis between anthropometric and insufficient fruit and vegetable intake as bellow.

Body mass index (BMI), there was classified into 3 groups, the result revealed that there was no significantly associated with insufficient fruit and vegetable intake .

**Table 4.8** Association between anthropometric factors and insufficient fruit and vegetable intake.

Anthropometric factor	Insufficient fruit and vegetable intake				
	n	Yes (%)	No (%)	Crude OR (95% CI)	p-value
Body mass index	<b>3787</b>				.962
Underweight	339	77.0	23.0	0.98(0.74-1.30)	.895
Normal	2160	77.6	22.4	1.02(0.86-1.20)	.858
Overweight	1288	77.3	22.7	1	

#### 4.9 Association between health related factors and insufficient Fruit and vegetable intake.

Table 4.9 shows association between health-stage related factors and insufficient fruit and vegetable intake. The result showed no found to have significantly associated with insufficient fruit and vegetable intake.

**Table 4.9** Association between health related factors and insufficient fruit and vegetable intake

Health related factors	Insufficient fruit and vegetable intake				
	N	Yes (%)	No (%)	Crude OR (95% CI)	p-value
<b>Hypertension</b>	<b>3787</b>				
Yes	1208	77.1	22.9	0.97(0.82-1.14)	.702
No	2579	77.6	22.4	1	
<b>Diabetes</b>	<b>3787</b>				
Yes	673	78.6	21.4	1.09(0.89-1.33)	.430
No	3114	77.2	22.8	1	
<b>Stroke</b>	<b>3787</b>				
Yes	125	75.2	24.8	0.88(0.58-1.33)	.541
No	3662	77.5	22.5	1	
<b>Angina</b>	<b>3787</b>				
Yes	79	73.4	26.6	0.80(0.48-1.33)	.387
No	3708	77.5	22.5	1	
<b>Lost all of your natural teeth</b>	<b>3787</b>				
Yes	2577	77.3	22.7	0.97(0.83-1.15)	.747
No	1210	77.8	22.2	1	
<b>Depression</b>	<b>3787</b>				
Yes	99	78.8	21.2	1.08(0.67-1.77)	.747
No	3688	77.4	22.6	1	

#### **4.10 Multiple logistic regression**

Table 4.10 shows association between independent variable factors and insufficient fruit and vegetable intake by using multiple logistic regression technic. There were 4 factors significantly associated with insufficient fruit and vegetable intake including current marital status, household monthly income, region and tobacco using, as bellow.

With regard to current marital status, single group (p-value = 0.011) was less likely to have insufficient fruit and vegetable intake than divorced, separated or widowed group.

Considering to household monthly income, those household had monthly income less than 10,000 baht (p-value = 0.046) was 1.38 time more likely to have insufficient fruit and vegetable intake than those having more than 30,000 baht.

With regard to regions, People in north eastern region (p-value = 0.004) was 1.43 more likely to have insufficient fruit and vegetable intake than those in the southern region.

Concerning to tobacco using, smoking group (p-value = 0.023) was likely had insufficient fruit and vegetable intake 1.36 times as numerous as non-smoking group.

**Table 4.10** Multiple logistic regression for insufficient fruits and vegetable intake

Variables	Adj. OR	95% CI for OR		P-value
		Lower	Upper	
<b>Current marital status</b>				.036
Single	.65	.47	.91	.011
Married/Cohabiting	.93	.78	1.12	.464
Divorced, Separated and Widowed	1			
<b>Household monthly income (Baht/month)</b>				.155
<10000	1.38	1.01	1.89	.046
10001-20000	1.21	.87	1.67	.256
20001-30000	1.31	.89	1.94	.173
>30000	1			
<b>Health Insurance</b>				
Universal coverage	1.14	.93	1.40	.211
Non-Universal coverage	1			
<b>Region</b>				<.001**
Northern	.79	.58	1.08	.139
Central	.91	.71	1.17	.465
North eastern	1.43	1.12	1.81	.004*
Eastern	1.34	.95	1.89	.092
Western	.92	.71	1.19	.539
Southern	1			
<b>Tobacco use</b>				
Yes	1.36	1.04	1.78	.023
No	1			

## **CHAPTER V**

### **DISCUSSION**

This study aimed to determine the prevalence and examine associated factors of fruit and vegetable intake among Thai adults aged 50 years and older in the communities of Thailand. Independent factors included in the study were classified into 4 categories namely; socio-demographic factors, lifestyle factors, anthropometric factors, and health related factors. A household cross-sectional study was conducted for Thai adults aged 50 years and older in 16 districts across different regions of Thailand. The data were collected from September 2015 to March 2016. By multi-stage cluster sampling, a total of 3,875 subjects from sixteen districts were face-to-face interviewed by trained research assistants. There were 3,787 completed questionnaires were included in the analysis. The chapter presents discussion of the findings according to four independent variables and compared with previous studies and also in relation other findings in this study.

#### **5.1 The prevalence of fruit and vegetable intake among Thai adults aged 50 years and older in communities of Thailand**

This study was conducted in adults aged 50 years and older in the communities of Thailand. Overall prevalence of insufficient fruit and vegetables intake were 77.4 %, 78.3% in men and 76.9 % in women. These were compatible with The World Health Survey in 2002-2003 has shown that prevalence of inadequate fruits and vegetable consumption from 52 low-and middle-income countries are 77.6% men and 78.4% women (5). However, the prevalence of insufficient fruit and vegetable intake in this study was less than that in several Asian Health and Demographic Surveillance System sites where insufficient FVI was found to be more than 89% in men and 96% in women in Bangladesh, 96% in men and 92% in women in Indonesia, and more than 84% in men and more than 79% in women in Thailand (25).

Thailand National Health Examination Survey III (age over 15) found that they consumed FV only 73.4%. Moreover it was found that Thais adult aged 50 years and older consumed insufficient FV, 77.4% which was slightly better. Even though previously we had campaign for FV consuming for Thais but the traditional Thai eating pattern was changed to fast food from Western culture. In addition the problem of insufficient FV consuming could lead to health problems especially NCD, cancer and CVD risk. Therefore one perform this study to access prevalence and factors which correlated with insufficient FV consuming using results to set better policy for promoting Thais health consume more FV.

## **5.2 Socio-demographic factors**

Multivariable analysis determined that three socio-demographic factors were associated with insufficient fruits and vegetable intake as current marital status, household monthly income and regions ( $p$ -value < 0.05).

### **5.2.1 Age**

This study indicated that the level of insufficient of FV increased by age which were 77.8, 76.7, 78.5 and 76.4 in the age groups of 50 – 59, 60 – 69, 70 – 79 and over 80 years old respectively. This is correlated with Thailand National Health Examination Survey III, IV (19, 21). Considering from the age, the older of age showed the higher of insufficient FV consuming due to they are facing the difficulty of preparation. These obstacles depend on personal, health and lowering of appetite contrasts with the research (68) that indicated FV sufficient consuming when older. However the factor of age in this research was not significantly associated with insufficient FV intake when getting older. The factor of age in this research was not significantly related with insufficient FV intake, which is related to study in South Africa (26). These might due to sample size of population has low distribution of age which is different from other studies (5,20,27,29,62) indicated that age is the factor showed relation with insufficient FV intake.

### **5.2.2 Gender**

Even though gender is the factor that showed no significantly to insufficient FV intake but in this study found that among female consume sufficient FV per day according to standard recommend (400 gram or 5 serving per person daily) which is higher that among male. This study supports other studies' result that older women eat more fruits and vegetable than older men, even though older men eat more food overall (62, 68, 79). These differences affected from disparity of knowledge, confidence and good nutrition of food preparation. In addition we found that male realized in health consumption less than female (79-80). Male who is able to cook and access information about nutrition will consume more FV (62,80). In the context of Thai social, female is the person who responsible for food in the family.

### **5.2.3 Current marital status**

From data analysis by Bi-variable analysis and Multivariable analysis, current marital status showed significantly associated with insufficient FV intake. This study found that elderly who is widow, divorce status or separate status has higher chance to have insufficient FVI than those who were single or marital status. These were related to other studies that marriage is positively associated with fruits and vegetable intake among older men and older women. Single men are at particularly high risk of low intake (62). Marriage is particularly beneficial for older mens' fruit and vegetable intake and the presence of a woman in the household is associated with higher fruit and vegetable intake of male household members (63). However, the benefits of marriage for fruit and vegetable intake are difficult to separate from the benefits related to companionship and eating meals together (61).The experience of widowhood heightens risk of inadequate diet for both men and women because they often lack skills in the process of choosing and preparing nutrient-rich foods. Following the death of a spouse, women are particularly socioeconomically vulnerable and at risk of social isolation. Older women, who might be more accustomed to cooking for others, are often less inclined to prepare food and cook complete meals for themselves that might be reserved for shared special occasions (63). From previous study found that married participants consume FV more than widow or divorced participants. Moreover married men have more FV than single men but it was not

different in women. This is suggestion to study more in this topic about relations among status, supporting from families and FV consumption in different culture (28). In addition, the study should be added currently marital status and interaction in social or family members because previous studies showed separation causes lower FV consumption. Social interactions causes increasing of FV consumption except elderly people who is limited area with nutrition risk (81).

#### **5.2.4 Religions denomination**

Major of population in this study are Buddhist (92.6%). Therefore, the association between insufficient FV intake and religion denomination was not found significantly.

#### **5.2.5 Education level**

There were many studies showed that low educated population is the significant factor that causes inadequate FV consumption(25, 29, 74). In USA found that high education level related to adequate consumption of FV. Some studies found that knowledge is the factor related to amount of FV consumption (28). Therefore the study in the future should be cover relationship between level of education in elderly and their knowledge about amount of FV consumption to confirm that knowledge is major factor to state adequate FV consumption. However in this study was not show that level of education related to inadequate FV consumption. These could explain from most of population of this study are in elementary education level (63.9%) causes no differences.

#### **5.2.6 Household monthly income**

Household monthly income was the significant factor that associated with inadequate FV consumption which is similar to many studies (5, 20, 27, 29, 62). From this study found that family that has low household income, lower than 10,000 baht, has a chance to face inadequate FV consumption which has higher chance to have 1.38 times of inadequate FV consumption of family that has household income over 30,000 baht. Even though Thailand is agricultural country, be able to produce high amount, varieties and export FV (82), but we found that Thai population consume

FV lower than standard recommend due to FV is more expensive. These reasons leading to low income family could access to FV lower than high income family. Therefore high income indicated ability to access to quality food, varieties and sufficient amount (83). Consequent of these is setting policy and develop program for low income population to consume seasonal FV. However there should be further study that include relationship between income, price, demand of consumers and healthy food.

### **5.2.7 Area of residence**

This study found that population who live in urban area consume adequate FV higher than population who live in rural area which is correlated with Thailand National Health Examination Survey III and IV (19,21) due to it is convenient to purchase food. There are many fresh markets and convenient stores available all the time which is different from population who live in rural area which most of vegetable and fruit were naturally planted. These plants depend on natural water sources therefore the drought has direct effects to inadequate FV consumptions (82). These results agreed with studies from other countries showed that the differences of food in each area found obviously differences in city area due to easy to access FV (10). Restaurants in countryside carry less FV. Moreover the price of FV in countryside is more expensive than others (10). Elderly who lives in countryside has difficulty to access FV due to they could not in driving (81). In rural area, elderly were consume lower FV (13) and program that government stated could not be access due to low tax collection (10). In addition FV consumption in rural area and urban area was different even though this study found that it is not significantly associated between area of resident. Moreover it is not related to factor of inadequate FV.

### **5.2.8 Health insurance**

From data analysis by Bi-variable analysis we found that health insurance shows significantly associated insufficient FV but Multivariable analysis, show not significantly associated insufficient FV intake. This study showed population that used universal coverage system had consume inadequate FV 78.1% while population that used other health systems had consume inadequate FV 74.0%. These

showed not significantly associated due to most of population use universal coverage system, 84.4%.

### **5.2.9 Region**

From data analysis by Bi-variable analysis and Multivariable analysis, we found that region shows significantly associated insufficient FV intake. In this study, the population were classified into 6 regions as follows Northern, Central, North-eastern, Eastern, Western, and Southern region. Region is the significant factor that related to inadequate FV consumption. The study found that fruit and vegetable consumption is different among regions and mostly is insufficient. Especially in North-eastern region, has the highest prevalence of insufficiently fruit and vegetable consumption followed by Eastern, Southern, Western, Central and Northern region respectively. On the other hand the people in Northern region is the most prevalence of sufficient fruit and vegetable consumption. In this result is different to Thailand National Health Examination Survey III and IV (19, 21). The surveys found that people in Southern region is the highest prevalence of sufficient fruit and vegetable consumption, similar to eating culture in this region that has been gotten influence from Indian Chinese and Java, because mostly foods is spicy, they is often eat with vegetable. Sticky rice and chili sauces (Naampik aung, Naampik num) are the main menu of Northern people, these are always eaten with vegetable. As for people in North-eastern region has highest prevalence of insufficient fruit and vegetable consumption may conform to eating culture due to some region is arid, the mostly raw material for cooking come from Natural source. There for fruit and vegetable consumption of this region is depend on topography and seasonal status. However for more understand about differentiation of quantity of fruit and vegetable consumption among regions, the author suggest that should further study other factors that may be effect.

## **5.3 Lifestyle factors**

Multivariable analysis determined that lifestyle factors were associated with insufficient fruits and vegetable intake as tobacco using ( $p$ -value < 0.05).

### **5.3.1 Alcohol consumption**

This study showed population that consumed alcohol had inadequate FV consumption 76.1% while non-alcohol consumption population had inadequate FV consumption 77.6%. Proportion of these was not different plus these are not setting factor of this study. However this is different from other study that showed population who is alcohol consumed especially heavy drinker is the group that has high inadequate FV consumption due to heavy drinker will have lower function of taste, smell, sound and touch leading to no good health behavior. It is the not significantly factor to inadequate FV consumption.

### **5.3.2 Tobacco Use**

This study showed that tobacco used was significant factor of insufficient FV intake. Smoking group had higher chance to have insufficient FV intake 1.36 times as numerous as non-smoking group (adjOR 1.36, 95%CI 1.04 to 1.78,  $P < 0.023$ ). These might due to non-smoking group have better health behavior. They keep healthy positive way which is agreed with other studies (26, 69-70) presented that heavy smoker is significant factor that effect insufficient FV intake. However in this study included current tobacco use in 3 month part. Since smoking is related to insufficient FV intake, therefore study about regular and occasionally smoking should be conducted in further study.

### **5.3.3 Physical activity**

This study measured physical activity by using strengthening level correlate with FV intake which found that show not significantly associated insufficient FV intake. These are contrast to other studies (70) but related with study in South Africa (26). There are many studies showed evidence that regularly and adequate physical activity could decrease incident of chronic diseases such as decrease incidence of CAD, DM and cancers from WHO (8). Inadequate physical activity causes CVD 22-23%, Colon cancer 16-17%, DM 15%, CVD 12-13%. In Thailand inadequate of physical activity is the 9<sup>th</sup> major reason of diseases leading to loss 1.3 percent of Disability Adjusted Life Year (22). Therefore inadequate of physical activity causes consequent of improper health.

## 5.4 Anthropometric

### Body mass index

Even if evidence base is clear that high fruits and vegetable consumption can loss weight. But in this study found that BMI not significantly associated insufficient FV intake. The population was classified in 3 BMI groups (underweight, normal and overweight), the result is nearby in each group ( 77%, 77.6% and 77.3% orderly), similar to studies in South Africa and Spain (26, 74, 76)

## 5.5 Health stage related factors

In this study, health stage including Hypertension, Diabetes, Stroke, Angina, Lost all of natural teeth and Depression were not related to insufficiently fruit and vegetable consumption significantly similar to studies in South Africa (38). But different result in other studies (70), which showed that health stage related to consumption.

Nutrition is linked to the function and quality of life for older adults with chronic disease (39-41). Sufficiently fruit and vegetable consumption in all ages help reducing incidence of chronic disease (42), delay developing of dementia and related conditions (50), delay physical declination due to high serum carotenoids level, promote muscle and bone strength (52), reduce incidence of cataract in women (54). Even if sufficiently fruit and vegetable consumption help to prevent these previous conditions but geriatrics is high risk for sufficiently fruit and vegetable consumption due to limitation of physical function, disability and chronic illness, accessibility, preparation, loss of appetite and dental problem, all factors are relates to less fruit and vegetable consumption.

Loss of appetite result from changing of hungry reception (77), taste and smelling(78) worry about digestion, contentment of eating, mood condition each day, dental problems. Mostly vegetable is eaten in fresh condition (40), it was difficult in chewing, bitten or swallowed, common problems in geriatrics are molar tooth or false tooth (67).

However, four factors (current marital status, household monthly income region in Thailand, and tobacco use) that related to insufficiently fruits and vegetable consumption significantly, when it is determined by adj OR found that size of relation is not high, even if 95%CI is narrow, it may be have other factors besides aforementioned variables such as knowledge, perception of benefit of vegetal consumption, believe and attitude.

## **5.6 Strength and limitation of the study**

### **Strength of the study :**

This study is a large sample size of older adults across different region of the communities of Thailand. It is modified from international standard questionnaire which reflects a significant advantage over other national dataset sources. Moreover, On-line electronic form of questionnaire was developed for data entering from all study sites.

### **5.7 Limitation of the study**

This study had several limitations. First, the process of data collecting with face to face interview of health variables such as FV intake, physical activity, tobacco or alcohol use should be interpreted with caution because of time limiting with many questions; it is possible that measurement errors occurred. The two FV questions depend on memory, therefore, there was the possibility of recall bias. However, this bias is minimized since the questions refer to a very short time period. One main limitation is that this method may not provide reliable estimates of the usual intake of participants. The face to face interview assessment of physical activity remains the most feasible and affordable instrument for global surveillance. However, objective population measures of physical activity, such as pedometers or accelerometers\_may be beneficial to determine if differences between groups revealed in the present study represent true differences in physical activity behavior. The study did not validate the measurement of dietary intake of FV and physical

activity, which are highly susceptible to respondent bias in the form of under or over reporting. Many studies in the area of nutritional epidemiology have established the need to integrate validation of measurements of dietary intake and physical activity into the study design. Without such an inbuilt component, the internal validity of the measurements are compromised.

Second, information on knowledge, psychosocial determinants (habit, motivation, goals, beliefs about capabilities, skills, taste, attitudes, and self-efficacy) and environmental factors such as local availability were not collected and should be included in future studies. Further, seasonal differences in availability of FVs may have influenced the consumption patterns and should be assessed in future studies.

Finally, this study was based on data collected in a cross-sectional survey. We cannot, therefore, ascribe causality to any of the associated factors in the study.

## **CHAPTER VI**

### **CONCLUSION AND RECOMMENTATIONS**

#### **6.1 Conclusion**

This study aimed to determine the prevalence of insufficient fruits and vegetable intake and identify factors associated with insufficient fruit and vegetable intake in adults aged 50 years and older in the communities of Thailand, and explaining predictive factors related to insufficient fruit and vegetable intake.

A household cross-sectional study was conducted for Thai adults aged 50 years and older in sixteen districts across all different regions of Thailand. The data were collected from September 2015 to March 2016 by multi-stage cluster sampling. A total of 3,977 subjects from sixteen districts were face-to-face interviewed by trained research assistants, and total 3,787 completed questionnaires were included in the analysis.

Data were analyzed by chi-square tests and multiple logistic regressions. Chi-square tests were used to identify the association and measure the strength of the relationship between insufficient fruit and vegetable intake and each independent variable ( $p$ -value < 0.05). Further, the independent variables with a  $p$ -value < 0.05 In the bivariate analysis were included in the multivariate analysis to determine the most predictive factors to insufficient fruit and vegetable intake.

This survey revealed that 77.4% of adults aged 50 years and older in the communities of Thailand were insufficient fruit and vegetable intake. This reflects the fact that insufficient fruit and vegetable intake is still a public health concern for older adults in Thailand.

This study highlighted that four factors were associated with insufficient fruits and vegetable intake as current marital status, household monthly income, region in Thailand and tobacco used ( $p$ -value<0.05). On the other hand; age, gender, religions denomination, education level, area of residence, health insurance, alcohol consumption, physical activity, anthropometric and health stage related factors

(diabetes, hypertension, stroke, angina, lost all of your natural teeth and depression) were not found to be associated with insufficient fruits and vegetable intake.

## **6.2 Recommendation**

### **6.2.1 Recommendations for policy maker**

Fruit and vegetable intake behaviors among older adults is a current global topic of growing public health concern, including Thailand. This study highlighted the prevalence of insufficient fruit and vegetable intake in older adults related to the predictive factors, this emerging trend and outline public health challenges for the coming future. Policy maker should take these findings into consideration when planning preventive intervention to achieve the most benefit for the indicated groups such as program for adults aged 60 years and older by both public policy maker and local policy maker.

1. This study found that elderly people insufficient fruit and vegetable intake, lower than standard recommend (400 gram or 5 serving per day). The older of population, the higher risk of insufficient fruit and vegetable intake. Moreover elderly populations who lived with low household monthly income family, lived rural area have insufficient fruit and vegetable intake. These should be promoted FVs intake and promote in planting of local vegetables according to seasons. Water should be managed sufficiently to supply for agriculture all year round. In addition adequate physical activity and smoking cessation should be promoted in elderly populations to increase FVI.

2. There should be promoted activity on FVs consumption campaigns, announced as national agenda and all organizations integrate, worked together to increase FV intake including children, juvenile until geriatrics.

3. Policy about food security of Thailand should be reviewed in terms of accessibility of FV of people. Although Thailand had policy that cover FAO (Food and Agriculture Organization of the United Nation) and similar to policy of other country but most of them still focus on economic development which was not connect to food security and nutrition of people especially fruit and vegetable.

4. Promotion of FVs consumption should be changed because previously Thailand and other countries focus on knowledge but USA provide free FV for students which could increased FV consumption in this group of populations. Moreover these could contribute farmers. Other countries still have no method to manage system and mechanism such as price and tax, control of market mechanisms and products distribution.

5. Fruit and vegetable intake should be promoted among older people who are widowed/ divorced/ separate marital status, and live in north eastern region.

### **6.2.2 Recommendation for health care provider**

Insufficient fruit and vegetable intake data in elderly has to be used to apply for planning and management in public health for elderly population. Activities and project could be set easily and practical. These could be used to adjusted in order to correct health behavior. For long last success these have to be returned to community and everyone brain storm, take action and process by themselves supported by government and associates.

### **6.2.3 Recommendations for future study**

1. In further study, it should be comparison study of FV consumption in younger adults and older adults to determine association. Thus, the data could be used as guideline to promote FV consumption precisely.

2. For next study, other factors that related to FV consumption behavior should be included such as knowledge of FV consumption, perceived benefit, family members, social interaction, believe and attitude.

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## **APPENDICES**

**APPENDIX A**  
**SAMPLE QUESTIONNAIRE**  
**PREVALENCE OF INSUFFICIENT FRUIT AND VEGETABLE**  
**INTAKE AND THE ASSOCIATED FACTORS IN OLDER**  
**ADULTS IN THAILAND**

**Individual Questionnaire**

<p>Q1001 INTERVIEWER: Does the respondent have obvious cognitive limitations that prevent him/her from being interviewed?</p>	<p>1.YES.....-&gt; 2.NO</p>	<p><b>Q1005</b></p>
<p>Q1002 How would you best describe your memory at present? Is it very good, good, moderate, bad or very bad?</p>	<p>1.VERY BAD 2. BAD 3.MODERATE 4. GOOD 5.VERY GOOD</p>	
<p>Q1003 Compared to 12 months ago, would you say your memory is now better, the same or worse than it was then?</p>	<p>1. WORSE 2. SAME 3. BETER</p>	
<p>Q1004 INTERVIEWER:</p>	<p>1 NO REASON TO THINK RESPONDENT HAS ANY COGNITIVE LIMITATIONS.....→ 2.COGNITIVE LIMITATIONS OR HEALTH PROBLEMS, PROXY.....→</p>	<p>INDIVIDUAL CONSENT FORM AND INDIVIDUAL Q</p> <p>Q1005</p>

<p>Q1005 INTERVIEWER: WE WOULD LIKE TO ASK SOMEONE WHO KNOWS THE RESPONDENT A FEW QUESTIONS ABOUT THE RESPONDENT'S MEMORY AND HEALTH. Who is the proxy?</p>	<p>1.SPOUSE .....→ 2 .NON-SPOUSE...→</p>	<p>Proxy Q Proxy Q</p>
<p>INTERVIEWER: GO TO PROXY CONSENT &amp; QUESTIONNAIRE</p>		

<p><b>Section 1:</b> <b>8 QUESTION ASK ABOUT SOCIO-DEMOGRAPHIC FACTORS</b></p>		
<p>Q1001 How old are you now? INTERVIEWER: This would be age at last birthday. If don't know - probe.</p>	<p><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/> AGE IN YEARS</p>	
<p>Q1002 INTERVIEWER: Record sex of the respondent</p>	<p>1. Male 2. Female</p>	
<p>Q1003 What is your current marital status?</p>	<p>1. NEVER MARRIED.....→ 2. CURRENTLY MARRIED...→ 3. CURRENTLY MARRIED...→ 4. SEPARATED/DIVORCED...→ 5. WIDOWED.....→</p>	<p><i>Q1014</i> <i>Q1013</i> <i>Q1013</i> <i>Q1012</i> <i>Q1012</i></p>
<p>Q1004 Do you belong to a <u>religious denomination</u>? INTERVIEWER: allow the respondent to reply without reading categories. Clarify as needed.</p>	<p>1.NO, NONE 2.BUDDHISM 3.CHRISTIANITY 4.ISLAM 87 .OTHER , SPECIFY: 97 .REFUSED</p>	
<p>Q1005 What is the highest level of education that you have completed</p>	<p>1. NEVER BEEN TO SCHOOL 2.LESS THAN PRIMARY SCHOOL 3.PRIMARY SCHOOL COMPLETED 4.SECONDARY SCHOOL COMPLETED 5.HIGH SCHOOL( OR EQUIVALENT) COMPLETE</p>	

	6.COLLEGE/PRE-UNIVERSITY/ UNIVERSITY COMPLETED 7.POST GRADUATE DEGREE COMPLETED
Q1006 What is your total household monthly income?	1 Less than 10000 baht/month 2 10000-20000 baht/month 3 20000-30000 baht/month 4 More than 30000 baht/month
Q1007 What is the type of neighbourhood you live in?	1. NON MUNICIPAL AREA 2 .MUNICIPAL AREA
Q1008 Do you have health insurance coverage?	1 = Yes, Universal coverage 2 = Yes, Social security 1 = Yes, Public welfare 2 = Yes, Voluntary insurance = No, none.

<b>Section 2:</b>		
<b>18 QUESTIONS ASK ABOUT PART LIFESTYE FACTORS</b>		
<b>Instructions:</b> These questions ask about psychoactive substances in the PAST 3 MONTHS ONLY		
Q 2001 Did you have a drink containing alcohol?	Yes [1] No [0]	> No: Skip to Q2
Q 2002 Did you smoke a cigarette containing tobacco?	Yes [1] No [0]	> No: Skip to Q3
<b>PHYSICAL ACTIVITY</b>		
<p>Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be an active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, household chores, harvesting food/crops, fishing or hunting for food, providing care or seeking employment.</p> <p>In answering the following questions 'vigorous activities' require hard physical effort and cause large increases in breathing or heart rate, 'moderate activities' require moderate physical effort and cause small increases in breathing or heart rate.</p>		
Q2003 Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate, [like heavy lifting, digging or chopping	1.YES 2.NO .....→	Q2006

wood] for at least 10 minutes continuously? INSERT EXAMPLES & USE SHOWCARD		
Q2004 In a typical week, on how many days do you do <u>vigorous-intensity</u> activities as part of your work?	<input type="checkbox"/> DAYS	
Q2005 How much time do you spend doing <u>vigorous-intensity</u> activities at work on a typical day?	□□:□□ HOURS:MINUTES	
Q2006 Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate [such as brisk walking, carrying light loads, cleaning, cooking, or washing clothes] for at least 10 minutes continuously? INSERT EXAMPLES & USE SHOWCARD	1. YES 2. NO .....→	Q2009
Q2007 In a typical week, on how many days do you do moderate-intensity activities as part of your work?	<input type="checkbox"/> DAYS	
Q2008 How much time do you spend doing moderate-intensity activities at work on a typical day?	□□:□□ HOURS:MINUTES	
The next questions exclude the physical activities at work that you've already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example, getting to work, to shopping, to the market, to place of worship. [Insert other examples if needed]		
Q2009 Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	1. YES 2.NO .....-->	Q3012
Q2010 In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	<input type="checkbox"/> DAYS	
Q2011 How much time would you spend walking or bicycling for travel on a typical day?	□□:□□ HOURS:MINUTES	
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness, leisure and recreational activities [insert relevant terms].		
Q2012 Do you do any vigorous intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate [like running or football], for at least 10 minutes continuously? INSERT EXAMPLES & USE SHOWCARD	1. YES 2 .NO..... →	Q2015
Q2013 In a typical week, on how many days do you	<input type="checkbox"/> DAYS	

do vigorous intensity sports, fitness or recreational (leisure) activities?	
Q2014 How much time do you spend doing vigorous intensity sports, fitness or activities on a typical day?	<input type="text"/> : <input type="text"/> HOURS:MINUTES
Q2015 Do you do any <u>moderate-intensity sports, fitness or recreational (leisure) activities</u> that causes a small increase in breathing or heart rate [such as brisk walking, cycling or swimming] for at least 10 minutes at a time? INSERT EXAMPLES & USE SHOWCARD	1. YES 2 .NO..... →
Q2016 In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?	<input type="text"/> DAYS
Q2017 How much time do you spend doing moderate intensity sports, fitness or recreational (leisure) activities on a typical day?	<input type="text"/> : <input type="text"/> HOURS:MINUTES

### Section :3 ANTHROPOMETRIC MEASUREMENTS

I would now like to measure how tall you are. To measure your height I need you to please take off your shoes. Put your feet and heels close together, stand straight and look forward standing with your back, head and heels touching the wall. Look straight ahead.

Q3001 Measured height in centimeters	<input type="text"/> <input type="text"/> <input type="text"/> centimeters 997 Refused 998 Not able
--------------------------------------	---

Now we want to measure your weight - could you please keep your shoes off and step on this scale. We will also measure your waist and hips using a tape measure.

Q3002 Measured weight In kilograms	<input type="text"/> <input type="text"/> <input type="text"/> kilograms 997 Refused 998 Not able
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Q2018 How much time do you usually spend sitting reclining on a typical day?	<input type="text"/> : <input type="text"/> HOURS:MINUTES
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### Section 4:

#### 6 QUESTION ASK ABOUT HEALTH STAGE – RELATED FACTORS

Now I would like to read you questions about some health problems or health care needs that you may have experienced, and the treatment or medical care that you may have received.

<b>HYPERTENSION</b> Q 4001 Have you ever been diagnosed with high blood pressure (hypertension)?	1.YES 2 NO	
<b>DIABETES</b> Q 4002 Have you ever been diagnosed with diabetes (high blood sugar)? (Not including diabetes associated with a pregnancy)	1.YES 2 NO	
<b>STROKE</b> Q 4003 Have you ever been told by a health professional that you have had a stroke?	1.YES 2 NO	
<b>ANGINA</b> Q 4004 Have you ever been diagnosed with <u>angina</u> or <u>angina pectoris</u> (a heart disease)?	1.YES 2 NO	
<b>ORAL HEALTH</b> Q 4005 Have you lost all of your natural teeth?	1.YES 2 NO	
<b>DEPRESSION</b> Q 4006 Have you ever been diagnosed with depression?	1.YES 2 NO	

<b>Section 5 :</b>	
<b>2 QUESTION ASK ABOUT FRUIT AND VEGETABLE INTAKE</b>	
<b>NUTRITION</b>	
<p>Studies have shown that nutrition and life-style are very important health factors. I want to ask you a few questions about your diet. I am going to ask you about the fruit and vegetables you usually eat.</p>	
Q5001 How many servings of fruit do you eat on a typical day?	<input type="checkbox"/> <input type="checkbox"/> SERVINGS -8 DON'T KNOW
Q5002 How many servings of vegetables do you eat on a typical day?	<input type="checkbox"/> <input type="checkbox"/> SERVINGS -8 DON'T KNOW

## APPENDIX B

**Table 1** Number and percentage of completed questionnaires respondents by districts.

Region/districts	Number	Percentage
<b>All</b>	<b>3787</b>	<b>100</b>
<b>Northern</b>	<b>319</b>	<b>8.4</b>
Wiang pa pao district	319	8.4
<b>North Eastern</b>	<b>1223</b>	<b>32.3</b>
moung district	0	0
Srirattana district	274	7.2
Phonnakeaw district	328	8.7
Thaicharoen district	307	8.1
Kudchum district	314	8.3
<b>Central</b>	<b>674</b>	<b>17.7</b>
Huaipulu district	282	7.4
Baanna district	301	7.9
Bang Bua Thong district	0	0
Wihandang district	61	1.6
Danchang district	30	0.8
<b>Eastern</b>	<b>310</b>	<b>8.2</b>
Baanpoh district	310	8.2
<b>Western</b>	<b>645</b>	<b>17</b>
Photaram district	333	8.8
Watpleng district	312	8.2
<b>Southern</b>	<b>616</b>	<b>16.3</b>
Kaochaison district	306	8.1
Kuankalong district	310	8.2

**Table 2** Descriptive statistics of sample characteristics and prevalence rate of insufficient fruit and vegetable intake

Variables	Total sample	Insufficient fruit and vegetable intake	
	N	Yes(%)	No(%)
<b>All</b>	3787	77.4	22.6
<b>Age</b>			
50-59	1404	77.8	22.2
60-69	1354	76.7	23.3
70-79	745	78.5	21.5
80 and over	284	76.4	23.6
<b>Gender</b>			
Male	1404	78.3	21.7
Female	2383	76.9	23.1
<b>Region</b>			
Northern	319	71.8	28.2
Central	674	73.9	26.1
North eastern	1123	82.6	17.4
Eastern	310	80.6	19.4
Western	645	74.0	26.0
Southern	616	76.1	23.9

## APPENDIX C

### คู่มือประกอบการตอบคำถามและการวัดกิจกรรมทางกาย Q2003-Q2018






#### ความหมายของกิจกรรมทางกาย

กิจกรรมทางกาย หมายถึง การเคลื่อนไหวร่างกายที่มีการใช้พลังงานในร่างกาย การสำรวจสุขภาพประชาชนไทยครั้งนี้ใช้แบบสอบถาม Global Physical Activity Questionnaire (GPAQ) version 28 ซึ่งมีข้อคำถามครอบคลุมกิจกรรมทางกาย 3 ลักษณะ คือ

- 1) กิจกรรมจากการทำงาน (Activity at work) ได้แก่ การทำงานโดยปกติ ที่ต้องออกแรงกายอย่างหนักหรือปานกลาง
- 2) กิจกรรมจากการเดินทางในชีวิตประจำวัน (travel to and from places) ได้แก่ การเดิน และการขี่จักรยาน
- 3) กิจกรรมยามว่าง (recreational activities) ได้แก่ การออกกำลังกาย เล่นกีฬา มีกิจกรรมยามว่าง








การออกกำลังกายหรือกิจกรรมทางกายแบบหนัก หมายถึง การออกกำลังกายอย่างหนักซึ่งอัตราการเต้นของหัวใจจะเร็วแรงและหายใจเร็วหรือหอบเหนื่อย (เช่น วิ่ง ยกของหนัก ขุดดิน) ดังรูป

Q3016. Does your work involve vigorous-intensity activity that causes large increase in breathing or heart rate, like [heavy lifting, digging or chopping wood] for at least 10 minutes continuously?

<p>1. Drawing a cart</p>  <p>ลากจูง</p>	<p>2. Cycle rickshaw driving</p>  <p>ถีบสามล้อ</p>
<p>3. Chopping, digging</p>  <p>ขุดดิน</p>	<p>4. Grinding (with pestle)</p>  <p>นวดคั่ว</p>
<p>5. Heavy lifting</p>  <p>แบกกระสอบ</p>	






การออกกำลังกายหรือกิจกรรมทางกายแบบปานกลาง หมายถึง การออกกำลังกายระดับปานกลางซึ่งอัตราการเต้นของหัวใจไม่แรงนักและหายใจเร็วแต่ไม่หอบเหนื่อย (เช่น เดินแอโรบิก

**Q3019. Does your work involve moderate-intensity activity that causes small increase in breathing or heart rate, such as brisk walking [or carrying light loads] cleaning, cooking, washing clothes, for at least 10 minutes continuously?**

<p>1. Shopping</p> 	<p>เดินซื้อของ</p>	<p>2. Carrying a light load</p> 	<p>ถือของเบาๆ</p>
<p>3. Walking with load on head</p> 	<p>แบกของบนศีรษะ</p>	<p>4. Cleaning - sweeping</p> 	<p>กวาดบ้าน</p>
<p>5. Washing clothes</p> 	<p>ซักผ้า</p>	<p>6. Ironing clothes</p> 	<p>รีดผ้า</p>
<p>7. Gardening</p> 	<p>รดน้ำต้นไม้</p>		





เดินเร็ว ทำงานเข็นผัก, ปลา ในตลาด) ดังรูป

Q3025. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that causes large increases in breathing or heart rate like [running, or football] for at least 10 minutes continuously?

<p>1. Fast swimming</p>  <p>ว่ายน้ำเร็ว</p>	<p>2. Running</p>  <p>วิ่ง</p>
<p>3. Playing badminton</p>  <p>เล่นแบดมินตัน</p>	<p>4. Playing football</p>  <p>เตะฟุตบอล</p>
<p>5. Cycling</p>  <p>ปั่นจักรยาน</p>	

การออกกำลังกายแบบปานกลาง ดังรูป

Q3028. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate, such as brisk walking [cycling or swimming] for at least 10 minutes at a time?

<p>1. Brisk walking</p>  <p>เดินเล่น</p>	<p>2. Cycling</p>  <p>ปั่นจักรยานเล่น</p>
<p>3. Swimming</p>  <p>ว่ายน้ำ</p>	<p>4. Playing table-tennis</p>  <p>เล่นปิงปอง</p>

กิจกรรมทางกาย (การทำงาน)		การออกกำลังกายยามว่าง	
กิจกรรมทางกาย แบบปานกลาง	กิจกรรมทางกาย แบบหนัก	การออกกำลังกาย ยามว่างแบบปานกลาง	การออกกำลังกาย ยามว่างแบบหนัก
ตัวอย่าง : - การทำความสะอาดบ้าน (ขัดพื้น, ถูพื้น, รีดผ้า, ถูบ้าน, ถูคีย์บอร์ด) - การซักล้าง - การทำสวน - รีดนมวัว - การปลูกและเก็บเกี่ยวพืช - ขุดดิน - การถักทอ - งานตอกสั้ว, เลื่อยไม้ - ผสมปูน - การใช้แรงงาน (เข็นรถ, ตอกค้อน) - การแบกของ - ดำน้ำ - การเลี้ยงสัตว์	ตัวอย่าง : - การทำป่าไม้ (ตัดไม้, ขนไม้) - เลื่อยไม้แข็ง - ไถนา - ตัดอ้อย - การตัด - การนวด - บั่นสามล้อ	ตัวอย่าง : - ปั่นจักรยานเล่น - วิ่งเหยาะๆ - เดินรำ - ขี่ม้า - ไทเก๊ก - โยคะ - ขี่ม้า	ตัวอย่าง : - เตะฟุตบอล - เล่นรักบี้ - เล่นเทนนิส - ว่ายน้ำ - ปั่นจักรยานเสือภูเขา - การเดินระบำเท้า

กิจกรรมทั้ง 3 ลักษณะนี้ แต่ละลักษณะมีการถามความหนักเบาของการใช้แรงกาย (intensity), ระยะเวลาที่มีกิจกรรมเป็นนาทีต่อวัน และความถี่ของการมีกิจกรรมเป็นวันต่อสัปดาห์

**ระดับความหนักเบา (Intensity) ของการมีกิจกรรมทางกายกิจกรรมอย่างหนัก หมายถึง**

1. การทำงานออกแรงกายอย่างหนัก ทำให้หายใจแรงขึ้น หรือหัวใจเต้นเร็วขึ้นมาก ออกแรงกายต่อเนื่องเป็นเวลาตั้งแต่ 10 นาที ขึ้นไปในแต่ละครั้ง เช่น การยกของหนัก งานก่อสร้าง งานขุดดิน การทำนา ทำสวน ทำไร่ เป็นต้น

2. กิจกรรมยามว่างที่ออกแรงกายอย่างมาก ได้แก่ การออกกำลังกาย หรือเล่นกีฬาอย่างหนัก จนทำให้หายใจแรงขึ้น หรือหัวใจเต้นเร็วขึ้นมาก โดยออกแรงกายเป็นเวลาตั้งแต่ 10 นาทีขึ้นไป ในแต่ละครั้ง เช่น เดินแอโรบิก วิ่ง เล่นฟุตบอล เป็นต้น

### กิจกรรมอย่างปานกลาง หมายถึง

1. การทำงานออกแรงกายปานกลาง ทำให้หายใจแรงขึ้นหรือ หัวใจเต้นเร็วขึ้นปานกลาง ออกแรงกายต่อเนื่องเป็นเวลาตั้งแต่ 10 นาที ขึ้นไปในแต่ละครั้ง เช่น การเดินไปมาในที่

2. การเดินทางจากสถานที่หนึ่งไปอีกที่หนึ่ง โดยการเดินหรือขี่จักรยานเป็นเวลา 10 นาที อย่างต่อเนื่อง

3. มีกิจกรรม เล่นกีฬา ออกกำลังกาย หรือมีกิจกรรมยามว่างที่ใช้แรงกายอย่างปานกลาง เป็นเวลาตั้งแต่ 10 นาทีขึ้นไปในแต่ละครั้ง เช่น เดินเร็ว ขี่จักรยาน เล่นวอลเลย์บอล หรือว่ายน้ำ เป็นต้น ความหนักเบาของการออกแรงกายนี้ สามารถแปลงเป็นพลังงานที่ร่างกายต้องใช้ไปต่ออนาทิต่อวัน และต่อสัปดาห์ โดยการคำนวณเป็นค่า metabolic equivalent (MET) MET หมายถึง อัตราส่วนของ พลังงานที่ร่างกายใช้ในการออกแรงกายต่อพลังงานที่ใช้ขณะพัก โดย 1 MET = 1kcal/kg/hr เป็นพลังงานที่เทียบเท่ากับพลังงานที่ร่างกายใช้ขณะอยู่ร่างกายนิ่งอยู่เฉยๆ โดยร่างกายจะใช้พลังงาน 1 kcal ต่อน้ำหนักตัว 1 kg ต่อชั่วโมง

### ความเชื่อมโยงระหว่าง ความหนักเบาของกิจกรรมทางกายกับ MET

การออกแรงกายอย่างปานกลางจะใช้พลังงานเป็น 4 เท่า ของการนั่งเฉยๆ และการออกแรงกายอย่างหนักจะใช้พลังงานเป็น 8 เท่า ดังนั้น

ลักษณะกิจกรรมทางกาย	ค่า MET
การทำงาน	ออกแรงปานกลาง ค่า MET = 4.0 ออกแรงหนัก ค่า MET = 8.0
การเดินทาง	ขี่จักรยาน หรือเดิน ค่า MET = 4.0
กิจกรรมยามว่าง	ออกแรงปานกลาง ค่า MET = 4.0 ออกแรงหนัก ค่า MET = 8.0

**วิธีการคำนวณ MET**

1. กิจกรรมทางกายอย่างหนัก : MET = รวม เวลา (นาที) ของกิจกรรมอย่างหนักใน 1 สัปดาห์  
 $\times 8$
2. กิจกรรมทางกายปานกลาง : MET = รวม เวลา (นาที) ของกิจกรรมอย่างปานกลาง ใน 1 สัปดาห์  $\times 4$

**เกณฑ์ระดับกิจกรรมทางกาย****มาก (High physical activity)**

- มีกิจกรรมทางกายอย่างหนัก  $\geq 3$  วัน/สัปดาห์ และ total MET-นาที/สัปดาห์  $\geq 1500$  หรือ
- มีกิจกรรมทางกายอย่างหนัก หรือปานกลางรวม  $\geq 7$  วัน/สัปดาห์ และ total MET-นาที/สัปดาห์  $\geq 3000$

**ปานกลาง (Moderate physical activity)**

- มีกิจกรรมทางกายไม่มากถึงระดับมาก และ
- มีกิจกรรมอย่างหนัก  $\geq 3$  วัน/สัปดาห์ และเวลา  $\geq 20$  นาทีต่อวัน หรือทำงาน หรือร้านค้า ทำงานบ้าน ทำครัว หรือถือของเบาๆ เป็นต้น
- กิจกรรมปานกลาง หรือเดิน  $\geq 5$  วัน/สัปดาห์ อย่างน้อยวันละ 30 นาทีต่อวัน หรือ
- กิจกรรมหนักและปานกลางหรือเดิน รวม  $\geq 5$  วัน/สัปดาห์ และ total MET-นาที/สัปดาห์  $\geq 600$

**น้อย (Low physical activity)**

- ระดับของการมีกิจกรรมทางกายต่ำกว่าเกณฑ์ระดับปานกลางและมาก

### คู่มือประกอบการตอบคำถามและการวัด Q5001

คำถามเกี่ยวกับปริมาณการรับประทานผลไม้ โภชนาการ (NUTRITION)

ผลไม้ 1 ส่วน = 1 หน่วยบริโภค = 80 กรัม

ผลไม้ 1 ส่วน ให้คาร์โบไฮเดรต 15 กรัม พลังงาน 60 กิโลแคลอรี

การวัดปริมาณผลไม้ 1 หน่วยบริโภคของผลไม้ เท่ากับ ข้อใดข้อหนึ่ง ดังต่อไปนี้

1.ผลไม้สด 1 หน่วยบริโภค เท่ากับ ตัวอย่างด้านล่าง

แอปเปิ้ล 1 ผลเล็ก	กล้วยหอม 1/2 ผล	ฝรั่ง 1 ลูกเล็ก ฝรั่ง 1/2 ผลกลาง
สับปะรด 8 ชิ้นคำ	แตงโม 8 ชิ้นคำ	แคนตาลูป 10 ชิ้นคำ
ชมพู่ 2 ลูก	มะม่วงสุก 1/2 ผลกลาง มะม่วงดิบ 1 ผลใหญ่	กล้วยน้ำหว้า 1 ผล กล้วยไข่ 1 ผลกลาง กล้วยหักมุก 1/2 ผลกลาง
	ลิ้นจี่สด 6 ผล	กล้วยเล็บมือนาง 2 ผล
สาลี่ (ฝรั่งกลม) 1 ผลเล็ก	พีช 1 ผล	พลับพลึง 1/2 ผล
แพร์ 1 ผลเล็ก	มะขามหวาน 2 ผล	มะพร้าวอ่อน 5 1/2 ซ้อนโต๊ะ
ส้มเขียวหวาน 1 ผลใหญ่	มะละกอสุก 8 ชิ้นคำ	พุทรา 4 ผล
ระกำ 2 ผล	ลองกอง 5-6 ผล	ลำไย (สด) 6 ผล
ลูกตาลอ่อน (สด) 3 ลอน	สตอเบอรี่ 13 ผลเล็ก	ส้มจีน 3 ผล
อินทผลัม 3 ผล	แก้วมังกร 10 ชิ้นคำ	มังคุด 4 ผล
ส้มเขียว 1 ผลกลาง	ส้มโอ 2 กลีบใหญ่	องุ่น 20 ผลเล็ก
เงาะ 4 ผล	ลางสาด 7 ผล	ขนุน 2 ยวงกลาง
ลำไย 6 ผล	น้อยหน่า 1/2 ผล	ละมุด 1- 1 1/2 ผล
ทุเรียน 1 เมล็ดเล็ก	เชอร์รี่ 10 ผล	แตงไทย 10 ชิ้นคำ

2. น้ำผลไม้ขึ้นกับชนิดของน้ำผลไม้ ½ ถ้วยตวง (120 ซีซี) หรือ 1/3 ถ้วยตวง (80 ซีซี) เท่ากับ 1 หน่วยบริโภค

ชนิดของน้ำผลไม้	ขนาด
น้ำแอปเปิ้ล	½ ถ้วยตวง (120 ซีซี)
น้ำองุ่น	1/3 ถ้วยตวง (80 ซีซี)
น้ำส้ม	½ ถ้วยตวง (120 ซีซี)
น้ำสับปะรด	½ ถ้วยตวง (120 ซีซี)
น้ำพ룬	1/3 ถ้วยตวง (80 ซีซี)
น้ำผลไม้รวม	1/3 ถ้วยตวง (80 ซีซี)

### คู่มือประกอบการตอบคำถาม Q5002 และการวัด ปริมาณการรับประทานผัก

การวัดปริมาณการบริโภคผัก ประกอบด้วย ข้อใดข้อหนึ่ง ดังต่อไปนี้

1. ผักดิบ 2 ทัพพี = 1 หน่วยบริโภค = 80 กรัม
2. ผักสุก 1 ทัพพี = 1 หน่วยบริโภค = 80 กรัม
3. ผักใช้ผล/หัว/ราก เช่น มะเขือเทศ แครอท พริกทอง ข้าวโพด กระหล่ำดอก ถั่วฝักยาว

หอมหัวใหญ่ 1 ทัพพี = 1 หน่วยบริโภค = 80 กรัม

4. 1/2 ถ้วยตวง = 1 หน่วยบริโภค = 80 กรัม

**ประเภท ก.** ผัก 1 ส่วน คือ ผักสุก 1/2 ถ้วยตวง หรือ 1 ทัพพี หรือ ผักดิบ 1 ถ้วยตวง หรือ 2 ทัพพี ให้พลังงานต่ำมาก ได้แก่ ผักต่างๆ ดังนี้ : ผักกาดขาว ผักกาดสลัด ผักแว่น ผักกาดเขียว ผักสลัดแก้ว ผักปวยเล้ง ยอดพริกทองอ่อน ใบโหระพา กระหล่ำปลี ขึ้นฉ่าย สายบัว มะเขือเทศ มะเขือพริกเขียว ผักกาดหอม ผักบั้ง ผักกาดเขียว ผักแว่น มะเขือเทศ ขมิ้นขาว แดงร้าน แดงกวา ใบกระเพรา แดงโมอ่อน พริกเขียว น้ำเต้าแฟง พริกหนุ่ม บวบ พริกหยวกคุณ หยวกกล้วยอ่อน ตั้งโอ้ มะเขือยาว มะเขือพวง ฝรั่งอ่อน ต้นหอม ผักกระสัง ผักกวางตุ้ง หัวปลี ไซเท้า ตำลึง

**ประเภท ข.** ผัก 1 ส่วน คือ ผักสุก 1/2 ถ้วยตวง หรือ 1 ทัพพี หรือ ผักดิบ 1 ถ้วยตวง หรือ 2 ทัพพี ให้โปรตีน 2 กรัม คาร์โบไฮเดรต 5 กรัม พลังงาน 25 กิโลแคลอรี ได้แก่ ผักต่างๆ ดังนี้ : มะละกอดิบ แครอท ดอกขี้เหล็ก ผักหวาน ผักกระเฉด ผักคะน้า ขนุนอ่อน ดอกกะหล่ำ ถั่วงอกหัวโต ถั่วลันเตา ถั่วฝักยาว ถั่วแขก ถั่วพู บีตรูต ต้นกระเทียม ยอดแค ยอดชะอม ยอดมะพร้าวอ่อน ยอดกระถิน ยอดสะเดา ดอกขจร ดอกโสน ผักต้ว พริกหวาน มะระ ดอกผักกวางตุ้ง ใบทองหลาง ใบขจร รากบัว ข้าวโพดอ่อน บวบ สะเดา บรอกโคลี มะละกอดิบ หน่อไม้ปิ้ง ใผ่ตง เห็ดนางรม เห็ดเป๋าฮื้อ มะรุ้ม ดอกผักกวางตุ้ง ต้นกระเทียม หน่อไม้ฝรั่ง มะเขือเปราะ มะเขือพวง ผักโขม หอมหัวใหญ่ สะตอ



ตัวอย่างรูปภาพประกอบ

## **BIOGRAPHY**

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