THE ASSOCIATION BETWEEN LIFESTYLE AND METABOLIC SYNDROME AMONG MALE NAVAL PERSONNEL IN BANGKOK AND SUBURBAN

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Lieutenant Commander Duangkmol Chatngern

THE ASSOCIATION BETWEEN LIFESTYLE AND METABOLIC SYNDROME AMONG MALE NAVAL PERSONNEL IN BANGKOK AND SUBURBAN

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ABSTRACT

This cross-sectional study aimed to examine the association between lifestyle and metabolic syndrome among male naval personnel in Bangkok and suburban. Participants were selected randomly from male naval personnel in Bangkok and suburban. A cross-sectional study was undertaken of data from 344 male naval personnel between aged 35-60 years who received annual health check ups at Somdejprapinklao Hospital and Bangkok Naval Hospital during May to October 2007. Information about general characteristics and lifestyles of participants was collected by using structured questionnaires and results of health examinations. Metabolic syndrome was detected by using NCEP- ATP III criteria. Data were analyzed by use of descriptive statistics, tested association by univariate analysis (Chi-square test) and multivariate analysis (Binary logistic regression), at 95% confidence intervals (p-value < 0.05).

The prevalence of metabolic syndrome among male naval personnel in Bangkok and suburban was 11.9%. This study showed that there was an association between the subjects aged ≥45 years ($OR_{adjust} = 5.17$, 95% CI= 1.91 -13.99, p= 0.001), physical inactivity ($OR_{adjust} = 5.93$, 95%CI = 2.39 -14.71, $p < 0.001$), and salty food intake ($OR_{adjust} = 6.84$, 95% CI= 2.21 -21.21, p= 0.001) with metabolic syndrome. Whereas no relationship with metabolic syndrome was found in the subjects who received income >20,000 baht/month ($OR_{adjust} = 0.25$, 95% CI= 0.07 -0.85, p= 0.03)

These findings suggest that a metabolic syndrome reduction campaign using health prevention and health promotion methods, based on annual health check up data, would succeed by adopting therapeutic lifestyle changes(TLC) such as weight reduction activities, physical activity, and healthy diets.

KEY WORDS: LIFESTYLE / METABOLIC SYNDROME / MALE NAVAL PERSONNEL IN BANGKOK AND SUBURBAN

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ความสัมพันธ์ระหว่างการดำเนินชีวิตกับการเกิดเมตาบอลิคซินโดรมในข้าราชการทหารเรือชายสังกัดกรุงเทพและปริมณฑล (THE ASSOCIATION BETWEEN LIFESTYLE AND METABOLIC SYNDROME AMONG MALE NAVAL PERSONNEL IN BANGKOK AND SUBURBAN)

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บทคัดย่อ

การศึกษาครั้งนี้ มีวัตถุประสงค์เพื่อ ศึกษาความสัมพันธ์ระหว่างการดำเนินชีวิต กับการเกิดเมตตาบอลิคซินโดรมในข้าราชการทหารเรือชายสังกัดกรุงเทพและปริมณฑล การศึกษาเป็นแบบภาคตัดขวางจากการเก็บข้อมูลจากกลุ่มตัวอย่างทหารเรือชายในกรุงเทพและปริมณฑลจำนวน 344 คน อายุ 35-60 ปี ที่มารับการตรวจสุขภาพประจำปีที่โรงพยาบาลสมเด็จพระปิ่นเกล้า และ โรงพยาบาลทหารเรือกรุงเทพ ระหว่าง พฤษภาคม 2550 ถึง ตุลาคม 2550 โดยข้อมูลที่นำมาศึกษาเกี่ยวกับลักษณะทั่วไปและการดำเนินชีวิตได้จากการตอบแบบสอบถามของกลุ่มตัวอย่าง ผลการตรวจร่างกายผู้วิจัยเป็นผู้บันทึก สำหรับการวินิจฉัยว่าเป็นเมตตาบอลิคซินโดรมนั้นใช้ตามนิยามของ NCEPT-ATP III และวิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา ทดสอบความสัมพันธ์โดยใช้สถิติไคว์สแควร์ วิเคราะห์ความถดถอยโลจิสติก ระดับนัยสำคัญทางสถิติที่ 0.05

ผลการศึกษาพบว่าข้าราชการทหารเรือชายสังกัดกรุงเทพและปริมณฑลมีความชุกของเมตตาบอลิคซินโดรม 11.9%จากการวิเคราะห์ORแบบMultivariate analysisพบว่า ปัจจัยที่มีความสัมพันธ์กับการเกิดเมตาบอลิคซินโดรมในกลุ่มตัวอย่างนี้ มีความสัมพันธ์ในกลุ่มที่มีอายุมากกว่า45ปี (OR_{adjust}=5.17, 95% CI=1.91 -13.99, p=0.001), กลุ่มที่ไม่ค่อยออกกำลังกาย (OR_{adjust}=5.93, 95%CI =2.39 -14.71, p<0.001) และ กลุ่มที่ชอบรับประทานอาหารเค็ม (OR_{adjust}=6.84, 95% CI=2.21 -21.21, p= 0.001) ส่วนในกลุ่มผู้ที่มีเงินเดือน>20,000 บาท กลับพบว่าเป็นปัจจัยป้องกัน (OR_{adjust} = 0.25, 95%CI = 0.07-0.85, p=0.03)

จากการศึกษาครั้งนี้มีข้อเสนอแนะว่าการรณรงค์เพื่อลดการเกิดเมตาบอลิคซินโดรม โดยโครงการป้องกันและส่งเสริมสุขภาพ ให้ตรวจสุขภาพประจำทุกปี และปรับเปลี่ยนวิถีชีวิตเช่นการลดน้ำหนัก, ออกกำลังกายและรับประทานอาหารโดยคำนึงถึงสุขภาพ สิ่งเหล่านี้เป็นเรื่องสำคัญโดยเฉพาะในข้าราชการทหารเรือชายสังกัดกรุงเทพและปริมณฑลที่มีอายุตั้งแต่ 45 ปีขึ้นไป

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CHAPTER I
INTRODUCTION

Background and Significance of the Study

Metabolic syndrome, which is characterized by a group of metabolic risk factors, is associated with the subsequent development of cardiovascular disease (CVD) and type2 diabetes. The risk of CVD and all cause mortality increases with the development of metabolic syndrome. (1) The metabolic syndrome includes high blood pressure, elevated triglycerides, low high-density lipoprotein(HDL), impaired fasting glucose and excess abdominal fat. (2) Among this clustering of risk factors, visceral fat and insulin resistance play a major roll of metabolic syndrome. (3) Recently, several report showed that risk factors for the development of metabolic syndrome are overweight and obesity, physical inactivity, atherogenic dietary habits, cigarette smoking, alcohol consumption, age, sex and genetic factors.(4,5,6) Overweight and excess abdominal fat have been associated with the components of metabolic syndrome. (7) People with metabolic syndrome are increased risk, being twice as likely to die from and three times as likely to have a heart attack or stroke compared to people without the syndrome. (8) Early detection and more intensive management of the metabolic syndrome are in order to diminish the long-term risk of cardiovascular disease and diabetes.

According to the data from the Third National Health and Nutrition Examination Survey (NHANES III), the prevalence of metabolic syndrome in the U.S. population increases with age, from 7% among young adults (20-29 years) to about 42% at later ages (60-70 years). (9) It is believed that these metabolic disorders emerge in the aged subjects who are living in inappropriate lifestyle. (10) Moreover, prevalence of the syndrome in previous studies was 10-40% in most Asian countries. (11) Thailand, moving toward changes in lifestyle and behaviors are similar to the Western cultures. In Thailand, the estimated prevalence of metabolic syndrome by using NCEP ATP III

criteria in an annual health examination was 12.8%.(12) In addition to predisposing factors, inappropriate dietary intake and lifestyle play important roles in the development of all components of metabolic syndrome. (1, 4, 13) The Fifth National Food and Nutrition Survey of Thailand in 2005 by Department of Health, Ministry of Public Health, found the prevalent rate of over nutrition in the age group 19-59 years was 23.7%. (14.) From EGAT study was found there was metabolic syndrome among EGAT personnel by using NCEP, IDF and WHO criteria 15.2%, 10.1% and 4.5% respectively. (15) While, the prevalence of this syndrome was found among professional and office workers in Bangkok 15.2% and approximately 3 times more common among men than women. (16) Regarding, the reports from the Royal Thai Naval Medical Department showed in fiscal year 2000 there was overweight among male naval personnel 4.6% and increased to 7.2% in next year. During 1992-2002, was found there was increasing of overweight among male naval personnel in Bangkok and suburban from 28.69% to 33.92% that was higher than others areas. Another survey by using questionnaire was found the leading medical illness among naval personnel and employees were hypertension, cardiovascular disease and hyperlipidemia .There was smoker among them 25%(in non-commissioned officers smoked higher than officers).The average of alcohol used was 2 bottles of beer and 0.7 bottle of whisky. (17) For military personnel in others countries, metabolic syndrome was found 9%among French military personnel in Paris and the major criteria were older , higher BMI , greater body weight**,** smoking, little physical activity and family histories of diabetes and arterial hypertension.(18) Al-Qahtani DA et al. found the prevalence of metabolic syndrome in Saudi Arabia male soldiers was found to be 20.8%. Abdominal obesity was the most common component in the study population closely followed by raised serum triglycerides and elevated systolic blood pressure. Over two-thirds of the subjects (71%) exhibited at least one criterion for metabolic syndrome. Prevalence of individual factors showed a steady increase with increase in age and body fat.(19.) From the result above nowadays increasing of the number of people with metabolic syndrome is associate with epidemic of obesity ,diabetes and hypertension and also develop to be cardiovascular disease.

In these respects, at first time of their entry into the Royal Thai Navy, all of them were healthy young men but nowadays male naval personnel in Bangkok and

suburban are attacking from the metabolic disorder diseases that influence to work performance and loss of fiscal for treatment of The Navy. In present time, there is rare study about metabolic syndrome among Royal Thai Naval personnel. Thus, the objective of this study is to study the association between lifestyle and metabolic syndrome among male naval personnel in Bangkok and suburban. Because, living and working in urbanization is easy to expose to unhealthy lifestyle that influence to development of metabolic syndrome.

I wish this study will be useful to increase understanding and awareness about metabolic syndrome and be implicating data of campaigns for health promotion or health prevention program in the Royal Thai Navy.

Research question

Is lifestyle associate with metabolic syndrome among male naval personnel in Bangkok and suburban?

Objectives of the study

1. To study association between lifestyle and metabolic syndrome among male naval personnel in Bangkok and suburban.
2. To study prevalence of metabolic syndrome among male naval personnel in Bangkok and suburban.

Research Hypothesis

1. Factors of lifestyle associate with metabolic syndrome among male naval personnel in Bangkok and suburban.
2. Factors of demographics population associate with metabolic syndrome among male naval personnel in Bangkok and suburban.

Scope of the Study

The research study was conducted among male naval personnel in Bangkok and suburban who received annual health checkup at Somdejprapinklao Hospital and Bangkok Naval Hospital.

Definition of the Terms

1. Lifestyle is concept of habitual behaviors of male naval personnel in Bangkok and suburban such as dietary pattern, regular physical activity, cigarette smoking, alcohol consumption, stress and duration of sleeping time.

2. Metabolic Syndrome is a cluster of the risk factors such as high blood pressure, elevated triglycerides, low high-density lipoprotein (HDL), impaired fasting glucose and excess abdominal fat. In this study defined by using the US National Cholesterol Education Program Adult Treatment Panel III (2001) requires at least three of the following (20)

- central obesity: waist circumference ≥ 36 inches or 90 cm (male)
- dyslipidaemia: TG ≥ 1.695 mmol/L (150 mg/dl)
- dyslipidaemia: HDL-C < 40 mg/dL (male)
- blood pressure ≥ 130/85 mmHg
- fasting plasma glucose ≥ 6.1 mmol/L (110 mg/dl)

For the waist circumference, it was using a definition of the International Diabetes Federation (IDF), for South Asian and South-East Asian men ≥ 90 cm (36 inches) (21)

3. Male naval personnel in Bangkok and suburban are refer to male naval personnel who worked in 30 Naval Departments in Bangkok and perimeter and lived in Bangkok and suburban area with age 35-60 years old

4. Suburban is defined to Samutprakarn, Nonthaburi, Pathumthani, and Samutsakorn province.

5. Abdominal obesity is refer to waist circumference by using IDF definition for South Asian and South-East Asian ≥90 cm(36 inches) in male.

Waist circumference is measured when the subjects were in standing position by using the bendable and not stretch measurement tape at the level of navel in horizontal line. (15, 22)

6. Serum triglyceride (Tg) refer to serum triglyceride level in fasting blood normal subject, based on NCEP (16), Tg level of <150, 150-199, 200-499 and ≥500 mg/dl were classified to be normal, borderline high, high and very high, respectively. (20)

7. Serum HDL cholesterol (HDL-C) refer to serum high density lipoprotein cholesterol in fasting blood normal subject, based on NCEP (20), HDL-C level of <40, 40-59 and ≥ 60 mg/dl were classified to be low, normal and high, respectively. (20)

8. Hypertension (HT) refer to blood pressure (BP) ≥140/90 mmHg**,** based on JNC 7(23)

9. Hyperglycemia refers to high level of fasting plasma glucose (FPG). It is the primary stage of diabetes. FPG level were classified according to the expert committee on the diagnosis and classification of diabetes mellitus (24)FPG level of < 110, 110-125 and ≥ 126 mg/dl were classified to be normal, impaired fasting glucose and diabetes mellitus, respectively.

10. Alcohol consumption: Several health problems including hypertension and hyperglycemia are related to a high alcohol intake.

Alcohol consumption was classified as;

: Drinker means the subjects who drank alcohol beverage regularly and/or who drank alcohol beverage when they participated in social activity

: Non-drinker means the subjects who never drank alcohol beverage and/or the subjects who ceased alcohol beverage for a certain period prior to this study.

11. Cigarettes smoking: Smoking is recognized as one of several factors that might be related to a higher risk of CVD, HT and others metabolic disorder.

Cigarette smoking was classifieds as:

: Non-smoker mean the subjects who never smoked cigarette.

: Ex- smoker mean the subjects who smoked previously but ceased smoking for ≥1 years.

: Current-smoker mean the subjects who smoked regularly.

12. Physical activity: Physical activity is defined as any bodily movement produced by skeletal muscles that result in an expenditure of energy. (25)

Physical activity was classifieds as:

Light intensity physical activity = less activity such as sedentary working that spent a long time of the day , household activity or occupational activity which no more of activity or leisure time activity

Moderate-intensity physical activity = activity that some increase in breathing but did not gasp for breath from tiredness, could talk to other person like normal

High-intensity physical activity = activity that make feeling of tiredness or gasp for breath from tiredness by high and deep breathing, high heart rate more than normal , and conversation is difficult or broken.

Physical inactivity can be defined as a state when body movement is minimal and energy expenditure approximates resting metabolic rate. However, physical inactivity represents more than an absence of activity. (26)

Regular physical activity was recommended to performed most days of the week, preferably daily, 5 or more days of the week if moderate-intensity activities (in bouts of at least 10 minutes for a total of at least 30 minutes per day) or 3 or more days of the week if vigorous-intensity activities (for at least 20-60 minutes per session).

13. Food consumption: Food consumption pattern is one of lifestyle which influence to one's health if it is inappropriate diet, it may induce person to suffer from metabolic disorder diseases. Food consumption pattern is defined as habitual food intake during the past three month. Food consumption were classifieds as: fat-rich

food, salty food, total fiber food and high calories beverage. It is measured that how often the subjects have per week. (27)

14. Stress: Stress in humans results from interactions between persons and their environment that are perceived as straining or exceeding their adaptive capacities and threatening their well-being.

In this study stress is assessed by use questionnaires which tested frequency of signs, behaviors, feeling of person in last 2 months. The questionnaires use pattern of Mental Health Department, Ministry of Public Health. (28)

15. Duration of sleeping time: The relationship between sleep (quantity and quality) and estimates of morbidity and mortality remains controversial. Data from epidemiological studies suggest that a habitual short sleep duration (less than six hours sleep per night) or long sleep duration (more than nine hours sleep per night) is associated with increased mortality. (29)

Duration of sleeping time is assessed by use questionnaires asked the subjects how long of their sleep at night.

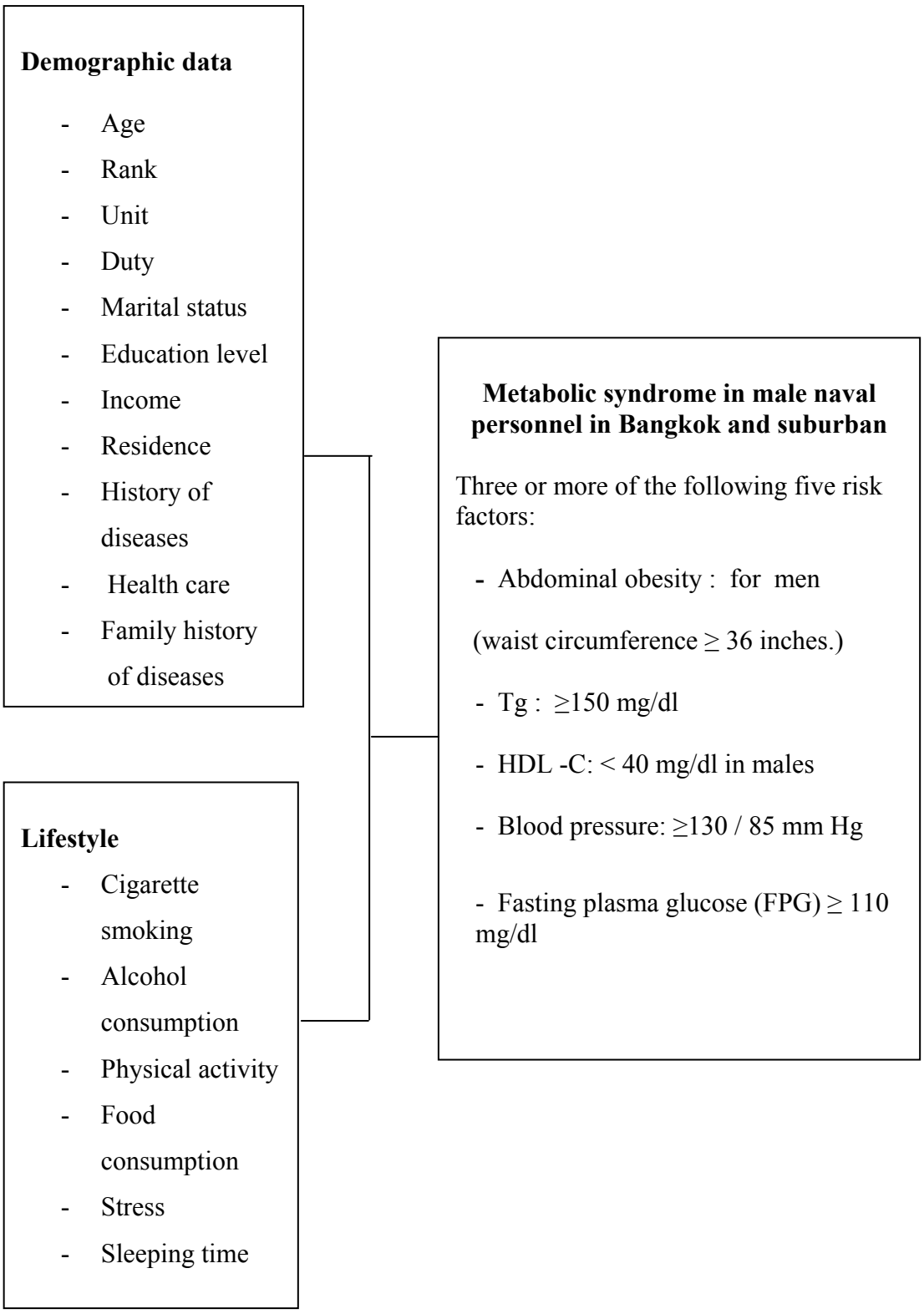
Benefit of the study

1. To create understanding and awareness about metabolic syndrome among the naval personnel.

2. To provide implicating data of campaigns for health promotion or health prevention program in the Royal Thai Navy.

3. To provide data for others researchers who are interested to study health status of male naval personnel in Bangkok and suburban.

Conceptual Framework of this Study



CHAPTER II

LITERATURE REVIEWS

Metabolic syndrome

Metabolic syndrome is the concept of clustering risk factors comprising insulin resistance, abdominal fat distribution, dyslipidemia (high triglyceride and low HDL-C) and elevated blood pressure (30-33). Metabolic syndrome is also known as metabolic syndrome X, syndrome X, insulin resistance syndrome. Metabolic syndrome is a combination of medical disorders that increase the risk of developing cardiovascular disease and diabetes(34). It affects a great number of people, and its prevalence increases with age. Some studies estimate the prevalence of this syndrome in the U.S. to be increase to 25% of the population (35). People with metabolic syndrome are increased risk, being twice as likely to die from and three times as likely to have a heart attack or stroke compared to people without the syndrome (8).

Research by Louisiana State University published in the Journal of the American Medical Association in 2003 found that those suffering from Metabolic Syndrome were at significantly greater risk of dying from a heart attack than those without the condition (1).

Components of Metabolic Syndrome

The National Cholesterol Education Program (NCEP)-ATP III identified 6 components of the metabolic syndrome that relate to cardiovascular disease (CVD) as the following: (36)

- Abdominal obesity
- Atherogenic dyslipidemia
- Raised blood pressure
- Insulin resistance ± glucose intolerance

- Proinflammatory state
- Prothrombotic state

These components of the metabolic syndrome constitute a particular combination of what ATP III terms underlying, major, and emerging risk factors. According to ATP III, underlying risk factors for CVD are obesity (especially abdominal obesity), physical inactivity, and atherogenic diet; the major risk factors are cigarette smoking, hypertension, elevated LDL cholesterol, low HDL cholesterol, family history of premature coronary heart disease (CHD), and aging; and the emerging risk factors include elevated triglycerides, small LDL particles, insulin resistance, glucose intolerance, proinflammatory state, and prothrombotic state. For present purposes, the latter 5 components are designated metabolic risk factors. Each component of the metabolic syndrome will be briefly defined.

- Abdominal obesity is the form of obesity most strongly associated with the metabolic syndrome. It presents clinically as increased waist circumference.

- Atherogenic dyslipidemia manifests in routine lipoprotein analysis by raised triglycerides and low concentrations of HDL cholesterol. A more detailed analysis usually reveals other lipoprotein abnormalities, eg, increased remnant lipoproteins, elevated apolipoprotein B, small LDL particles, and small HDL particles. All of these abnormalities have been implicated as being independently atherogenic.

- Elevated blood pressure strongly associates with obesity and commonly occurs in insulin-resistant persons. Hypertension thus commonly is listed among metabolic risk factors. However, some investigators believe that hypertension is less "metabolic" than other metabolic-syndrome components. Certainly, hypertension is multifactorial in origin. For example, increasing arterial stiffness contributes significantly to systolic hypertension in the elderly. Even so, most conference participants favored inclusion of elevated blood pressure as one component of the metabolic syndrome.

- Insulin resistance is present in the majority of people with the metabolic syndrome. It strongly associates with other metabolic risk factors and correlates

univariately with CVD risk. These associations, combined with belief in its priority, account for the term insulin resistance syndrome. Even so, mechanisms underlying the link to CVD risk factors are uncertain, hence the ATP III's classification of insulin resistance as an emerging risk factor. Patients with longstanding insulin resistance frequently manifest glucose intolerance, another emerging risk factor. When glucose intolerance evolves into diabetes-level hyperglycemia, elevated glucose constitutes a major, independent risk factor for CVD.

- **A proinflammatory state**, recognized clinically by elevations of C-reactive protein (CRP), is commonly present in persons with metabolic syndrome. Multiple mechanisms seemingly underlie elevations of CRP. One cause is obesity, because excess adipose tissue releases inflammatory cytokines that may elicit higher CRP levels.

- **A prothrombotic state**, characterized by increased plasma plasminogen activator inhibitor (PAI)-1 and fibrinogen, also associates with the metabolic syndrome. Fibrinogen, an acute-phase reactant like CRP, rises in response to a high-cytokine state. Thus, prothrombotic and proinflammatory states may be metabolically interconnected.

Etiology of the metabolic syndrome

The underlying causes of Metabolic Syndrome continues to challenge the experts but both insulin resistance and central obesity are considered significant factors.(37,38) Genetics, physical inactivity, aging , a proinflammatory state and hormonal changes may also have a causal effect, but the role of these may vary depending on ethnic group.(39-41)The root causes of the metabolic syndrome are overweight/ obesity, physical inactivity, and genetic factors. The metabolic syndrome is closely associated with a generalized metabolic disorder called insulin resistance, in which tissue responsiveness to the normal action of insulin is impaired.(42-44)Some individuals are genetically predisposed to insulin resistance; in these persons, acquired factors (excess body fat and physical inactivity) elicit insulin resistance and the metabolic syndrome. Most persons with insulin resistance have abdominal obesity.

(45-47). The mechanistic connections between insulin resistance and metabolic risk factors are not fully understood and appear to be complex. Most patients are older, obese, sedentary, and have a degree of insulin resistance.The most important factors in order are aging, genetics and lifestyle, i.e., low physical activity and excess caloric intake. Some people may also have a genetic predisposition to Insulin Resistance, while others develop the condition through high stress and unhealthy lifestyles**.** From all reasons the major causes of metabolic syndrome which several researchers always explain were insulin resistance and obesity or central obesity/ abdominal obesity.

Insulin resistance

Insulin resistance occurs when cell in the body (liver, skeletal muscle and adipose/ fat tissue) become less sensitive an eventually resistant to insulin, the hormone which is produced by the beta cells in pancreas to facilitate glucose absorption. Glucose can no longer be absorbed by the cells but remains in the blood, triggering the need for more and more insulin (hyperinsulinaemia) to be produced in an attempt to process the glucose. The production of ever-increasing amounts of insulin weakens and may eventually wear out the beta cells. Once the pancreas is no longer able to produce enough insulin then a person becomes hyperglycaemic (too much glucose in the blood) and will be diagnosed with type 2 diabetes. Even before the happens, damage in occurring to the body, including a building-up of triglyceride which further impairs insulin sensitivity (48). Insulin resistance is often found in people with visceral adiposity (i.e., a high degree of fatty tissue underneath the abdominal muscle wall - as distinct from subcutaneous adiposity or fat between the skin and the muscle wall), hypertension, hyperglycemia and dyslipidemia involving elevated triglycerides, small dense low-density lipoprotein (sdLDL) particles, and decreased HDL cholesterol levels. However, there are some grounds for suspecting that insulin resistance is related to a high-carbohydrate diet (49).

Obesity and Central obesity

Generally accept that obesity relate to an imbalance between energy intake and expenditure. Nowadays, it is clear that obesity is not always simple a result of over-indulgence in highly palatable foods or of a lack of physical activity. Biological

factors (genetic, hormone), age, stress play a role in the etiology of obesity (50).Obesity is associated with insulin resistance and the metabolic syndrome. Obesity contributes to hypertension, high serum cholesterol, low HDL-C and hyperglycemia, and is independently associated with higher CVD risk(37,51 ,52)The risk of serious health consequences in the form type2 diabetes , coronary heart disease (CHD) and a range of other conditions, including some forms of cancer, has been shown to rise with an increase in body mass index (BMI) (53) ,but it is and excess of body fat in the abdomen ,measured simply by waist circumference , that is more indicative of the metabolic syndrome profile than BMI (54-56). Abdominal obesity especially correlates with metabolic risk factors. Excess adipose tissue releases several products that apparently exacerbate these risk factors. They include nonesterified fatty acids (NEFA), cytokines, PAI-1, and adiponectin. A high plasma NEFA level overloads muscle and liver with lipid, which enhances insulin resistance. High CRP levels accompanying obesity may signify cytokine excess and a proinflammatory state. An elevated PAI-1 contributes to a prothrombotic state, whereas low adiponectin levels that accompany obesity correlate with worsening of metabolic risk factors. The strong connection between obesity (especially abdominal obesity) and risk factors led ATP III to define the metabolic syndrome essentially as a clustering of metabolic complications of obesity consist of IDF.

The role of obesity for the metabolic syndrome definition is controversial (2, 57) even though obesity is strongly related to insulin resistance (fasting insulin levels) (58), chronic inflammation (high-sensitivity C-reactive protein [hsCRP] levels), and coronary heart disease (CHD) (59, 60).

Independent Factors That Mediate Specific Components of the Metabolic Syndrome

Beyond obesity and insulin resistance, each risk factor of the metabolic syndrome is subject to its own regulation through both genetic and acquired factors. This leads to variability in expression of risk factors. Lipoprotein metabolism, for instance, is richly modulated by genetic variation; hence, expression of dyslipidemias in response to obesity and/or insulin resistance varies considerably. The same holds for

blood pressure regulation. Moreover, glucose levels depend on insulin-secretory capacity as well as insulin sensitivity. This variation in distal regulation cannot be ignored as an important factor in causation of metabolic syndrome (61).

Other Contributing Factors

Advancing age probably affects all levels of pathogenesis, which likely explains why prevalence of the metabolic syndrome rises with advancing age.(9) Recently, a proinflammatory state has been implicated directly in causation of insulin resistance, as well as atherogenesis. Finally, several endocrine factors have been linked to abnormalities in body-fat distribution and hence indirectly to metabolic syndrome. Thus, pathogenesis of the metabolic syndrome is complex and ripe with opportunities for further research.

Definitions of metabolic syndrome

Over the last decade several clinical criteria for metabolic syndrome have been developed. (20, 62, 63) Clinically defined metabolic syndrome criteria were proposed by many definitions that aim to describe the metabolic syndrome. Moreover, it is difficult for many researchers to make decision for using the appropriate definitions of metabolic syndrome that cause of the various genetic, ethic factors, age, sex and lifestyle in each country (64). The NCEP , IDF and WHO definitions of metabolic syndrome are similar and it can be expected that they will identify many of the same individuals as having metabolic syndrome. But, there are some differences in the detail and criteria. The differences are that IDF excludes any subject without increased waist circumference, while in the NCEP definition metabolic syndrome can be diagnosed based on other criteria and the IDF uses geography-specific cut points for waist circumference, while NCEP uses only one set of cut points for waist circumference regardless of geography. The NCEP ATP III is risk factor-based definition but WHO is disease- based definition. (65) The WHO definition, higher blood pressure was required than in ATP III. BMI (or increased waist:hip ratio) was used instead of waist circumference, and microalbuminuria was listed as one criterion. The requirement of objective evidence of insulin resistance should give more power to predict diabetes than does ATP III, but like ATP III, the presence of type 2 diabetes does not exclude a

diagnosis of metabolic syndrome. A potential disadvantage of the WHO criteria is that special testing of glucose status beyond routine clinical assessment may be necessary to diagnose metabolic syndrome.

The World Health Organization (WHO) definition of metabolic syndrome (66) : In order to make a diagnosis of metabolic syndrome a patient must present with glucose intolerance, impaired glucose tolerance (IGT) or diabetes and /or insulin resistance, together with two or more of the following components:

-Impaired glucose regulation or diabetes

-Insulin resistance (under hyperinsulinaemic, euglycaemic conditions, glucose uptake below lowest quartile for background population under investigation)

-Raised arterial pressure ≥ 140/90 mmHg

-Raised plasma triglycerides (≥ 1.7 mmol/L; 150 mg/dl) and/or low high-density lipoprotein cholesterol (HDL-C) (< 0.9 mmol/L; 35 mg/dl (male),< 1.0 mmol/L , 39 mg/dL (female)

-Central obesity (waist:hip ratio > 0.90 (male); > 0.85 (female), and/or body mass index (BMI) > 30 kg/m^2)

-Microalbuminuria (urinary albumin excretion ratio ≥ 20 g/min or albumin:creatinine ratio ≥ 30 mg/g

In 2001, the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III provided a definition for metabolic syndrome (20) The NCEP criteria are practical for physicians to use, since the variables defining metabolic syndrome are commonly available in clinical practice. The National Cholesterol Education Program (NCEP) considers that each metabolic factor has the same importance (20), whereas the WHO requires impaired glucose tolerance among its criteria to diagnose metabolic syndrome (62)

The National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) definition of metabolic syndrome (2001) requires at least three or more of the following five risk factors: (63)

- Central obesity (waist circumference)

  Male > 102 cm (40 inches)

  Female > 88 cm (35 inches)

- HDL-C

  Male < 40 mg/dL(1.03 mmol/L)
  Female < 50 mg/dL (1.29mmol/L)

- Triglycerides ≥ 150 mg/dl (1.7mmol/L)
- Blood pressure ≥ 130/85 mmHg
- Fasting plasma glucose ≥ 110 mg/dl (6.1 mmol/L)

International Diabetes Federation definition of the metabolic syndrome (21)

According to the International Diabetes Federation definition, for a person to be defined as having the metabolic syndrome, they must have:- Central obesity (define as waist circumference ≥94 cm for Europe men and ≥80 cm for Europe women, with ethnicity specific values for other groups *) a person to be defined as having the metabolic syndrome they must have:

Central obesity (defined as waist circumference, for) with at least two of the following

- Triglyceride ≥150 mg/ dl or on drug treatment
- HDL cholesterol: < 40 mg/dl in males and < 50 mg/dl in females or on drug treatment
- Blood pressure: systolic BP ≥130 or diastolic BP ≥ 85 mm Hg or on drug

treatment

- Fasting Plasma Glucose (FPG) ≥ 100 mg/dl or being type 2 diabetes

* South Asian and South-East Asian ≥ 90cm for men and ≥ 80cm for women ; Japanese men ≥ 85 cm, women ≥ 90 cm.

The IDF definition requires obesity for diagnosis of metabolic syndrome. These guidelines explain that central (abdominal) obesity is a prerequisite for this diagnosis because it is easy to assess and independently associated with each of the other metabolic syndrome components (67). The IDF guidelines do not essentially require insulin resistance because it is difficult to measure in day-to-day clinical practice (62, 67). However, although increased waist circumference is an important component of metabolic syndrome, some individuals with multiple risk factors and an increased risk of CVD mortality have normal waist circumference. (68,69) For example, Katzmarzyk et al. (68) reported that waist circumference is a valuable component of metabolic syndrome, but they also raised the concern that the IDF requirement of an increased waist circumference warranted caution because a large proportion of individuals with normal waist circumference also have multiple risk factors and an increased risk of mortality. Waist circumference supposedly indicates visceral fat more accurately than BMI in terms of predicting diabetes (70)

The World Health Organization (WHO) states that individual risk factors for cardiovascular disease (CVD) convey greater CVD risk. Furthermore, even though each one of these risk factors alone is not serious, the risk becomes more powerful when they are combined (71). Finally, the International Diabetes Federation (IDF) and the Japanese guidelines require central obesity defined by waist circumference to diagnose metabolic syndrome. (67, 72)

Thus, whether a relationship between metabolic risk factor clustering and CVD mortality differs according to obesity or impaired glucose tolerance, which are both required for a diagnosis of metabolic syndrome, should be determined.

Clinical Outcomes of Metabolic Syndrome

Individuals with metabolic syndrome are at increased risk of all-cause and cardiovascular disease (CVD) mortality. (1, 73, 74) In Framingham, the metabolic syndrome alone predicted ≈25% of all new-onset CVD. In the absence of diabetes, the metabolic syndrome generally did not raise 10-year risk for CHD to >20%; this is the threshold for ATP III's CHD risk equivalent. Ten-year risk in men with metabolic syndrome generally ranged from 10% to 20%. Cardiovascular disease(CVD) is the primary clinical outcome of metabolic syndrome. Additionally, risk for type 2 diabetes is higher, and diabetes is a major risk factor for CVD.

Therapeutic Implications (61)

-Obesity and Body Fat Distribution as Targets of Therapy : ATP III recommended that obesity be the primary target of intervention for metabolic syndrome. First-line therapy should be weight reduction reinforced with increased physical activity. Weight loss lowers serum cholesterol and triglycerides, raises HDL cholesterol, lowers blood pressure and glucose, and reduces insulin resistance. Weight reduction and increased exercise should be focused first on lifestyle changes. Even individual who emphasized the role of insulin resistance in the pathogenesis of the metabolic syndrome acknowledged that therapeutic lifestyle changes deserve priority.

-Insulin Resistance as Target of Therapy : If insulin resistance, whether primary or secondary to obesity, is in the chain of causation of metabolic syndrome, it would be an attractive target. Certainly, weight reduction and increased physical activity will reduce insulin resistance. Insulin resistance as a target has caught the imagination of the pharmaceutical industry, and drug discovery is underway. Two classes of drugs are currently available that reduce insulin resistance. These are metformin and insulin sensitizers such as thiazolidinediones (TZDs).

Prevention

Various strategies have been proposed to prevent the development of metabolic syndrome. These include increased physical activity (such as walking 30 minutes

every day), and a healthy, reduced calorie diet. There are many studies that support the value of a healthy lifestyle as above. The most obvious method of prevention is undoubtedly to reduce the amount of carbohydrates, starches and sugars.

Special Considerations for Different Population Groups

Middle-Aged Men (35-65 Years) : In general, men have a higher risk for CHD than do women. Middle-aged men in particular have a high prevalence of the major risk factors and are predisposed to abdominal obesity and the metabolic syndrome. A sizable fraction of all CHD in men occurs in middle age. Thus, many middle-aged men carry a relatively high risk for CHD, and for those who do, intensive LDL-lowering therapy is needed.

Lifestyle

In public health, "lifestyle" generally means a pattern of individual practices and personal behavioral choices that are related to elevated or reduced health risk. Since the mid-1970s, there has been a growing recognition of the significant contribution of personal behavior choices to health risk in the United States thirty-eight percent of deaths in 1990 were attributed to tobacco, diet and activity patterns, and alcohol. Equally important, illnesses attributable to lifestyle choices play a role in reducing health-related quality of life and in creating health disparities among different segments of the population(75).

Lifestyle is the most important modifiable factor influencing health and illness today (76). Recently, human's lifestyle changed a lot because the speed of technology and social, man could do every thing more comfortable and use their activity less than the past.Data from the Third National Health and Nutrition Examination Survey (NHANES III), conducted between 1988 and 1994, were used to measure the risk of having the metabolic syndrome in healthy adult Americans who follow certain lifestyle behaviors, such as dietary practices, levels of physical activity, smoking and drinking habits. Found low physical activity level, high carbohydrate intake, and current smoking habits were all significantly associated with an increased risk of having the metabolic syndrome.(77) The Korea National Health and Nutrition

Examination Survey found physical inactivity, excessive weight gain, high alcohol intake, and certain dietary factors have been identified as important modifiable risk factors for metabolic syndrome.(78)

Food consumption

Food consumption is a powerful instrument to prevent non-communicable diseases (NCDs) as many countries have already found (79).Unhealthy diets and physical inactivity are major risk factors of metabolic disorder, obesity and chronic diseases.

Unhealthy food consumption is one of the major risk factors for a range of chronic diseases, including cardiovascular diseases, cancer, diabetes and other conditions linked to obesity. Specific recommendations for a healthy diet include: cutting down on salt, sugar and fat; eating more fruit, vegetables, nuts and grains; and substituting unsaturated vegetable oils for saturated animal fats (80). Nutrition is the intake of food, considering in relation to the body's dietary needs. Good nutrition combined with regular physical activity is a cornerstone of good health. Poor nutrition can lead to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity.

Salty-food intake elevates blood pressure and increase the prevalence of hypertension. Generally salt - intake should not over 6 g. or 1 tea- spoon full/day or Sodium 2400mg. but recommend to 4 g. or 2/3 tea-spoon full/day (81).

Fruit and vegetables are important components of a healthy diet, and their sufficient daily consumption could help prevent major diseases, such as cardiovascular diseases and certain cancers. Overall, it is estimated that up to 2.7 million lives could potentially be saved each year if fruit and vegetable consumption were sufficiently increased.A recently published WHO/FAO report recommends as a population-wide intake goal the consumption of a minimum of 400g of fruit and vegetables per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases such as heart disease, cancer, diabetes and obesity, as well as for the prevention and

alleviation of several micronutrient deficiencies, especially in less developed countries.

The WHO Global Strategy on Diet, Physical Activity and Health emphasizes the increase of fruit and vegetables consumption as one of the dietary recommendations to be considered when preparing national policies and dietary guidelines for populations and individuals. Recognizing the increasing scientific evidence that low fruit and vegetable intake is a key risk factor for several noncommunicable diseases (80).

Rissanen et al. examined 4-day diet data from middle-aged Finnish men participating in the Kuopio Ischemic Heart Risk Factor Study, found that men who higher intakes of fruits and vegetables (excluded fried potatoes) had lower body weights (82)

Mendoza JA et al. had studied dietary energy density is associated with obesity and the metabolic syndrome in 9688 US adults, aged ≥ 20 years old .Found that dietary energy was independently and significantly associated with higher BMI , waist circumference, and elevated fasting insulin level in both gender. Metabolic syndrome's prevalence ratio = 1.10, 95% CI [1.03, 1.17] (83).

Alberto et al. had studied nutrition factors and hypertension among US men. A prospective study was conducted with among 30681 subjects in 1986. During 4 years of follow-up, 1248 men reported a diagnosis of hypertension. Diet fiber had independence inverse association with hypertension. For men with a fiber intake < 12 g/day, the relative risk of hypertension was 1.57[95 %CI=1.20 to 2.05] compared with an intake > 24 g/day (84).

Vollmer et al. studied effects of diet and sodium intake on blood pressure among 412 adults subjects with untreated hypertension and followed the DASH diet or a control diet for three consecutive 30 days feeding periods. In all subgroups, the DASH diet and reduced sodium intake were each associated with significant decrease in blood pressure ; these two factors combined produced the greatest reduction (84).

Physical activity (85)

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure. Physical activity has 3 components : occupational work; household work and other chores and leisure time physical activity.

Exercise is subset of physical activity behavior that involves purposive and repetitive movements with the aim of improving cardio-respiratory or muscular fitness. Exercise is carried out in a more structured manner, often performed at a greater intensity (more vigorous).

Moderate-intensity physical activity refers to activity some increase in breathing or heart rate

Vigorous-intensity physical activity refers to activity with large increase in breathing or heart rate (conversation is difficult or broken)

Importantly, physical activity can be accumulated throughout the day in blocks as short as 10 minutes. For young people (5-18 years old), 60 minutes of moderate- to vigorous-intensity physical activity each day that is developmentally appropriate and involves a variety of activities. For adult (18-65 years old) , 30 minutes of moderate-intensity physical activity 5 days per week or 20 minutes of vigorous-intensity physical activity 3 days per week or an equivalent combination of moderate - intensity physical activity / vigorous-intensity physical activity and should to take 8-10 muscular strengthening exercises (8-12 repetitions) at least 2 days per week. For older adult, is the same recommendations as described for adults with due consideration for the intensity and type of physical activity appropriate for older people to maintain flexibility and balance exercises (86). However, this does not mean that physical activity must always be performed for 30 minutes at a time. The activity can be accumulated over the course of the day: a 10 minute brisk walk, three times a day; or 20 minutes in the morning and 10 minutes later that day. These activities can be incorporated into individual daily routine.

Physical activity is a key determinant of energy expenditure, and it is fundamental to energy balance and weight control, reduces the risk of coronary heart disease and stroke, type II diabetes, hypertension, colon cancer, breast cancer and improve mental health and cognitive function such as depression and anxiety.

Active lifestyles often provide older persons with regular occasions to make new friendships, maintain social networks, and interact with other people of all ages. While being active from an early age can help prevent many diseases, regular movement and activity can also help relieve the disability and pain associated with these conditions. Importantly, the benefits of physical activity can be enjoyed even if regular practice starts late in life.

Physical inactivity, (a lack of physical activity) is an independent risk factor for chronic diseases, and overall is estimated to cause 1.9 million deaths globally. Levels of inactivity are high in virtually all developed and developing countries. In developed countries more than half of adults are insufficiently active. In rapidly growing large cities of the developing world, physical inactivity is an even greater problem. Urbanization has resulted in several environmental factors which discourage participation in physical activity particularly in the transport and occupational domains. In rural areas of developing countries, sedentary pastimes (e.g. watching television) are also becoming increasingly popular.(86)

Each year at least 1.9 million people die as a result of physical inactivity. Physical inactivity is an independent modifiable risk factor for common NCDs.

More than 35 million people died of NCDs in 2005 - this represented 60% of all deaths worldwide, 80% of deaths from NCDs occur in low- and middle-income countries if without action to address the causes, deaths from NCDs will increase to be 17% between 2005 and 2015. (86)

Son le NT et al. studied prevalence of metabolic syndrome and its risk factors in 611 participants urban population of Ho Chi Minh City, a cross-sectional study . The prevalence increased with age and sedentary work. Metabolic syndrome showed a positive association with age, body fat percentage and sedentary occupation (87).

Cigarette smoking (88)

Cigarette smoking is one of the main risk factors for a number of chronic diseases, including cancer, lung diseases, and cardiovascular diseases. Despite this, it is common throughout the world. In developed country, smokers died from ischemic heart disease more than non-smokers almost 3 times. Smoking associated with amount of cigarette if smoked over 1 cigarette case would increase risk of heart disease. In Thailand, population with ischemic heart disease was found that smoking over 10 cigarettes/day or over 20 cigarettes /day will increase risk factor. Especially, in people who have DM, HT, obesity, lipidemia, stress, and physical inactivity.

Nicotine, the active ingredient in tobacco, is inhaled into the lungs, where most of it stays. The rest passes into the bloodstream, reaching the brain in about 10 seconds and dispersing throughout the body in about 20 seconds. Nicotine is a powerful, addictive stimulant and is one of the main factors leading to the continued tobacco smoking.

Nicotine stimulated adrenal glands to release of epinephrine into the blood. Epinephrine causes several physiological changes , temporarily narrows the arteries, raises the blood pressure, raises the levels of fat in the blood, and increases the heart rate and flow of blood from the heart. Some researchers think epinephrine contributes to smokers' increased risk of high blood pressure.

Nicotine, by itself, increases the risk of heart disease. However, when a person smokes, he or she is ingesting a lot more than nicotine. Smoke from a cigarette, pipe, or cigar is made up of many additional toxic chemicals, including tar and carbon monoxide. Tar is a sticky substance that forms into deposits in the lungs, causing lung cancer and respiratory distress. Carbon monoxide limits the amount of oxygen that the red blood cells can convey throughout your body. Also, it may damage the inner walls of the arteries, which allows fat to build up in them. Each of cigarette has nicotine 0.8-1.8 mg.(standard is 1 mg.),Thai cigarette has tar 12-24mg. the people who smoked 1 case/day will get tar about 30 mg./1 cigarette.

Miyatake N et al. studied link between metabolic syndrome and cigarette smoking in the Japanese population. They found that prevalence of current smoker in subjects with metabolic syndrome was significantly higher than in subjects with non-metabolic syndrome in men with and without adjustment for age. (89)

Park HS et al. studied in subjects who aged 20-79 years from the Korean National Health and Nutrition Examination Survey 1998. Metabolic syndrome was presented in more than 15% of South Koreans with higher BMI and current smoking were identified as independent modifiable risk factors of the metabolic syndrome.(90)

Alcohol Consumption (91)

Alcoholic beverage is liquid that contains alcohol (ethanol).Ethyl alcohol, or ethanol, is an intoxicating ingredient found in beer, wine, and liquor. Alcohol is produced by the fermentation of yeast, sugars, and starches

The intensity of the effect of alcohol on the body is directly related to the amount and rapidly consumed. Individual reactions to alcohol vary, and are influenced by many factors such as age, gender, race, physical condition(weight, fitness level, etc), amount of food consumed before drinking, how quickly the alcohol was consumed, use of drugs or prescription medicines, family history of alcohol problems.

Concentration of alcohol in alcohol beverage, beer is usually contain 6% alcohol, wine 12-15%alcohol, hard liquor or spirits (whisky, brandy) 35-45% alcohol (84)

The Standard Measure of Alcohol

In the United States, a standard drink has about half an ounce (13.7 grams or 1.2 tablespoons) of pure alcohol. Generally, this amount of pure alcohol is found in:

- 12 ounces of regular beer or wine cooler
- 8 ounces of malt liquor
- 5 ounces of wine

- 1.5 ounces of 80-proof distilled spirits or “liquor” (gin, rum, vodka, whiskey)

In calculating the amount of alcohol consumed (in grams per day), how to converse into gram of alcohol by 1 ounces(oz.) 1oz.= 29.57 ml..Thus, 5 oz or 150 ml of wine (14% alcohol) contained 21 g, 5 oz of beer (6% alcohol) contain 9 g, 1 oz of liquor (35% alcohol) contained 10.5 g and 1 oz of whisky or brandy (42% alcohol) contained 12.2 g of alcohol (84).

Levels and Patterns of Drinking according to the Dietary Guidelines for Americans (92)

Moderate drinking ;, drinking in moderation is defined as having no more than 1 drink per day for women and no more than 2 drinks per day for men. This definition is referring to the amount consumed on any single day and is not intended as an average over several days.

Heavy drinking ; For men, heavy drinking is typically defined as consuming an average of more than 2 drinks per day. For women, heavy drinking is typically defined as consuming an average of more than 1 drink per day.

Binge drinking ; For men, binge drinking is typically defined as consuming an average of more than 4 drinks during a single occasion.For women binge drinking is typically defined as consuming an average of more than 3 drinks during a single occasion.

Excessive drinking ; Includes heavy drinking, binge drinking or both. Average amount one unit per drink: beer 360 ml, wine 150 ml, brandy or whisky 45 ml.

Mild alcohol ingestion raises serum high density lipoprotein-cholesterol (HDL-C) level excess alcohol ingestion can precipitate hypertriglycerideemia in subjects who can not clear triglycerides efficiently. Besides, several health problem including hypertension and hyperglycemia are related to a high alcohol intake (93).

Yoon YS et al. studied to examined the association between alcohol consumption and the metabolic syndrome. They found that moderate alcohol consumption and moderate long-term changes in alcohol consumption are positively related with the levels and changes in high-density lipoprotein cholesterol in healthy adult men and women (94).

Wannamethee G. et al. had studied to assess the interrelationship between alcohol intake, cigarette smoking, body weight, and blood lipid concentrations. Univariate analysis showed a strong positive relation with HDL cholesterol, and a significant increase in triglycerides in heavy drinkers. Total cholesterol and triglycerides were significantly and positively associated with alcohol intake in non-smokers, the cholesterol association being largely mediated by the influence of alcohol on body weight. The association between alcohol intake and body weight and alcohol intake and blood lipids are strongly conditioned by cigarette smoking (95).

Stress

Stress is an individual's physical and mental reaction to environmental demands or pressures. Stress in humans results from interactions between persons and their environment that are perceived as straining or exceeding their adaptive capacities and threatening their well-being. The element of perception indicates that human stress responses reflect differences in personality, as well as differences in physical strength or general health.

Risk factors for stress-related illnesses are a mix of personal, interpersonal, and social variables. These factors include lack or loss of control over one's physical environment, and lack or loss of social support networks. People who are dependent on others (e.g., children or the elderly) or who are socially disadvantaged (because of race, gender, educational level, or similar factors) are at greater risk of developing stress-related illnesses. Other risk factors include feelings of helplessness, hopelessness, extreme fear or anger, and cynicism or distrust of others.

Stress-related physical illnesses, such as irritable bowel syndrome, heart attacks, and chronic headaches, result from long-term over stimulation of a part of the nervous

system that regulates the heart rate, blood pressure, and digestive system. Stress-related emotional illness results from inadequate or inappropriate responses to major changes in one's life situation, such as marriage, completing one's education, becoming a parent, losing a job, or retirement.

Some people react to stress and emotional upset by overeating, others overeat in response to boredom or loneliness. In each case, they have learned to handle unpleasants emotions with the solace of food. Smoking, drinking, and drugs are others habits that may be used to cope with the tension that accompanies stress (96). Stress is associated with poorer health behaviors (diet and exercise habits, substance use, etc.) and increased self-reported illness(97).

Branth S et al. had studied the effects of long-term stress on different features of the metabolic syndrome (MES) in formerly non-obese healthy young males during 5months of defined conditions. Sixteen healthy male sailors (mean age 36.5 (SD)+/-7years) participating in a sailing race around the world were recruited for the study. Non-obese healthy young men exposed to long-term stress developed abdominal obesity and signs of a metabolic syndrome, also emphasized by biochemical and blood pressure alterations. It is suggested that long-term and sustained stress activation might be an additional risk factor for the development of metabolic syndrome. (98)

Suratsawadee et al. Found waist circumference was positively correlated significantly with triglyceride level ($p< 0.001$) among 120 males employees factory of Bangprakong industrial area (age 35-60 years old)(99)**.**

Sleeping time

Adequate sleep is essential for individual's healthy functioning, normal growth and development and survival**.** Restricting sleep to four hours a night for only a few days causes abnormal glucose metabolism, suggesting the mechanism for increased rates of diabetes in sleep deprived individuals. Additionally, sleep disorders that disrupt sleep, such as obstructive sleep apnea, also increase the likelihood of developing diabetes. Treating the sleep disorders improves glucose metabolism and diabetes control. On average, most adults need seven to eight hours of sleep each night

to feel alert and well-rested. Adolescents should sleep about nine hours a night, school-aged children between 10-11 hours a night and children in pre-school between 11-13 hours a night. Gangwisch JE explored the relationship between sleep duration and the diagnosis of diabetes over an eight-to-10-year follow-up period between 1982 and 1992 among 8,992 subjects who participated in the Epidemiologic Follow-Up Studies of the first National Health and Nutrition Examination Survey. The subjects' ages ranged from 32 to 86 years. The subjects who reported sleeping five or fewer hours and subjects who reported sleeping nine or more hours were significantly more likely to have incident diabetes over the follow-up period than were subjects who reported sleeping seven hours, even after adjusting for variables such as physical activity, depression, alcohol consumption, ethnicity, education, marital status, age, obesity and history of hypertension (100).

Miranda Hitti studied included some 10,300 British government workers who were followed for 12-17 years.At the study's start and midpoint, the workers got checkups and completed a health survey that included a question about their typical hours of nightly sleep.During the study, she found that death rates were higher for people who spent too much or too little time sleeping. The researchers recommend getting seven to eight hours of nightly sleep on a regular basis. (101)

Marital status

Marital influenced health behaviors in various ways. Spouses who care and are concerned about one another should have a major stake in each other's continuing good health. Close maritalties, as expressed in frequent and pleasurable interactions between husband and wife, should positively influence each spouse's health habit (102).

Bauduceau B et al. had studied in a population of 2045 male military personnel based in the Paris region. The initial 1-year cross-sectional study(began on February 1, 2003) will be followed by a 10-year follow-up and patient care. The 2045 subjects included 185 (9%) presented at least 3 of the 5 NCEP ATP III criteria defining metabolic syndrome. They were significantly older (42.2 +/- 8.5 yrs) than the other

subjects (37.3 +/- 8.7 yrs, P<0.001), had a higher BMI (29.5 +/- 3.4 vs 24.8 +/- 2.9 kg/m2, P<0.001) and a greater body weight at age 20 (75.4 +/- 11 vs 70.4 +/- 8.5 kg, P<0.01). Smoking, little physical activity and family histories of diabetes and arterial hypertension were more frequent in these men. While levels of the cholesterol and CRP us were higher, Lp(a) and homocysteine concentrations were normal. Plasma insulin and BMI (r = 0.456 P<0.0001) and plasma insulin and waist circumference (r = 0.446 P<0.0001) were well correlated. These results in a large and particularly uniform population of men show the prevalence of metabolic syndrome in adult men, and demonstrate its link with insulin resistance.(18)

Al-Qahtani DA et al. had studied to estimate the prevalence of metabolic syndrome in Saudi male soldiers,a cross-sectional survey involving a group of 2250 Saudi male soldiers aged 20-60 years residing in a military city in Northern Saudi Arabia in 2004. Participants were recruited from a primary care setting. The age-adjusted prevalence of metabolic syndrome was found to be 20.8%. Abdominal obesity was the most common component in the study population (33.1%) closely followed by raised serum triglycerides (32.2%) and elevated systolic blood pressure (29.5%). Over two-thirds of the subjects (71%) exhibited at least one criterion for metabolic syndrome. Prevalence of individual factors and mean values of the components of the syndrome showed a steady increase with increase in age and body fat.(19)

Son le NT et al. had studied to determine the prevalence of metabolic syndrome (MeS) and its risk factors in urban population of Ho Chi Minh City. A cross-sectional study was conducted in urban areas of Ho Chi Minh City with 611 participants. The demographic, socio-economic details, anthropometric indexes and blood pressure were recorded. A fasting blood sample was collected for the analyses of glucose, total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C). MeS was defined by presence of three or more of the following components: abdominal obesity, hypertriglyceridemia, low HDL-cholesterolemia, high blood pressure and high fasting plasma glucose. The crude prevalence of MeS was 18.5% (95% CI: 15.5-21.9). After age, sex standardization, this prevalence was 12.0% (95% CI: 10.9-13.2). The prevalence increased with age

and sedentary work. Subjects with MeS had significantly higher body fat percentage than that of normal subjects. Metabolic syndrome showed a positive association with age, body fat percentage and sedentary occupation. This first study on MeS showed that 12% adults in urban areas of Ho Chi Minh City had metabolic syndrome. (103)

Life style, such as poor diet behavior, being overweight, physical inactivity, cigarette smoking, high alcohol consumption, it is modifiable factors that influence to the components of metabolic syndrome.

CHAPTER III

MATERIALS AND METHODS

Research Design

This study was a cross-sectional study design. To studied association between lifestyle and metabolic syndrome among male naval personnel in Bangkok and suburban.

Study population

Populations in this study were 13,294 male naval personnel who work in 30 departments of the Navy in Bangkok and suburban.

Sample size

The amount of participants were 300 male naval personnel who received annual health checkup at Somdejprapinklao Hospital and Bangkok Naval Hospital during May through October 2007. The age range was between 35-60 years old.

Sample size was calculated from 1082 male naval personnel in Bangkok and suburban who received annual health checkup at Somdejprapinklao during October 2005 through September 2006. From the data found prevalence of metabolic syndrome 9% by using NCEP- ATPIII criteria(20).

Calculated follow formula:

$$n = \frac{Z^2_{\alpha/2}\, NPQ}{Z^2_{\alpha/2}\, PQ + Nd^2}$$

n = Sample size

$Z_{\alpha/2}$ = the standard value under normal curve at 95% = 1.96

P = Study proportion in population

Q = 1-P

d = Maximum allowable error between study proportion in sample

size and population (d = 0.05)

Therefore

$$n = \frac{(1.96)^2 (0.09) (0.91) (13294)}{\{((1.96)^2(0.09) (0.91)) + ((13294) (0.05)^2)\}}$$

$$= 124.67$$

$$\approx 125$$

The minimum sample size for this study was 125 male naval personnel. Thus, this cross-sectional study conducted 300 male naval personnel in Bangkok and suburban who received annual health checkup at Somdejprapinklao Hospital and Bangkok Naval Hospital during May through October 2007.

Exclusion criteria

1. The naval personnel who did not participate in this study.
2. The male naval personnel who were not 35-60 years old.
3. For questionnaire which was not complete many answers and /or the result of physical examination was not complete.

Research Instrument

The instrument of this study was questionnaire which designed on the independent factors. The questionnaire was proved by the professional and tested reliability before used.

Part I: General characteristics of subject : rank, age, unit, duty, marital status , education level, income per month, residence, history of disease, health care, family history of disease (diabetes, hypertension, dyslipidemia and obesity).

Part II: Health behavior characteristics of subject: cigarette smoking, alcohol consumption, physical activity and sleeping time.

Part ΙΙΙ: Data of dietary pattern (fatty diet, total fiber food, salty diet and

energy density beverages diet

Part IV: Data of stress test in 2 months, use pattern of Mental health Department (97)

Part V: Data of health examined (waist circumference, blood pressure, fasting blood sugar, triglyceride and HDL-C) that were recorded by the researcher.

The questionnaire and Quality Control

Content validity of the questionnaire will be examined. It will be revised for clearer content and suitability according to the experts' recommendations, and it will be subsequently tested with the group of 30 naval personnel who work at Naval personnel department. The reliability in the part of stress test was found Alpha = 0.8911.

Data collection

After the proposal was reviewed and approved by Mahidol University Ethical Committee and Naval Medical Department Ethical Committee. Researcher collected data at Somdejprapinklao hospital and Bangkok Naval Hospital.

Duration of collecting was between May to October 2007. The subjects were informed about the objective of this study and signed in the consent form. Self-administered questionnaire on socio-demography, history of medical illness, history of regular lifestyle (cigarette smoking, alcohol drinking behavior, physical activity, sleeping time, food consumption and stress) were sent to participants for completion during routine clinic visits and sent back to the researcher when they finished. For result of physical examination the researcher completed the results according to process of health checkup unit. The chemical chemistry results of blood examination were from laboratory recorded. Fasting plasma glucose, HDL-C and Tg were measured by enzymatic method.

Data analysis

Statistical analyses were performed using SPSS /FW version 11.5(Statistical Package for the Social Personal Computer Plus/For Window)

1. Percentage, mean and standard deviation that were described characteristics, lifestyle behaviors and metabolic syndrome component of the subjects.

2. Univariate analysis was illustrated the association between subject's characteristics, lifestyle behaviors and metabolic syndrome by using Chi-square. Risk of the metabolic syndrome was presented by crude Odds Ratio (OR) and 95% confidence interval 1or higher. Significant statistical level was p-value less than 0.05.

3. Multivariate analysis was manifested for comparison between OR_{crude} and OR_{adjust} by using logistic regression.

CHAPTER IV

RESULTS

This research aimed to examine the association between lifestyle and metabolic syndrome among male naval personnel in Bangkok and suburban. The data were collected by using questionnaires and results from annual health checked-up. The studied results were presented as follow:

Part I. Description of characteristics of subjects

1.1 General characteristics

1.2 Health behavior characteristics

1.3 Health status of the subjects

1.4 Prevalence of metabolic syndrome of the subjects

Part II. Univariate analysis the association between subject's characteristics and metabolic syndrome

Part III. Multivariate analysis of the comparison between OR_{crude} and OR_{adjust} by using logistic regression

Part I. Description of characteristics of subjects

1.1 General characteristics

General characteristics of 344 subjects were shown in table 1. The general characteristics were independence variable, including rank, age, unit, duty, marital status, education level, income per month (baht) and residence. The results of the general characteristics of subjects for each variable mentioned above were as follow:

Rank

The majority of subjects were Petty Officer 1st Class-Master Chief Petty Officer (46.5%). The next groups were Lieutenant Commander – Captain (28.8%) and Ensign – Lieutenant (24.1%).Rear Admiral Lower Half – Admiral was the smallest group (0.6%).

Age

The majority of subjects were age 45-49 years (34%). The second group was age 35-39 years (26.7%). The third group was age 40-44 years (23%). The fourth group was age 50 -54 years (11.9%). The last group was age 55-60 years (4.4%).The average age was 43.96(± 5.72) years. Minimum and maximum ages were 35 and 60 years.

Work place

The majority work place of subjects was Naval Personnel Department (15.4%). Institute of Advanced Naval Studied, Naval Military Police Regiment, Naval Medical Department and Naval Transportation Department were nearly number (12.8%, 12.2%, 11.9% and 11.3% respectively). The others from 25 work places were 36.4% that each place was less than 5%.

Duty

The majority of subjects worked in staff unit and staff positions of each unit every rank (36.9%). The Officers in auxiliary unit and education unit who didn't work in staff position and captains in forced unit were the next group (26.7%).The third group were Non officers in auxiliary unit and education unit who didn't work in staff position (22.7%).The last were every ranks of naval personnel except captain who worked in forced unit and didn't work in staff position (13.7%).

Marital status

The majority of subjects were couple 82.8%.The single was 12.2%. The total of widowed, divorce and separated were only 5%.

Educational level

The majority of educational levels in subjects were lower Bachelor degree 52.6%. The second group was Bachelor degree 40.4%. Masters degree was only 7%.

Income per month (Baht)

The majority of subject's income was ≤20,000 baht per month (55.5%).The others group of subject's income were between >20,000-30,000 bath per month (28.2%), >30,000 - 40,000 baht per month (9.9%) and the subjects who had income > 40,000 baht per month were only 6.4%.

Residence

Bangkok was residence of the most subjects (65.1%). Samutprakarn was the second residence of subjects (10.2%).Subjects lived in Nakhonphatom 9.6% and Nonthaburi 7.6%.The rest provinces were Samutsakorn and Pathumthani less than 5%.

Table1. The number and percentage of general characteristics of subjects

Characteristics	Number (n=344)	Percentage (%)
Rank		
Petty Officer 1st Class – Master Chief Petty Officer	160	46.5
Ensign - Lieutenant	83	24.1
Lieutenant Commander - Captain	99	28.8
Rear Admiral Lower Half - Admiral	2	0.6
Age (years)		
35 - 39	92	26.7
40 - 44	79	23.0
45 - 49	117	34.0
50 - 54	41	11.9
55 - 60	15	4.4
Mean (SD)	43.96(5.72)	
Min - Max	35-60	
Work place		
Naval Personnel Department	53	15.4
Institute of Advanced Naval Studied	44	12.8
Naval Military Police Regiment	42	12.2
Naval Medical Department	41	11.9
Naval Transportation Department	39	11.3
Others	125	36.4

Table1. The number and percentage of general characteristics of subjects

(Continued)

Characteristics	Number (n=344)	Percentage (%)
Duty		
Duty in staff unit and in staff position of unit every rank	127	36.9
Officer in auxiliary unit and education unit who doesn't work in staff position and captain in forced unit	92	26.7
Non officer in auxiliary unit and education unit who doesn't work in staff position	78	22.7
All personnel except captain who work in forced unit and doesn't work in staff position every rank	47	13.7
Marital status		
Couple	285	82.8
Single	42	12.2
Widowed	4	1.2
Divorce	9	2.6
Separated	4	1.2
Education level		
Lower Bachelor degree	181	52.6
Bachelor degree	139	40.4
Masters degree	24	7.0
Income per month (baht)		
10,000 - 20,000	191	55.5
>20,000 - 30,000	97	28.2
>30,000 - 40,000	34	9.9
>40,000	22	6.4
Residence		
Bangkok	224	65.1
Samutprakarn	35	10.2
Nonthaburi	26	7.6
Pathumthani	5	1.5
Nakhonphatom	33	9.6
Samutsakorn	15	4.4
Others Provinces	6	1.7

1.2 Health behavior characteristics

The results of health behavior characteristics of the subjects in term of history of disease, health care, family history of disease, cigarette smoking, alcohol drinking behavior, physical activity, sleeping time, stress and food intake (fat-rich food, salty food, fiber food and high-calories beverage) were shown in table 2. The results of health behavior characteristics of subjects for each variable mentioned above were as follow:

History of disease

The result showed 40.7% of subjects who had not health history of diseases such as Diabetes mellitus, Hypertension, Hyperlipidemia and over weight. The subjects who had health history of these diseases were 59.3%.

For health history of diseases, the most to least prevalence was Hyperlipidemia (38.7%) over weight (29.1%), Hypertension (22.4%) and Diabetes mellitus (6.4%), respectively.

Health care

Most of the subjects answered about their health care that didn't take medicine or follow up the doctor/ visit (68%), the other subjects took medicine and followed up the doctor /visit (32%).

The family history of disease

The results showed 61% of subjects with family history of diseases such as Diabetes mellitus, Hypertension, Hyperlipidemia and over weight. The subjects without family history of these diseases were 39%.

Health behavior characteristics (Lifestyle)

The data of health behavior characteristics of the subjects in meaning of cigarette smoking behavior, alcohol drinking behavior, physical activity, sleeping time, consumption of food and stress.

Cigarette smoking

For cigarette smoking, it was found that 64.5% of the subjects were non – smoker, while 18.0% were ex-smoker and 17.5% were current smoker. Among subjects who smoked, 30.3% smoked 1-5 rolls/day, 35.2% smoked 6-10 rolls/day, 8.2% smoked 11-15 rolls/day, 23.8% smoked 16-20 rolls/day and 2.5% smoked more than 20 rolls/day. For duration of cigarette smoking, it was found that among subjects who smoked, 10.7% smoked for 1-10 years, 45.1% smoked for 11-20 years and 44.3% smoked for 21-33 years.

Alcohol drinking behavior

In term of alcohol drinking behavior, there were subjects who drank alcohol beverage 74.7%. In this amount drank hard liquor 52.9%, wine 4.7% and beer 42.4%. Among the subjects who drank alcohol beverage, 74.3% of them drank less than 1day/week, 17.5% drank 1-3 days/week, 5.1% drank 4-6 days/week and 3.1 % drank everyday or almost everyday. And quantity of alcohol drinking of subjects who drank alcohol beverage, it was found that 51.4% drank 1-63 grams alcohol/day, while 42% drank 64-168 grams alcohol/day and 6.6% drank more than 168 grams alcohol/day.

Physical activity

For Physical activity, it was found that 20.6% of the subjects were inactivity, 54.7% were moderate-intensity physical activity, while 9.6% were vigorous- intensity physical activity and 15.1% were moderate and vigorous- intensity physical activity.

Sleeping time

In case of sleeping time, it was found that the majority of subjects who slept 6-8 hours/day were 85.5%, the subjects who slept less than 6 hours/day were 11% and 3.2% were the subjects who slept more than 8 hours/day.

Stress

In case of stress, it was found that the majority of subjects were in normal level (63.4%), 18.3% were lower than normal level, 15.1% were light stress,1.2% of subjects were moderate stress and 1.4% were high stress.

Food intake

In term of food intake, it was categorized the frequency of food intake into never/seldom, 1-2 times/week, 3-4 times/week and almost everyday/everyday. For fat-rich food intake were 26.2%, 62.2%, 11% and 0% respectively. While salty food intake were 54.1%, 30.5%, 11.6% and 3.8% respectively. And total fiber food intake were 2.9%, 49.4%, 40.4% and 7.0% respectively. In the case of high calories beverage intake were 26.2%, 20.3%, 26.2% and 27.3% respectively.

Table 2. The number and percentage of health behavior characteristics of the subjects

Characteristics	Number (n=344)	Percentage (%)
History of disease		
Never	140	40.7
Diabetes mellitus	22	6.4
Hypertension	77	22.4
Hyperlipidemia	133	38.7
Over weight	100	29.1
Health care		
Didn't use medicine or follow-up doctor	234	68.0
Used medicine for treatment and followed-up doctor	110	32.0
The family history of disease		
No	134	39.0
Yes	210	61.0
Cigarette smoking		
Non -smoker	222	64.5
Ex-smoker	62	18.0
Current smoker	60	17.5

Table2. The number and percentage of health behavior characteristics of the subjects (Continued)

Characteristics	Number (n=344)	Percentage (%)
Quantity of cigarette smoking (rolls/day)(n=122)		
1- 5 rolls/day	37	30.3
6-10 rolls/day	43	35.2
11-15 rolls/day	10	8.2
16-20 rolls/day	29	23.8
>20 rolls/day	3	2.5
Mean(SD)	11.34(7.07)	
Min - Max	1- 40	
Duration of cigarette smoking(n=122)		
1 - 10 years	13	10.7
11 – 20 years	55	45.1
21 – 33 years	54	44.3
Mean(SD)	19.36(6.9)	
Min - Max	2-33	
Alcohol drinking behavior		
No	87	25.3
Yes	257	74.7
Frequency of alcohol drinking day /week (n=257)		
< 1 day/week	191	74.3
1 -3 days/week	45	17.5
4-6 days/week	13	5.1
>6 days/week	8	3.1
Type of alcohol beverage(n=257)		
Hard liquor	136	52.9
Wine	12	4.7
Beer	109	42.4
Quantity of alcohol drinking (grams alcohol/day) (n=257)		
1 – 63 grams alcohol/day	132	51.4
64 – 168 grams alcohol/day	108	42.0
>168 grams alcohol/day	17	6.6
Mean(SD)	76(59.11)	
Min- Max	7- 400	

Table2. The number and percentage of health behavior characteristics of the subjects (Continued).

Characteristics	Number (n=344)	Percentage (%)
Physical activity		
Inactivity	71	20.6
Moderate-intensity physical activity	188	54.7
Vigorous- intensity physical activity	33	9.6
Moderate and Vigorous- intensity physical activity	52	15.1
Sleeping time (hours/day)		
<6 hours/day	38	11.0
6 – 8 hours/day	294	85.5
>8 hours/day	11	3.2
Missing	1	0.3
Mean(SD)	6.69(1.134)	
Min - Max	2-10	
Stress		
Lower normal level	63	18.3
Normal level	218	63.4
Light stress	52	15.1
Moderate stress	4	1.2
High stress	5	1.4
Missing	2	0.6
Fat- rich food intake		
Never/seldom	90	26.2
1-2 times/week	214	62.2
3-4 times/week	38	11.0
>4 times/week	0	0
Missing	2	0.6
Salty food intake		
Never/seldom	186	54.1
1-2 times/week	105	30.5
3-4 times/week	40	11.6
>4 times/week	13	3.8
Total fiber food intake		
Never/seldom	10	2.9
1-2 times/week	170	49.4
3-4 times/week	139	40.4
>4 times/week	24	7.0
Missing	1	0.3
High calories beverage		
Never/seldom	90	26.2
1-2 times/week	70	20.3
3-4 times/week	90	26.2
>4 times/week	94	27.3

1.3 Health status of the subjects

The results of health status of the subjects in term of results of annual health checked-up of the subjects such as waist circumferences, systolic blood pressure, diastolic blood pressure, fasting blood sugar, serum triglyceride and serum high density cholesterol. The details of results were shown in table 3 and each variable mentioned above were as follow:

Waist circumferences

The results of waist circumferences were showed that 25.6% of subjects who had waist circumferences ≥36 inches. The subjects who had waist circumferences <36 inches were 74.4%.The average of waist circumferences of subjects was 33.71(±2.95) inches. Minimum and maximum of waist circumferences were 29 and 45 inches.

Systolic blood pressure

The results of systolic blood pressure were showed that 67.2% of subjects who had systolic blood pressure in optimal level (<120mmHg).There were 3.2% of subjects who had systolic blood pressure in normal level (120-129 mmHg). There were 16% of subjects who had systolic blood pressure in borderline level (130-139 mmHg).The subjects who had systolic blood pressure in level of hypertension (≥140mmHg) were 13.7%. The average of systolic blood pressure of subjects was 120.67(±13.43) mmHg. Minimum and maximum of systolic blood pressure were 100-171 mmHg. (23)

Diastolic blood pressure

The results of diastolic blood pressure were showed that 72.4% of subjects who had diastolic blood pressure in optimal level (<80mmHg).There were 2.6% of subjects who had diastolic blood pressure in normal level (80-84 mmHg). There were 3.2% of subjects who had diastolic blood pressure in borderline level (85-89 mmHg).The

subjects who had diastolic blood pressure in level of hypertension (≥90mmHg) were 21.8%. The average of diastolic blood pressure of subjects was 80.98 (±9.27) mmHg. Minimum and maximum of diastolic blood pressure were 60-120 mmHg.

Fasting plasma glucose

. The results of fasting plasma glucose were showed that 89% of subjects who had fasting plasma glucose in acceptable level (<110mg/dl). There were 7.6% of subjects who had fasting plasma glucose in level of impaired glucose tolerance (110-125mg/dl). There were 3.5% of subjects who had fasting plasma glucose in level of Diabetes mellitus (≥126mg/dl). The average of fasting plasma glucose of subjects was 97.87(±14.27) mg /dl. Minimum and maximum of fasting plasma glucose were 70-200 mg/dl.

Serum triglyceride

The results of serum triglyceride were showed that 73.5% of subjects who had serum triglyceride in acceptable level (<150mg/dl). There were 16.3% of subjects who had serum triglyceride in borderline level (150-199mg/dl). There were 9.9% of subjects who had serum triglyceride in high level (200-499mg/dl). There were only 0.3% of subjects who had serum triglyceride very high (≥500mg/dl). The average of serum triglyceride of subjects was 126.67(±70.32) mg /dl. Minimum and maximum of fasting blood sugar were 35-794mg/dl.

Serum high density lipoprotein cholesterol

The results of serum high density lipoprotein cholesterol were showed that 94.8% of subjects who had serum high density lipoprotein cholesterol in acceptable level (≥40mg/dl). There were 5.2% of subjects who had serum high density lipoprotein cholesterol in level of high-risk (<40mg/dl). The serum high density lipoprotein cholesterol of subjects was 52.46(±13.73)mg /dl. Minimum and maximum of serum high density lipoprotein cholesterol were 31- 240mg/dl.

Table3. The number and percentage of health status of the subjects

Health status	Number (n=344)	Percentage (%)
Waist circumferences		
≥36 inches	88	25.6
<36 inches	256	74.4
Mean(SD)	33.71(2.95)	
Min - Max	29 - 45	
Systolic blood pressure (SBP)		
Optimal (<120 mmHg)	231	67.2
Normal (120-129 mmHg)	11	3.2
Borderline (130-139 mmHg)	55	16.0
Hypertension (≥140 mmHg)	47	13.7
Mean(SD)	120.67(13.43)	
Min - Max	100-171	
Diastolic blood pressure (DBP)		
Optimal (<80 mmHg)	249	72.4
Normal (80-84 mmHg)	9	2.6
Borderline (85-89 mmHg)	11	3.2
Hypertension (≥90 mmHg)	75	21.8
Mean(SD)	80.98(9.27)	
Min- Max	60-120	
Fasting plasma glucose (FPG)		
Acceptable (<110 mg/dl)	306	89.0
Impaired glucose tolerance (110- 125 mg/dl)	26	7.6
Diabetes mellitus (≥ 126 mg/dl)	12	3.5
Mean(SD)	97.87(14.27)	
Min- Max	70-200	
Serum triglyceride (Tg)		
Acceptable (<150 mg/dl)	253	73.5
Borderline (150-199 mg/dl)	56	16.3
High (200 -499 mg/dl)	34	9.9
Very high (≥ 500 mg/dl)	1	0.3
Mean(SD)	126.67(70.32)	
Min- Max	35-794	
Serum high density lipoprotein cholesterol(HDL-C)		
High-risk (<40mg/dl)	18	5.2
Acceptable (≥40mg/dl)	326	94.8
Total	344	100.0
Mean(SD)	52.46(13.73)	
Min- Max	31-240	

1.4 Prevalence of metabolic syndrome of the subjects

The prevalence of metabolic syndrome was assessed by using NCEP: ATPIII criteria. The results of health checked-up of subjects were showed that there were subjects who had not any criteria of metabolic syndrome 41.3%. There were subjects who found 1 criterion 30.5%, 16.3% of subjects who found 2 criteria, 9.0% of subjects who found 3 criteria, 2.6% of subjects who found 4 criteria and 0.3% of subjects who found 5 criteria. Hence, the prevalence of metabolic syndrome was 11.9%. Fasting blood sugar ≥110 mg/dl(68.4%) was the major criterion of metabolic syndrome in subjects with metabolic syndrome. (Table 4)

Table 4 The number and percentage of criteria of metabolic syndrome in subjects by using NCEP: ATPIII criteria.

Health status	Number (n=344)	Percentage (%)
Waist circumferences		
≥36 inches	88	25.6
<36 inches	256	74.4
Mean(SD)	33.71(2.95)	
Min- Max	29-45	
Blood pressure		
≥130/85 mmHg	116	33.7
<130/85 mmHg	228	66.3
Fasting blood sugar		
≥110 mg/dl	38	11.0
<110 mg/dl	306	89.0
Mean(SD)	97.87(14.27)	
Min- Max	70- 200	
Serum triglyceride		
≥150 mg/dl	91	26.5
<150 mg/dl	253	73.5
Mean(SD)	126.67(70.32)	
Min- Max	35- 794	
Serum HDL-C		
<40 mg/dl	18	5.2
≥40 mg/dl	326	94.8
Mean(SD)	52.46(13.73)	
Min- Max	31- 240	

Table 4 The number and percentage of criteria of metabolic syndrome in subjects by using NCEP: ATPIII criteria (Continued)

Health status	Number (n=344)	Percentage (%)
The number and percentage of Risk factors of subjects		
0 criterion	142	41.3
1 criterion	105	30.5
2 criteria	56	16.3
3 criteria	31	9.0
4 criteria	9	2.6
5 criteria	1	0.3
Metabolic syndrome by NCEP		
YES	41	11.9
NO	303	88.1

Table 5 Major criteria of metabolic syndrome in subjects

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n (%)	Total n (%)
Waist circumferences			
≥36 inches	34(38.6%)	54(61.4%)	88(100%)
<36 inches	7(2.7%)	249(97.3%)	256(100%)
Blood pressure			
≥ 130/85 mmHg	40(34.5%)	76(65.5%)	116(100%)
< 130/85 mmHg	1(0.4%)	227(99.6%)	228(100%)
Fasting blood sugar			
≥110 mg/dl	26(68.4%)	12(31.6%)	38(100%)
<110 mg/dl	15(4.9%)	291(95.1%)	306(100%)
Serum triglyceride			
≥150 mg/dl	28(30.8%)	63(69.2%)	91(100%)
<150 mg/dl	13(5.1%)	240(94.9%)	253(100%)
Serum HDL-C			
<40 mg/dl	6(33.3%)	12(66.7%)	18(100%)
≥40 mg/dl	35(10.7%)	291(89.3%)	326(100%)

Part II. **Univariate analysis of association between subject's characteristics and metabolic syndrome**

Rank

Rank was categorized into Petty Officer1st Class - Master Chief Petty Officer, Ensign - Lieutenant and Lieutenant commander - Vice Admiral. For rank in the metabolic syndrome were 9.4%, 16.9% and 11.9% respectively. For rank in the non-metabolic syndrome were 90.6%, 83.1% and 88.1% respectively. There was not significant association between rank and metabolic syndrome. The odds ratio of Ensign – Lieutenant was 1.96 (95% CI = 0.90-4.30, p = 0.092). The odds ratio of Lieutenant commander – Vice Admiral was 1.30 (95%CI = 0.60–2.91, p=0.518). (Table 6)

Table 6. Association between rank and metabolic syndrome

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n (%)	OR	95%CI	p
Rank					
Petty Officer1st Class-Master Chief Petty Officer*	15(9.4%)	145(90.6%)	1.00		
Ensign-Lieutenant	14(16.9%)	69(83.1%)	1.96	0.90-4.30	0.092
Lieutenant commander-Vice Admiral	12(11.9%)	89(88.1%)	1.30	0.60-2.91	0.518

* *Reference category*

Duty

Duty was categorized into all personnel except captain who work in forced unit and doesn't work in staff position every rank**,** non- officer in auxiliary unit and education unit who doesn't work in staff position, officer in auxiliary unit and education unit who doesn't work in staff position and captain in forced unit and duty in staff unit and in staff position of unit every rank. For duty in the metabolic

syndrome were 17.0%, 5.1%, 16.3% and 11.0% respectively. For duty in the non-metabolic syndrome were 83.0%, 94.9%, 83.7% and 89.0% respectively. There was significant association between all personnel except captain who work in forced unit and doesn't work in staff position every rank and metabolic syndrome. The odds ratio was 3.94 (95% CI = 1.10-14.05, p = 0.035). There was significant association between officer in auxiliary unit and education unit who doesn't work in staff position and captain in forced unit and metabolic syndrome. The odds ratio was 4.24 (95% CI = 1.11-16.56, p = 0.038). Whereas there was not significant association between duty in staff unit and in staff position of unit every rank and metabolic syndrome. The odds ratio was 2.55 (95% CI = 0.74-8.81, p = 0.139). (Table 7)

Table 7. Association between duty and metabolic syndrome

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n (%)	OR	95%CI	p
Duty					
All personnel except captain who work in forced unit and doesn't work in staff position every rank	8(17.0%)	39(83.0%)	3.94	1.10-14.05	0.035
Non officer in auxiliary unit and education unit who doesn't work in staff position*	4(5.1%)	74(94.9%)	1.00		
Officer in auxiliary unit and education unit who doesn't work in staff position and captain in forced unit	15(16.3%)	77(83.7%)	4.24	1.11- 16.56	0.038
Duty in staff unit and in staff position of unit every rank	14(11.0%)	113(89.0%)	2.55	0.74- 8.81	0.139

** Reference category*

Age

Age was categorized into <45 years and ≥45 years. For age, <45 years and ≥45 years in the metabolic syndrome were 5.8% and 17.9% respectively. For age, <45 years and ≥45 years in the non-metabolic syndrome were 94.2% and 82.1% respectively. There was significant association between age ≥45 years and metabolic syndrome. Age ≥45 years had 3.52 times higher risk of metabolic syndrome than age <45 years (OR = 3.52, 95% CI = 1.66 – 7.42, p = 0.001). (Table 8)

Marital status

Marital status was categorized into 2 groups were couple and non - couple (single, widowed, divorce and separated). For marital status, non- couple and couple in the metabolic syndrome were 10.2% and 12.3% respectively. For marital status, non-couple and couple in the non - metabolic syndrome were 89.8% and 87.7% respectively. There was not significant association between marital status and metabolic syndrome, OR = 0.81 (95% CI = 0.32 – 2.02, p = 0.649). (Table 8)

Education level

Education level was categorized into lower Bachelor degree and Bachelor degree-Master degree. For education level, lower Bachelor degree and Bachelor degree-Master degree in the metabolic syndrome were 11.6% and 12.3% respectively. For education level, lower Bachelor degree and Bachelor degree-Master degree in the non - metabolic syndrome were 88.4% and 87.7% respectively. There was not significant association between education level and metabolic syndrome, OR = 1.07(95% CI = 0.56 – 2.05, p = 0.849). (Table 8)

Income (baht / month)

Income was categorized into ≤ 20,000 baht / month and > 20,000 baht / month. For income, ≤ 20,000 baht / month and > 20,000 baht / month in the metabolic syndrome were 11.5% and 12.4% respectively. For income, ≤ 20,000 baht / month and > 20,000 baht / month in the non - metabolic syndrome were 88.5% and 87.6%

respectively. There was not significant association between income and metabolic syndrome. The odd ratio was 1.09 (95% CI = 0.57– 2.10, p = 0.798). (Table 8)

Residence

Residence was categorized into Bangkok and suburban. For residence, Bangkok and suburban in the metabolic syndrome were 11.2% and 13.3% respectively. For residence, Bangkok and suburban in the non-metabolic syndrome were 88.8% and 86.7% respectively. There was not significant association between residence and metabolic syndrome. The odds ratio was 1.23 (95% CI = 0.63 – 2.40, p = 0.553). (Table 8)

Table 8. Association between general characteristics and metabolic syndrome

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n (%)	OR	95%CI	p
Age					
<45 years*	10(5.8%)	161(94.2%)	1.00		
≥45 years	31(17.9%)	142(82.1%)	3.52	1.66-7.42	0.001
Marital status					
Single, widowed, divorce and separated	6 (10.2%)	53 (89.8%)	0.81	0.32-2.02	0.649
Couple*	35 (12.3%)	250(87.7%)	1.00		
Education level					
Lower Bachelor degree*	21(11.6%)	160(88.4%)	1.00		
Bachelor degree-Master degree.	20(12.3%)	143(87.7%)	1.07	0.56-2.05	0.849
Income (baht)					
≤ 20,000*	22(11.5%)	169(88.5%)	1.00		
>20,000	19(12.4%)	134(87.6%)	1.09	0.57-2.10	0.798
Residence					
Bangkok*	25(11.2%)	199(88.8%)	1.00		
Suburban	16(13.3%)	104(86.7%)	1.23	0.63-2.40	0.553

** Reference category*

The family history of diseases

The family history of diseases was categorized into the answer were “yes or no”. For the family history of diseases, in the metabolic syndrome the subjects who answered “yes” were 12.4% and “no” were 11.2% respectively. In the non-metabolic syndrome in the subjects who answered “yes” were 87.6% and “no” were 88.8% respectively. There was not significant association between family history of diseases and metabolic syndrome. The odds ratio of the subjects who answered “yes” was 1.12 (95% CI = 0.57 – 2.20, p = 0.740). (Table 9)

Physical activity

Physical activity was categorized into inactivity and activity. For physical activity, inactivity and activity in the metabolic syndrome were 22.5% and 9.2% respectively. For physical activity, inactivity and activity in the non-metabolic syndrome were 77.5% and 90.8% respectively. There was significant association between physical activity and metabolic syndrome. The subjects who had physical inactivity were higher risk of metabolic syndrome than the subjects who had physical activity 2.89 times (95%CI = 1.44- 5.77, p = 0.002). (Table9)

Table 9. Association between family history of diseases, physical activity and metabolic syndrome

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n (%)	OR	95%CI	p
Family history of diseases					
Yes	26(12.4%)	184(87.6%)	1.12	0.57-2.20	0.740
No*	15(11.2%)	119(88.8%)	1.00		
Physical activity					
Inactivity	16(22.5%)	55 (77.5%)	2.89	1.44-5.77	0.002
Activity*	25 (9.2%)	248 (90.8%)	1.00		

** Reference category*

Cigarette smoking

Cigarette smoking was categorized into non-smoker, ex-smoker and current smoker. For cigarette smoking, non-smoker, ex-smoker and current smoker in the metabolic syndrome were 11.3%, 19.4% and 6.7% respectively. In non-metabolic syndrome; non-smoker, ex-smoker and current smoker were 88.7%, 80.6% and 93.3% respectively. There was not significant association between cigarette smoking and metabolic syndrome. The odds ratio of ex-smoker was 1.89 (95%CI = 0.88 – 4.01, p = 0.101). The odds ratio of current smoker was 0.59 (95%CI = 0.19 - 1.80, p = 0.350). (Table 10)

Quantity of cigarette smoking per day (rolls / day)

Quantity of cigarette smoking per day was categorized into non-smoker , group of subjects who smoked 1-19 rolls/day and 20-40 rolls/day. For quantity of cigarette smoking, non-smoker, the subjects who smoked 1-19 rolls/day and 20-40 rolls/day in the metabolic syndrome were 11.3%, 13.2% and 12.9% respectively. In non-metabolic syndrome; non-smoker, the subjects who smoked 1-19 rolls/day and 20-40 rolls/day were 88.7%, 86.8% and 87.1% respectively. There was not significant association between quantity of cigarette smoking and metabolic syndrome. The odds ratio of subjects who smoked 1-19 rolls/day was 1.20 (95%CI = 0.57- 2.50, p = 0.632). The odds ratio of subjects who smoked 20-40 rolls/day was 1.17 (95%CI = 0.38- 3.61, p = 0.788). (Table 10)

Duration of cigarette smoking (year)

Duration of cigarette smoking was categorized into non-smoker, group of subjects who had duration of smoking 1- 20 years and >20 years. For duration of cigarette smoking, non-smoker, group of subjects who had duration of smoking 1- 20 years and >20 years in the metabolic syndrome were 11.3%, 14.7% and 11.1% respectively. In non-metabolic syndrome; non-smoker, the subjects who had duration of smoking 1- 20 years and >20 years in the metabolic syndrome were 88.7%, 85.3% and 88.9% respectively. There was not significant association between duration of cigarette smoking and metabolic syndrome. The odds ratio of subjects who had

duration of smoking 1-20 years was 1.36 (95%CI = 0.62- 2.99, p = 0.447). The odds ratio of subjects who had duration of smoking > 20 years was 0.99 (95%CI = 0.38-2.54, p = 0.975). (Table 10)

Table 10. Association between smoking behavior and metabolic syndrome

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n(%)	OR	95%CI	p
Cigarette smoking					
Non-smoker*	25(11.3%)	197(88.7%)	1.00		
Ex-smoker	12(19.4%)	50(80.6%)	1.89	0.88-4.01	0.101
Current smoker	4(6.7%)	56(93.3%)	0.59	0.19-1.80	0.350
Quantity of cigarette smoking per day (rolls / day)					
Non-smoker*	25(11.3%)	197(88.7%)	1.00		
1-19 rolls / day	12(13.2%)	79(86.8%)	1.20	0.57-2.50	0.632
20-40 rolls/day	4(12.9%)	27(87.1%)	1.17	0.38-3.61	0.788
Duration of cigarette smoking					
Non smoker*	25(11.3%)	197(88.7%)	1.00		
1-20 years	10(14.7%)	58(85.3%)	1.36	0.62-2.99	0.447
>20 years	6(11.1%)	48(88.9%)	0.99	0.38-2.54	0.975

* *Reference category*

Alcohol drinking behavior

Alcohol drinking behavior was categorized into drinker and non-drinker. For alcohol drinking behavior, drinker and non-drinker in the metabolic syndrome were 10.9% and 14.9% respectively. For alcohol drinking behavior, drinker and non-drinker in the non-metabolic syndrome were 89.1% and 85.1% respectively. There was not significant association between alcohol drinking behavior and metabolic syndrome. The odds ratio was 0.70 (95%CI = 0.34- 1.41, p = 0.314). (Table 11)

Frequency of alcohol drinking per week (day)

Frequency of alcohol drinking per week was categorized into non-drinker, drinker who drank <1 day/week and drinker who drank ≥1 days/week. For frequency of alcohol drinking per week, non-drinker, drinker who drank <1 day/week and drinker who drank ≥1 days/week in the metabolic syndrome were 14.9%, 9.2% and 13.5% respectively. For frequency of alcohol drinking per week, non-drinker, drinker who drank <1 day/week and drinker who drank ≥1 days/week in the non-metabolic syndrome were 85.1%, 90.8% and 86.5% respectively. There was not significant association between frequency of alcohol drinking and metabolic syndrome. The odds ratio of drinker who drank <1 day/week was 0.57 (95%CI = 0.26- 1.28, p = 0.176). The odds ratio of drinker who drank ≥1 days/week was 0.89 (95%CI = 0.39- 2.00, p = 0.770). (Table 11)

Quantity of alcohol drinking (grams alcohol / day)

Quantity of alcohol drinking was categorized into non-drinker, drinker who drank 1-63 gm/ day, drinker who drank 64-168 gm/ day and drinker who drank >168 gm/ day. For quantity of alcohol drinking, non-drinker, drinker who drank 1-63 gm/ day, drinker who drank 64-168 gm/ day and drinker who drank >168 gm/ day in the metabolic syndrome were 14.9%, 11.4%, 10.2% and 11.8% respectively. For quantity of alcohol drinking, non-drinker, drinker who drank 1-63 gm/ day, drinker who drank 64-168 gm/ day and drinker who drank >168 gm/ day in the non-metabolic syndrome were 85.1%, 88.6%, 89.8% and 88.2% respectively. There was not significant association between quantity of alcohol drinking and metabolic syndrome. The odds ratio of drinker who drank 1-63 gm/ day was 0.73 (95%CI = 0.33- 1.62, p = 0.439). The odds ratio of drinker who drank 64-168 gm/ day was 0.65 (95%CI = 0.27-1.52, p = 0.317). The odds ratio of drinker who drank >168 gm/ day was 0.76 (95% CI = 0.16-3.72, p = 0.734). (Table11)

Table 11. Association between alcohol drinking behavior and metabolic syndrome

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n (%)	OR	95%CI	p
Alcohol drinking behavior					
Drinker	28 (10.9%)	229(89.1%)	0.70	0.34-1.41	0.314
Non-drinker*	13(14.9%)	74(85.1%)			
Frequency of alcohol drinking per week (day)					
Non-drinker*	13 (14.9%)	74 (85.1%)	1.00		
<1 day/week	14(9.2%)	139(90.8%)	0.57	0.26-1.28	0.176
≥1 days/week	14(13.5%)	90(86.5%)	0.89	0.39-2.00	0.770
Quantity of alcohol drinking (grams alcohol/day)					
Non-drinker*	13 (14.9%)	74 (85.1%)	1.00		
1 – 63 grams alcohol/day	15 (11.4%)	117 (88.6%)	0.73	0.33-1.62	0.439
64 – 168 grams alcohol/day	11(10.2%)	97 (89.8%)	0.65	0.27-1.52	0.317
>168 grams alcohol/day	2 (11.8%)	15 (88.2%)	0.76	0.16-3.72	0.734

* *Reference category*

Fat - rich food intake

Fat-rich food intake was categorized into Never/seldom intake, intake 1-2 times/week and >2 times/week. For fat-rich food intake, never/seldom intake, intake 1-2 times/week and >2 times/week in the metabolic syndrome was 14.4%, 11.2% and 10.5% respectively. For fat-rich food intake, Never/seldom intake, intake 1-2 times/week and intake >2 times/week in the non-metabolic syndrome was 85.6%, 88.8%and 89.5% respectively. There was not significant association between fat-rich food intake and metabolic syndrome. The odds ratio of intake 1-2 times/week was

0.75 (95%CI = 0.36- 1.55, p = 0.433). The odds ratio of intake >2 times/week was 0.70 (95%CI = 0.21- 2.30, p = 0.552). (Table 12)

Salty food intake

Salty food intake was categorized into Never/seldom intake, intake 1-2 times/week and >2 times/week. For salty food intake, never/seldom intake, intake 1-2 times/week and >2 times/week in the metabolic syndrome was 10.8%, 9.5% and 20.8 % respectively. For salty food intake, never/seldom intake, intake 1-2 times/week and >2 times/week in the non-metabolic syndrome was 89.2%, 90.5% and 79.2 % respectively. There was not significant association between salty food intake and metabolic syndrome. The odds ratio of intake 1-2 times/week was 0.87 (95%CI = 0.39- 1.94, p = 0.741). The odds ratio of intake >2 times/week was 2.17 (95%CI = 0.97- 4.89, p = 0.060). (Table 12)

Total fiber food intake

Total fiber food intake was categorized into Never/seldom intake, intake 1-2 times/week and intake >2 times/week. For total fiber food intake, never/seldom intake, intake 1-2 times/week and intake >2 times/week in the metabolic syndrome was 8.3%, 11.5% and 12.8 % respectively. For total fiber food intake, never/seldom intake, intake 1-2 times/week and intake >2 times/week in the non-metabolic syndrome was 91.7%, 88.5%, and 87.2% respectively. There was not significant association between total fiber food intake and metabolic syndrome. The odds ratio of never/seldom intake was 0.62 (95%CI = 0.14 - 2.82, p = 0.536). The odds ratio of intake 1-2 times/week was 0.89 (95%CI = 0.45- 1.75, p = 0.732). (Table 12)

High calories beverage

High calories beverage was categorized into Never/seldom intake, intake 1-2 times/week and intake >2 times/week. For high calories beverage, never/seldom intake, intake 1-2 times/week and intake >2 times/week in the metabolic syndrome was 17.8%, 14.3%, 8.2% respectively. For High calories beverage, never/seldom intake, intake 1-2 times/week and intake >2 times/week in the non-metabolic syndrome was 82.2%, 85.7%, 91.8% respectively. There was not significant

association between high calories beverage intake 1-2 times/week and metabolic syndrome. The odds ratio of intake 1-2 times/week was 0.77 (95%CI = 0.33-1.82, p = 0.553).Whereas there was significant association between high calories beverage intake >2 times/week, p = 0.021, 95%CI = 0.19- 0.87 but odds ratio was 0.41. (Table 12)

Table12. Association between consumption of food and metabolic syndrome

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n (%)	OR	95%CI	p
Fat- rich food intake					
Never/seldom*	13(14.4%)	77 (85.6%)	1.00		
1-2 times/week	24 (11.2%)	190 (88.8%)	0.75	0.36-1.55	0.433
>2 times/week	4(10.5%)	34(89.5%)	0.70	0.21-2.30	0.552
Salty food intake					
Never/seldom*	20 (10.8%)	166 (89.2%)	1.00		
1-2 times/week	10 (9.5%)	95 (90.5%)	0.87	0.39-1.94	0.741
>2 times/week	11(20.8%)	42(79.2%)	2.17	0.97-4.89	0.060
Total fiber food intake					
Never/seldom	2(8.3%)	22(91.7%)	0.62	0.14-2.82	0.536
1-2 times/week	16(11.5%)	123(88.5%)	0.89	0.45-1.75	0.732
>2 times/week*	23(12.8%)	157(87.2%)	1.00		
High calories beverage					
Never/seldom*	16 (17.8%)	74 (82.2%)	1.00		
1-2 times/week	10 (14.3%)	60 (85.7%)	0.77	0.33-1.82	0.553
>2 times/week	15(8.2%)	169(91.8%)	0.41	0.19-0.87	0.021

** Reference category*

Sleeping time (hrs /day)

Sleeping time was categorized into normal range (6–8 hours/day), <normal range (<6 hours/day) and >normal range (>8 hours/day). For sleeping time, the subjects who

slept in normal range, <6 hours/day and >8 hours/day in the metabolic syndrome were 11.2%, 18.4% and 9.1% respectively. For sleeping time, the subjects who slept in normal range, <6 hours/day and >8 hours/day in the non-metabolic syndrome were 88.8%, 81.6% and 90.9% respectively. There was not significant association between duration of sleeping and metabolic syndrome. The odds ratio of sleeping < 6 hours/day was 1.79 (95% CI= 0.73-4.38, p = 0.205). The odds ratio of sleeping > 8 hours/day was 0.79 (95% CI= 0.10-6.38, p = 0.826). (Table 13)

Stress

Stress was categorized into lower normal, normal stress and light - high stress. For stress; normal stress, lower normal stress and stress in light – high level in the metabolic syndrome were 11.9%, 15.9% and 8.2% respectively. For stress; normal stress, lower normal stress and stress in light – high level in the non-metabolic syndrome were 88.1%, 84.1% and 91.8% respectively. There was not significant association between stress and metabolic syndrome. The odds ratio of lower normal stress was 1.40 (95%CI = 0.63-3.07, p = 0.411). The odds ratio of stress in light – high level was 0.66 (95%CI = 0.24- 1.80, p = 0.415). (Table 13)

Table 13. Association between sleeping time, stress and metabolic syndrome

Variable	Metabolic syndrome n (%)	Non- Metabolic syndrome n (%)	OR	95%CI	p
Sleeping time (hrs./day)					
6 – 8 hours/day*	33 (11.2%)	261 (88.8%)	1.00		
<6 hours/day	7 (18.4%)	31 (81.6%)	1.79	0.73-4.38	0.205
>8 hours/day	1 (9.1%)	10 (90.9%)	0.79	0.10-6.38	0.826
Stress					
Normal level*	26 (11.9%)	192 (88.1%)	1.00		
Lower normal level	10 (15.9%)	53 (84.1%)	1.40	0.63-3.07	0.411
Light - high level	5 (8.2%)	56 (91.8%)	0.66	0.24-1.80	0.415

** Reference category*

Part III. Multivariate analysis of the comparison between OR $_{crude}$ and OR $_{adjust}$ by using logistic regression.

Multivariate analysis by logistic regression was performed, adjusted for independent variables such as rank, duty, age, marital status, education level, income, resident, family history disease, physical activity, cigarette smoking, frequency of alcohol consumption, food consumption, sleeping time and stress. The results showed that there was significant association between age ≥45 years and metabolic syndrome and after adjustment found that odds ratio of age ≥45 years increased from 3.52 to 5.17. Therefore age group ≥45 years had higher risk of metabolic syndrome than age group < 45 years 5.17 times (95% CI= 1.91 -13.99, p = 0.001). After adjustment, there was significant association between the subjects who had income >20,000 baht and metabolic syndrome 95%CI = 0.07 -0.85, p = 0.026, OR = 0.25. There was increasable significant association between physical inactivity and metabolic syndrome. In univariate analysis, p was 0.002 but after adjustment p changed to be <0.001. And opportunity of subjects who had physical inactivity had higher risk of metabolic syndrome than the subjects who had physical activity 5.93 times (95%CI = 2.39 - 14.71, p <0.001). After adjustment, there was significant association between salty food intake and metabolic syndrome. The group of subjects who consumed salty food >2 times/week had higher risk of metabolic syndrome than the subjects who never/seldom consumed salty food 6.84 times (95% CI = 2.21 -21.21, p = 0.001). (Table14)

Table 14. Multivariate analysis of the comparison between OR $_{crude}$ and OR $_{adjust}$ by using logistic regression.

Variable	OR $_{crude}$(95%CI)	*p*	OR** $_{adjust}$ (95%CI)	p
Rank				
Petty Officer1st Class-Master Chief Petty Officer*	1.00		1.00	
Ensign-Lieutenant	1.96(0.90-4.30)	0.092	1.30(0.37-4.54)	0.679
Lieutenant commander-Vice Admiral	1.30(0.60-2.91)	0.518	1.18 (0.24-5.88)	0.845
Duty				
All personnel except captain who work in forced unit and doesn't work in staff position every rank	3.94(1.10-14.05)	0.035	4.24(0.94-19.18)	0.060
Non officer in auxiliary unit and education unit who doesn't work in staff position *	1.00			
Officer in auxiliary unit and education unit who doesn't work in staff position and captain in forced unit	4.24(1.11-16.56)	0.038	3.68(0.70-19.41)	0.124
Duty in staff unit and in staff position of unit every rank	2.55(0.74-8.81)	0.139	3.35(0.74-15.27)	0.118

Table14. Multivariate analysis of the comparison between OR $_{crude}$ and OR $_{adjust}$ by using logistic regression (Continued)

Variable	OR $_{crude}$(95%CI)	*p*	OR** $_{adjust}$ (95%CI)	p
Age				
<45 years*	1.00		1.00	
≥45 years	3.52(1.66-7.42)	0.001	5.17(1.91-13.99)	0.001
Marital status				
Single, widowed, divorced and separated	0.81(0.32-2.02)	0.649	0.87(0.29-2.66)	0.807
Couple*	1.00		1.00	
Education level				
Lower Bachelor degree*	1.00		1.00	
Bachelor degree-Master degree	1.07(0.56-2.05)	0.849	1.19(0.46-3.08)	0.714
Income (baht)				
≤ 20,000*	1.00		1.00	
>20,000	1.09(0.57-2.10)	0.798	0.25(0.07-0.85)	0.026
Residence				
Bangkok*	1.00		1.00	
Suburban	1.23(0.63-2.40)	0.553	0.97(0.43-2.23)	0.950
Family history of diseases				
Yes	1.12(0.57-2.20)	0.740	1.62(0.70-3.76)	0.264
No*	1.00		1.00	
Physical activity				
Inactivity	2.89(1.44-5.77)	0.002	5.93(2.39-14.71)	<0.001
Activity*	1.00		1.00	
Cigarette smoking				
Non smoker*	1.00		1.00	
Ex- smoker	1.89(0.88-4.01)	0.101	1.49(0.58-3.83)	0.405
Current smoker	0.59(0.19-1.80)	0.350	0.25(0.06-1.05)	0.058

Table14. Multivariate analysis of the comparison between OR $_{crude}$ and OR $_{adjust}$ by using logistic regression (Continued)

Variable	OR $_{crude}$(95%CI)	*p*	OR** $_{adjust}$ (95%CI)	p
Frequency of alcohol drinking per week (day)				
Non-drinker*	1.00		1.00	
< 1 day/week	0.57(0.26-1.28)	0.176	0.45(0.17-1.22)	0.115
≥ 1 days/week	0.89(0.39-2.00)	0.770	0.99(0.34-2.89)	0.982
Fat- rich food intake				
Never/seldom*	1.00		1.00	
1-2 times/week	0.75(0.36-1.55)	0.433	0.63(0.25-1.61)	0.337
>2 times/week	0.70(0.21-2.30)	0.552	0.65(0.13-3.39)	0.612
Salty food intake				
Never/seldom*	1.00		1.00	
1-2 times/week	0.87(0.39-1.94)	0.741	0.96(0.37-2.52)	0.933
>2 times/week	2.17(0.97-4.89)	0.060	6.84(2.21-21.21)	0.001
Total fiber food intake				
Never/seldom	0.62(0.14-2.82)	0.536	0.73(0.12-4.63)	0.741
1-2 times/week	0.89(0.45-1.75)	0.732	0.80(0.34-1.86)	0.598
>2 times/week*	1.00		1.00	
High calories beverage				
Never/seldom*	1.00		1.00	
1-2 times/week	0.77(0.33-1.82)	0.553	1.15(0.40-3.25)	0.799
>2times/week	0.41(0.19-0.87)	0.021	0.53(0.20-1.39)	0.197
Sleeping time (hrs./day)				
6 – 8 hours/day*	1.00		1.00	
< 6 hours/day	1.79(0.73-4.38)	0.205	1.84(0.61-5.56)	0.280
> 8 hours/day	0.79(0.10-6.38)	0.826	0.63(0.04-10.14)	0.742
Stress				
Normal level*	1.00		1.00	
Lower normal level	1.40(0.63-3.07)	0.411	1.51(0.56-4.10)	0.414
Light - high level	0.66(0.24-1.80)	0.415	0.59(0.19-1.84)	0.363

* *Reference category*

** OR adjust for independent variables such as rank, duty, age, marital status, education level, income, resident, family history disease, physical activity, cigarrette smoking, and frequency of alcohol consumption, food consumption, sleeping time and stress.

CHAPTER V
DISCUSSION

This cross-sectional study was proposed to examine the association between lifestyle and metabolic syndrome among male naval personnel in Bangkok and suburban. There were 334 male naval personnel aged 35-60 years. All of them worked in 30 naval departments in Bangkok and suburban and lived in area of Bangkok and suburban too. They undertook annual health check up at Somdejprapinklao Hospital and Bangkok Naval Hospital. The waist circumference and serum HDL-C are not measured at the other Naval Hospitals. Data of their lifestyle and general characteristic were record by them selves. Thus, if some questionnaires were incomplete they were excluded from this study. And some of the laboratory results were incomplete they were excluded from this study too. Metabolic syndrome was defined using a modified version of the NCEP-ATP III criteria (20). In this study, the cut-off point of waist circumference defined for South Asian and South-East Asian men ≥ 90 cm (21). The NCEP-ATP III criteria is simple for practice and more suitable for the ability of Naval Hospital's laboratory because microalbuminuria, which is used by the WHO (73), it is not measured for routine health check up. And when the author had ever used the IDF criteria for pilot studied, it was found the prevalence of metabolic syndrome was 5% that it was lower than using the NCEP-ATP III criteria (9%).Some characteristics of the subjects in this study may be substantially different from other population such as waist circumference because when using IDF criteria that first component of each subjects who had metabolic syndrome was waist circumference ≥ 90 cm. Thus, the NCEP-ATP III criteria would be additional result and beneficial to this study.

General Characteristics

The majority of the subjects in this study were non-commissioned officers (46.5%), mean (SD) age was 43.96(± 5.72) years, married, lower Bachelor degree and income ≤ 20,000 baht/month. Similarly, the structure of the Navy in the present time

, the majority personnel is non-commissioned officer 47.32 % and age range is 45-49 years (24.7%) (104). This result corresponded with other studies, in the report of health promotion for prevention ischemic heart disease among naval personnel in budged year 2544 showed the majority rank of subjects were non-commissioned officers(105). Similarly, Poungnak N collected data from 50 non-commissioned officers of the Navy in Bangkok. The majority age of his participants were 40-49 years of age, couple and lower Bachelor degree (106) Generally accepted that obesity, hyperlipidemia, hyperinsulinemia, hyperglycemia and hypertension are metabolic disorders emerge in the aged subjects who are living in inappropriate lifestyle (107). Many surveys conducted in a wide variety of industrialized countries on numerous behaviors have consistently produced results showing associations between socio-economic status and health behaviors. The poorer and the people who less educated they are similarly to engage in patterns of behaviors that are not conducing to health (108). The majority of the subjects of the present study lived in Bangkok and worked in staff unit and staff positions of unit. Cross-sectional studies of Thanatadthanakul T. (2007) showed that the participants of his study were the urban government officials who worked in the office, married and mean age was 45.6.(109) For mrrital status, marital involvement likely influences health behaviors in various ways. Spouses who care and are concerned about one another should have a major stake in each other's continuing good health. And close maritalties, as expressed in frequent and presurable interactions between husband and wife, should positively influence each spouse's health habits (110). Recently, cardiovascular disease is often view as a male in middle adulthood's problem. (111)

Health behavior characteristics and lifestyle

This study showed the subjects who had health history of diseases such as Diabetes mellitus, Hypertension, Hyperlipidemia and over weight were 59.3%. There were hyperlididemia 38.7%, over weight 29.1%, hypertension 22.4% and diabetes mellitus 6.4%. Most of them didn't use medicine or follow up doctor. The subjects had family history of these diseases 61%. Recently, it is generally accepted that heredity and one's health history of diseases induce chronic diseases.

Lifestyle is the most important modifiable factor influencing health and illness today. A person‘s lifestyle or way of life and health behavior are closely interrelated. Health behavior refers to person’s actions or inactions take that directly or indirectly affect one’s health status or well-being (112). People who frequently engage in risky behaviors such as smoking, excessive drinking, few leisure activities and excessive food consumption are more vulnerable to disease and illness (113-114).

For cigarette smoking, in this study there were 64.5%, 18% and 17.5% of the subjects who were non-smoker, ex-smoker and current smoker respectively. For smoker, the major quantity of cigarette smoking was 6-10 rolls/day. Duration of smoking was 21-33 years. Similarly, The National Statistics Bureau (1999) reported that average of cigarette smoking in Thai working population was 1-10 rolls/day (115). Cigarette smoking is one of modifiable risk factors of chronic diseases. Masulli M and Vaccaro O showed their agreement with Oh et al. that chronic smoking was associated with higher triglycerides and lower HDL-C (116)**.** The prevalence of smokers in male and female participants in the CEGAT Study was 54.2% and 6.3%, respectively. For ex-smokers and current smokers who had smoked ≥6 years should be more severe from CHD than ex-smokers and current smokers who had smoked ≤5 years (117).

Alcohol drinking behavior of the subjects in this study were drinker 74.7%, the majority type of alcohol beverage was hard liquor , frequency of drinking was 1day/week and majority amount of alcohol beverage consumption was 1-63 gram alcohol. Poungnak N (1999) showed there were alcohol drinker 62% and 70.8% of control and case respectively. The study among non-commissioned police officers in metropolitan police station in Bangkok found that there were non-commissioned police officers 78.7% who drank alcohol and related to job stress (118). Pati K in a case-control study showed drinker who drank 3-4 days/week had the highest risk compared to non-drinkers (OR_{adj} = 3.56, 95%CI = 1.45-8.73), OR was 3.06 (95%CI = 1.68-5.58) among drinker who drank 1-2 days/week and OR was 2.37 (95%CI = 1.19-4.73) among drinker who drank <1 days/week (84). Freiberg MS et al. found mild to moderate alcohol consumption was a favorable influence on lipid, waist circumference and fasting insulin (119). Heavy alcohol consumption is associated with increased risk of cardiovascular disease and all-cause mortality (120) Ames G. and Cunradi C.

showed that heavy alcohol use was a significant problem in the U.S. military. Personnel often use alcohol in an attempt to cope with stress, boredom, loneliness and the lack of other recreational activities. The easy availability of alcohol, ritualized drinking opportunities and inconsistent policies contribute to a work culture that facilitates heavy and binge drinking in this population. The report showed rates of heavy alcohol use among 18 to 25 year old military personnel differ significantly by service branch and gender as showed that young males in the Marines Corps had the highest rate of heavy alcohol use, at 38.6%; Air Force, the rate was 24.5%. The Army and Navy had similar rates were 32.8% and 31.8% respectively. For women, rate of heavy alcohol use were Marines Corps 12.9% and Navy 11.5% and lower in the Air Force and Army (6.3% in each) (121). These report showed that alcohol use was the problem in the military personnel of several countries.

For physical activity, there was 20.6% of the subjects who had physical inactivity, 54.7% were moderate-intensity physical activity, 9.6% were vigorous-intensity physical activity and 15.1% were moderate and vigorous- intensity physical activity respectively. Compared activity of the subjects in this study with activity of the subjects of Poungnak N study shown most of his subjects spent the leisure-time for watching television 46% and 35.4% in control and case respectively , the subjects who had active activity were only 8% and 6.3% in control and case respectively(106). Salonen JT et al. found that the lack of leisure time physical activity and a sedentary occupation were associated with an increased risk of ischemic heart disease death (105,122). Likewise, it is generally accepted that commonly physical activity was associated with a lowering of essential hypertension, cholesterol level and triglyceride level but HDL-C was increase. A cohort study in French population aged 30-65 years , the impact of 3-year change in lifestyle habit (sporting activity, physical activity at home and at work) on metabolic syndrome the result was shown in men, 3-year increased in sporting activity were associated with a lowering of insulin, glucose, systolic blood pressure and waist circumference (all $p < 0.05$). For women, the only effect was on lowering waist circumference ($p < 0.03$). Increases in physical activity at home were beneficially associated with HDL-C, triglycerides, waist circumference and BMI changed (all $p < 0.05$) in men (123).

For food intake pattern of the subjects in this study was shown that the frequency of their fat-rich food and total fiber intake were 1-2 times /week. For salty food intake was never-seldom and high calories beverage was not difference in each level of consumption. For the reason of this result might be caused of recently there was the campaign of health promotion include a healthy diet, smoking cessation and physical activity in the Navy that influenced to health behavioral realization of the subjects.

For sleeping time and stress, the majority of the subjects were in the normal level in each factor. In the previous studies, Gangwisch JE showed the subjects who slept five or fewer hours per night continued to be significantly more likely to be diagnosed with hypertension after controlling for factors such as obesity, diabetes, physical activity, salt and alcohol consumption, smoking, depression, age, education, gender, and ethnicity (124). While, in another Gangwisch JE's study showed the subjects who reported sleeping five or fewer hours and subjects who reported sleeping nine or more hours were significantly more likely to have incident diabetes over the follow-up period than were subjects who reported sleeping seven hours, even after adjusting for variables such as physical activity, depression, alcohol consumption, ethnicity, education, marital status, age, obesity and history of hypertension. Epstein L**,** a past president of the American Academy of Sleep Medicine (AASM) said that this study is one of several large studies that have shown that people who don't get enough sleep have higher rates of diabetes. On average, most adults need seven to eight hours of sleep each night to feel alert and well-rested. Adolescents should sleep about nine hours a night, school-aged children between 10-11 hours a night and children in pre-school between 11-13 hours a night (100). Hitti M had studied in 10,300 British government workers who were followed for 12-17 years.During the study, the death rate was higher for people who spent too much or too little time sleeping. The researchers recommend getting seven to eight hours of nightly sleep on a regular basis (101).For stress, there was considerable evidence that physiological reactions to stress might impair bodily system over time. However, stress might also indirectly affects on health and contribute to the development of many chronic diseases (125).

Health status of the subjects

This study found that the figure of their health status was in acceptable level for each factors such as waist circumference < 36 inches, SBP< 120 mmHg , DBP < 80 mmHg , FBS < 110 mg/dl, triglyceride < 150mg/dl and HDL-C ≥ 40 mg/dl. The subjects in this study were naval personnel who received annual health checkup thus they might concern more and be careful of their health. Nowadays naval personnel's health status is one of criterion for individual assessment in the Navy.

Prevalence of metabolic syndrome

For metabolic syndrome, prevention and early detection were the most important to control. The prevalence of metabolic syndrome is influence on the direction of health management in the community. The prevalence of metabolic syndrome in the previous study was 10-40% in most Asian countries, and 12.0-25.0% in Europe, the United States and Australia (126). Estimated current global metabolic syndrome prevalence for adults > 20 years of age is 16.0% (127). In Thailand, by using NCEP ATP III criteria in an annual health examination the estimated prevalence of metabolic syndrome was 12.8 % (12). The prevalence of metabolic syndrome among Thai professional and office workers in Bangkok was 15.2% (128). Data from EGAT study found the people with metabolic syndrome and DM increase risk 0f CVD 5 times. The previous study in 1985 showed that the prevalence of metabolic syndrome by using NCEP's criteria, the majority key component of metabolic syndrome which found in Thai were low HDL-C, high TG and HT while using Asian criteria found increasing of abdominal obesity (129). The prevalence of metabolic syndrome in this study was 11.9% by using NCEP- ATPIII criteria. Among the subjects with metabolic syndrome in the present study HDL-C, it was not the problem that related with the result of physical activity of the subjects. While, the prevalence of fasting plasma glucose ≥110 mg/dl were the majority problem among the subjects who had metabolic syndrome in the present study (Table5). But data of annual health checkup in Navy during October 2548- September 2549 found that dyslipidemia and hypertension were the leading problem among the naval personnel who received annual health checkup (130). The prevalence of metabolic syndrome in this study was similarly with the

previous study in Thailand. Thus, the urgency needs to develop strategies for the detection, prevention and treatment of metabolic syndrome will attenuate cardiovascular disease and especially diabetes in the Navy.

The association between general characteristic, lifestyle and metabolic syndrome

The present study shows that there is an association between age ≥45 years, physical inactivity, and frequency of salty food intake with metabolic syndrome. Whereas the subjects who received income >20,000 baht/month was protective factor.

For age, according to the data from the Third National and Nutrition Examination Survey (NHANES III) showed the prevalence of metabolic syndrome in the US population increase with age (131) Elderly population tends to have a high degree of stress, physical inactivity and consume less fruit and vegetables that lead to a high prevalence of metabolic syndrome (132-133). The present study showed that there was significant association between age ≥ 45 years and metabolic syndrome and after adjustment found that OR_{adjust} of age ≥45 years increased from 3.52 to 5.17.

Physical inactivity is one of the important behaviors which raise the prevalence of metabolic syndrome. Regular physical activity substantially reduces the risk of dying of coronary heart disease, the nation's leading cause of death, and decreases the risk for stroke, colon cancer, diabetes, and high blood pressure. It also helps to control weight; contributes to healthy bones, muscles, and joints; reduces falls among older adults; helps to relieve the pain of arthritis; reduces symptoms of anxiety and depression; and is associated with fewer hospitalizations, physician visits, and medications. Balkau B found increases in physical activity over the 3 - year period were associated with beneficial effects on parameters of metabolic syndrome, particularly in men (123). Mohan V et al. found physical inactivity associated with the components of metabolic syndrome and CAD in urban south- Indian population (134). The present study showed that there was significant association between physical inactivity and metabolic syndrome. In univariate analysis, p was 0.002 but in multivariate after adjustment p changed to be <0.001. And opportunity of subjects who

had physical inactivity had higher risk of metabolic syndrome than the subjects who had physical activity 5.93 times (OR_{adjust} = 5.93, 95%CI = 2.39 -14.71, p <0.001).

It is generally accepts that hypertension is one of key components of metabolic syndrome and high sodium intake associate with high blood pressure level. The prevention and management of hypertension are major public health challenges for the United States. Mean sodium intake is approximately 4,100 mg per day for men and 2,750 mg per day for women, 75 percent of which comes from processed foods (135-136). Mc Donough J and Wilhelm CM. had studied the effect of excess salt intake on human blood pressure; they found that blood pressure increased 10/10 mmHg after adding salt 37 gm/day for 23 days (137). The present study showed there was significant association between salty food intake and metabolic syndrome. The group of subjects who consumed salty food >2 times/week had higher risk of metabolic syndrome than the subjects who never/seldom consumed salty food 4.13 times (OR_{adjust} = 4.13, 95% CI 1.64 -10.43, p = 0.003). The result related to prevalence of hypertension among the subjects who had metabolic syndrome in this study.

Income is one of the variables in this study, the subjects who had income >20,000 baht/month, which was found it was protective factor for metabolic syndrome (OR = 0.25, 95%CI = 0.07 -0.85, p = 0.026). The most of Naval personnel who have income >20,000 baht/month, they have opportunity for their life such as health care, type of activity after work, food intake and treatment.

In univariate analysis found there was significant association between metabolic syndrome and duty in all personnel except captain who work in forced unit and doesn't work in staff position every rank and metabolic syndrome. The odds ratio was 3.94 (95% CI = 1.10-14.05, p = 0.035). And there was significant association between officer in auxiliary unit and education unit who doesn't work in staff position and captain in forced unit and metabolic syndrome. The odds ratio was 4.24 (95% CI = 1.11-16.56, p = 0.038). However in multivariate analysis there was not association between metabolic syndrome and all of duty.

In univariate analysis found that the subjects who intake high calories beverage intake >2 times/week in this study was protective factor OR = 0.41, 95%CI = 0.19-0.87, p = 0.021). The subjects who intake high calories beverage intake >2 times/week

might have other lifestyle which not disturb their health such as other diet control or moderate activities. However in multivariate analysis there was not association between intake high calories beverage intake >2 times/week metabolic syndrome.

Discussion on Statistical Analyses

The descriptive analysis was expressed in the number, percentage, mean and standard deviation to describe general characteristic, health behaviors and lifestyle of the subjects.

Univariate analysis, by using Chi-squared test which was routinely applied in many cross-sectional studies to determine the magnitude of association between independent variables such as general characteristic, health behaviors and lifestyle of the subject and metabolic syndrome. Risk of the metabolic syndrome was presented by crude Odds Ratio (OR) and 95% confidence interval 1or higher. Significant statistical level was p-value less than 0.05. The classification of independent variables influenced on OR crude and p-value that inappropriate classification caused of the inappropriate number of the subjects in each classification.

Multivariate analysis by logistic regression was used to determine the association between independent variables and metabolic syndrome by compared OR crude and OR adjust. The independent variables which were adjusted such as rank, duty, age, marital status, education level, income, resident, family history disease, physical activity, duration of smoking, frequency of alcohol consumption, food consumption, sleeping time and stress. For cigarette smoking and alcohol consumption behaviors were selected from the variables which it's OR crude was the highest in each behavior.

The present study shows that there is an association between age, physical inactivity, frequency of salty food intake with metabolic syndrome.Whereas the subjects who received income >20,000 baht/month was protective factor.

There are limitations to the present study. The subjects included only individuals who received annual health checkup at Somdejprapinklao Hospital and Bangkok Naval Hospital. The reason for this is the serum HDL-C examination did not perform

in every subject of other Naval Hospital. The serum HDL-C examines was performed only in the subject with sign of borderline of dyslipidemia. The other reason is since October 2549 for the Naval personnel who receive annual health checkup must pay in cash the amount of the Naval personnel who received annual health checkup was decrease. This study can not refer to all personnel of Royal Thai Navy because this study was conducted in Bangkok and suburban area.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

This cross-sectional study was conducted to investigate the association between lifestyle and metabolic syndrome among male naval personnel aged 35-60 years in Bangkok and suburban.

This study was conducted among 334 male naval personnel in Bangkok and suburban. All of them undertook annual health checkup at Somdejprapinklao Hospital and Bangkok Naval Hospital, during the period of May through October 2007.

Self-administered questionnaire on socio-demography, history of medical illness, history of regular lifestyle (cigarette smoking, alcohol drinking behavior, physical activity, sleeping time, food consumption and stress) were sent to participants for completion during routine clinic visits. Participants underwent routine physical examinations that included a collection of venous blood samples after an overnight fast for lipid profiles and fasting blood sugar. Measurements of waist circumference and resting blood pressure were taken during exams. Waist circumference was measured horizontal at the umbilicus level. Blood pressure was taken in the seated position after each subject rested for at least 5 minutes.

All participants provided informed consent and research protocol was reviewed and approved by Mahidol University Ethical Committee and Naval Medical Department Ethical Committee.

Result from descriptive analysis showed that the majority of the subjects were non-commissioned officers (46.5%), mean (SD) age was 43.96(± 5.72) years, worked in staff unit and staff positions of unit (36.9%) and lived in Bangkok (65.1%). Most of them were married (82.8%), lower Bachelor degree (52.6%) and income ≤ 20,000 baht/month (55.5%). Regarding their health, the majority of the subjects had health history of diseases such as diabetes mellitus, hypertension, hyperlipidemia and over

weight (59.3%). Most of them didn't use medicine or follow up doctor (68%) and had family history of these diseases (61%). The majority of lifestyle among the subjects were non-smoker (64.5%), alcohol drinker (74.7%), moderate-intensity physical activity (54.7%), stress in normal level (63.4%), normal duration of sleeping time (85.5%) For food intake pattern of the subjects was shown that the frequency of their fat-rich food and total fiber intake were 1-2 times/week (62.2% and 49.4% respectively). For salty food intake was never-seldom (54.1%) and high calories beverage was not difference in each level of consumption (20-27%).

The prevalence of metabolic syndrome in this study was 11.9% by using NCEP-ATPIII criteria and waist circumference defined for South Asian and South-East Asian men ≥ 90 cm (≥36 inches). From the univariate analysis found the association between the subjects who age ≥45 years, physical inactivity, and all personnel except captain who work in forced unit and doesn't work in staff position every rank and officer in auxiliary unit and education unit who doesn't work in staff position and captain in forced unit with metabolic syndrome. Whereas the subjects who intake high calories beverage >2 times/week was protective factor. Additionally, the results from multivariate by using logistic regression after adjusted for rank, duty, age, marital status, education level, income, resident, family history disease, physical activity, cigarette smoking, frequency of alcohol consumption, food consumption, sleeping time and stress showed that there were strong higher association between age ≥45 years (OR = 5.17, 95% CI = 1.91 -13.99, p = 0.001) , physical inactivity (OR = 5.93, 95%CI = 2.39 -14.71, p <0.001), salty food intake >2 times/week(OR= 6.84, 95% CI 2.21 -21.21, p = 0.001). Whereas the subjects who received income >20,000 baht/month was protective factor (OR = 0.25, 95% CI= 0.07-0.85, p=0.03).

Recommendations

Based on the finding of this study, the following issues should be considered for improving the prevention of metabolic syndrome among naval personnel and family. Health promotion is necessary. The goal of health promotion program is to maximize

readiness, war fighting ability, and work performance includes enhancing the well-being of all naval personnel.

1. The Navy should to do campaign for health promotion in order to modify lifestyle about increase physical activity, control fasting plasma glucose level, reduce consuming high salty diet, include reduce weight, cessation of cigarette smoking, reduce alcohol use and stress management or spiritual health among naval personnel.

2. A prevention control and health promotion for metabolic syndrome can be inferred form the above factors obtained from this study. The naval personnel should be more informed about the knowledge of metabolic syndrome and health care to avoid these risk factors. Health risk behaviors should be monitored and modified through health education program. For controlling, the program should to emphasize in naval personnel who aged ≥45 years old.

3. The Navy must order the personnel to receive annual health checkup for monitoring prevalence of metabolic syndrome and emphasize about control fasting plasma glucose level should not over 110 mg/dl and waist circumference measurement (lower 90cm.in men and lower 80 cm. in women.). The Navy should to make agreement for waist circumference measurement in the same method and suitable for all naval personnel.

4. The navy should to foster the development of an enabling environment for sustainable at individual physical activity during free time or after work and suggest that a place for religious affair should be arranged at work place. The stressed persons who faced to serious problems in their life or work should have a place to clam down emotion or pray for blessing. Generally Thai people believe that religious is significant for people not only reducing anxiety but also increasing the happiness in their life.

5. The importance issue, by individual naval personnel should to take care of their health by receive routine annual health check up every year and follow up the result. While, they should to take healthy lifestyle by regularly exercise, healthy diet, weight control, adequate stress management, adequate night-sleeping and always

measure their waist circumference by themselves(not over 90 cm in men and not over 80 cm in women) .

Recommendations for further study

1. The further study should be explored prevalence of metabolic syndrome and variable which relate to the syndrome among all naval personnel of the Navy.

2. The further study may use other of research study such as retrospective cohort, conduct by using data in the past from health manual book of all personnel who graduated from Naval cadet and Naval rating school.

3. The further study may conduct cohort study to explore risk factors of the key component of metabolic syndrome among personnel who have just graduated from Naval cadet and Naval rating school and without metabolic syndrome or study for outcome of metabolic syndrome and cost of treatment among personnel with metabolic syndrome.

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APPENDIX

APPENDIX A

ใบยินยอมตนให้ทำการวิจัยโดยได้รับการบอกกล่าวและเต็มใจ

(Informed Consent Form)

การวิจัยเรื่อง ความสัมพันธ์ระหว่างการดำเนินชีวิตกับการเกิดเมตาบอลิคซินโดรม ในข้าราชการทหารเรือชายสังกัดกรุงเทพฯและปริมณฑล
วันให้คำยินยอม วันที่ ..... เดือน ..... พ.ศ. .....

ผู้วิจัยรับรองว่าจะเก็บข้อมูลเฉพาะที่เกี่ยวกับตัวข้าพเจ้าเป็นความลับ และเจะเปิดเผยได้เฉพาะในรูปแบบที่เป็นสรุปผลการวิจัย การเปิดเผยข้อมูลเกี่ยวกับตัวข้าพเจ้าต่อหน่วยงานต่าง ๆ ที่เกี่ยวข้องกระทำได้เฉพาะกรณีจำเป็นด้วยเหตุผลทางวิชาการเท่านั้น

ก่อนที่จะลงนาม ในใบยินยอมให้ทำการวิจัยนี้ ข้าพเจ้าได้รับการอธิบายจากผู้วิจัยถึง วัตถุประสงค์ของการวิจัย วิธีการวิจัย ความมุ่งหมาย รวมทั้งประโยชน์ที่ที่คาดว่าจะเกิดจากการวิจัยอย่างละเอียดและมีความเข้าใจดีแล้ว

ผู้วิจัยรับรองว่า จะตอบคำถามต่างๆ ที่ข้าพเจ้าสงสัย ด้วยความเต็มใจ ไม่ปิดบัง ซ่อนเร้น จนข้าพเจ้าพอใจ ข้าพเจ้ามีสิทธิที่จะบอกเลิกการเข้าร่วมโครงการวิจัยนี้เมื่อใดก็ได้ และเข้าร่วมโครงการวิจัยนี้ โดยสมัครใจ และการบอกเลิกการเข้าร่วมการวิจัยนี้ จะไม่มีผลต่อการรับบริการสุขภาพที่จะพึงได้รับและหน้าที่การงานของข้าพเจ้า ต่อไป

ผู้วิจัยรับรองว่าหากมีข้อมูลเพิ่มเติมที่ส่งผลกระทบต่อการวิจัย ข้าพเจ้าจะได้รับการแจ้งให้ทราบโดยไม่ปิดบังซ่อนเร้น

ข้าพเจ้าได้อ่านข้อความข้างต้นแล้ว และมีความเข้าใจดีทุกประการ และได้ลงนามในใบยินยอมนี้ด้วยความเต็มใจ

ลงนาม ..... ผู้ยินยอม
ลงนาม .....พยาน
ลงนาม... ..... พยาน

APPENDIX B

แบบสอบถาม

เรื่อง

ความสัมพันธ์ระหว่างการดำเนินชีวิตกับการเกิดเมตาบอลิคซินโดรมในข้าราชการทหารเรือชาย สังกัดกรุงเทพฯและปริมณฑล

เรียน ท่านผู้ตอบแบบสอบถาม

แบบสอบถามนี้จะถามเกี่ยวกับ วิถีชีวิตและการดำรงชีวิตประจำวันของท่านในช่วงอดีตที่ผ่านมา รวมทั้งแบบประเมินความเครียด ซึ่งพฤติกรรมเหล่านี้อาจมีความสัมพันธ์กับสุขภาพของท่าน โดย**ข้อมูลที่ได้นี้จะนำไปศึกษาถึงความสัมพันธ์ระหว่างการดำเนินชีวิตกับการเกิดเมตาบอลิคซินโดรม ได้แก่ กลุ่มความผิดปกติของระดับไขมันในเลือด,ระดับน้ำตาลในเลือด, ความดันโลหิตและขนาดของรอบเอว อันเป็นปัจจัยเสี่ยงที่สำคัญของโรคหลอดเลือดหัวใจ** ในข้าราชการทหารเรือชายสังกัดกรุงเทพฯและปริมณฑล คำตอบที่ได้จะเป็นความลับไม่มีผลกระทบต่อตัวท่านหรือหน่วยงานของท่าน แต่จะเป็นประโยชน์แก่ท่านและกองทัพในภาพรวม ในการดำเนินโครงการสร้างเสริมสุขภาพให้แก่ข้าราชการชายสังกัดกรุงเทพฯและปริมณฑลในโอกาสต่อไป

แบบสอบถาม แบ่งออกเป็น 4 ส่วน ประกอบด้วย

- **ส่วนที่ 1** แบบสอบถามข้อมูลทั่วไป
- **ส่วนที่ 2** แบบสอบถามเกี่ยวกับพฤติกรรมสุขภาพ
- **ส่วนที่ 3** แบบสอบถามเกี่ยวกับพฤติกรรมการบริโภค
- **ส่วนที่ 4** แบบประเมินความเครียด

ขอขอบคุณทุกท่านที่ให้ความร่วมมือเป็นอย่างดียิ่งในการตอบแบบสอบถามครั้งนี้

นาวาตรีหญิง ดวงกมล ฉัตรเงิน
นิสิตปริญญาโท หลักสูตรโรคติดเชื้อและ
วิทยาการระบาด (สาขาระบาดวิทยา)
คณะสาธารณสุขศาสตร์ มหาวิทยาลัยมหิดล

ส่วนที่ 1 แบบสอบถามข้อมูลทั่วไป

คำชี้แจง: โปรดเติมคำลงในช่องว่างและทำเครื่องหมาย √ ลงในช่อง ( ) หน้าข้อที่ตรงกับความเป็นจริงมากที่สุด

1.ชั้นยศ

( ) จอ. – พจอ. ( ) รต. – รอ. ( ) นต.- นอ. ( ) พล.รต.- พล.รอ.

2. อายุ..... ปี

3.สังกัด.....

4.ลักษณะงานที่ปฏิบัติ

( ) ผู้ปฏิบัติงานในกรมฝ่ายอำนวยการ และผู้ที่ปฏิบัติงานในฝ่ายอำนวยการของหน่วยต่างๆทุกชั้นยศ

( ) นายทหารสัญญาบัตรในหน่วยสนับสนุนการรบและหน่วยศึกษาที่ไม่ได้ทำหน้าที่ฝ่ายอำนวยการ รวมทั้งนายทหารชั้นยศนาวาเอกขึ้นไปในส่วนกำลังรบ

( ) นายทหารประทวนที่อยู่ในหน่วยสนับสนุนการรบและหน่วยศึกษาที่ไม่ได้ทำหน้าที่ฝ่ายอำนวยการ

( ) นายทหารสัญญาบัตรชั้นยศนาวาโทลงมาและนายทหารประทวนในส่วนกำลังรบที่ไม่ได้ทำหน้าที่ฝ่ายอำนวยการ

5.สถานภาพสมรส

( ) คู่ ( ) โสด ( ) ม่าย ( )หย่า ( )แยก

6.ระดับการศึกษา

( ) ต่ำกว่าปริญญาตรี ( ) ปริญญาตรี

( ) ปริญญาโท ( ) ปริญญาเอก

7.รายได้เฉลี่ยต่อเดือน

( ) 10,000 - 20,000 บาท ( ) 20,000 - 30,000 บาท

( ) 30,000 -40,000 บาท ( ) 40,000 บาทขึ้นไป

8.ที่พักอาศัยในปัจจุบัน

( ) กรุงเทพฯ ( ) สมุทรปราการ

( ) นนทบุรี ( ) ปทุมธานี

( ) นครปฐม ( ) สมุทรสาคร

( ) อื่นๆ.....

9.ใน 1 ปีที่ผ่านมาท่านเคยได้รับการวินิจฉัยว่าเป็นโรคหรือภาวะดังต่อไปนี้หรือไม่ (เลือกตอบได้มากกว่า 1 ข้อ)

( ) เบาหวาน ( ) ความดันโลหิตสูง

( ) ไขมันในเลือดสูง ( ) น้ำหนักตัวเกิน

( ) ไม่เคย

10.ถ้าเคยได้รับการวินิจฉัยดังที่กล่าวข้างต้น ปัจจุบันท่านปฏิบัติอย่างไร

( ) ปัจจุบันรักษาโดยการใช้ยาและปฏิบัติตนตามแผนการรักษาของแพทย์แผนปัจจุบัน

( ) ไม่ได้รับประทานยาหรือพบแพทย์ตามนัดอย่างต่อเนื่อง

11.ท่านมีญาติสายตรง เช่น ปู่, ย่า, ตา, ยาย, บิดา, มารดาหรือพี่น้องร่วมสายโลหิตป่วยด้วยโรคเบาหวาน, ความดันโลหิตสูง, ไขมันในเลือดสูง และน้ำหนักตัวเกิน หรือไม่

( ) มี ( ) ไม่มี

ข้อควรทราบ เพื่อให้ได้ข้อมูลที่เป็นจริงมากที่สุด ในกรณีที่ท่านถูกวินิจฉัยว่ามีอาการไขมันในเลือดสูง, ความดันโลหิตสูง, น้ำตาลในเลือดสูง หรือน้ำหนักเกิน กรุณาตอบแบบสอบถามโดยใช้พฤติกรรมประมาณ 1 ปี ก่อนที่ท่านถูกวินิจฉัยมาเป็นข้อมูลในการตอบแบบสอบถาม

ส่วนที่ 2 แบบสอบถามเกี่ยวกับพฤติกรรมสุขภาพ

1.โปรดพิจารณาว่าท่านมีกิจกรรมการเคลื่อนไหวออกแรง/ออกกำลังกายตามแบบใดหลังจากอ่านข้อความด้านล่างนี้

แบบที่ 1 "โดยปกติท่านเป็นผู้ที่ทำงานแบบสบายๆนั่งโต๊ะเกือบทั้งวัน ไม่ต้องออกแรงในงานอาชีพ หรืองานบ้าน และไม่มีการออกกำลังกายเพิ่มเติม หรือทำกิจกรรมที่เคลื่อนไหวร่างกายในช่วงนันทนาการหรือเวลาว่าง"

แบบที่ 2 "โดยปกติท่านมีการเคลื่อนไหวออกแรงหรือออกกำลังกาย ไม่ว่าจะเป็นการทำงานบ้าน งานอาชีพ หรือกิจกรรมในเวลาว่างจนทำให้รู้สึกหายใจแรงขึ้นแต่ไม่เหนื่อยจนหอบ ยังพูดกับคนข้างเคียงรู้เรื่องโดยไม่ต้องพักหายใจ อย่างน้อย30นาทีต่อวัน ทุกวันหรือเกือบทุกวัน"

แบบที่ 3 "โดยปกติท่านเล่นกีฬาหรือทำกิจกรรมที่ออกแรงหรือออกกำลังกาย ที่ต้องใช้แรงมากจนทำให้รู้สึกเหนื่อยมากหรือหอบ โดยหายใจแรงและลึกหรือหัวใจเต้นเร็วและแรงขึ้นมากกว่าปกติมาก ถ้าสนทนากับผู้อื่นก็ต้องหยุดหายใจก่อน อย่างน้อยครั้งละ 20 นาที 3-5 วัน/สัปดาห์ "

โปรดเลือกตอบว่ากิจกรรมในวิถีชีวิตที่ต้องเคลื่อนไหวออกแรง/ออกกำลังกายของท่านเป็นแบบใด

( ) แบบที่ 1
( ) แบบที่ 2
( ) แบบที่ 3
( ) แบบที่ 2และ3

2.ท่านสูบบุหรี่หรือไม่

( ) ไม่สูบ
( ) เคยสูบตั้งแต่อายุ.....ปีสูบ เฉลี่ย.....มวน/วัน แต่เลิกสูบเมื่ออายุ..... ปี
( ) เริ่มสูบตั้งแต่อายุ.....ปีและปัจจุบันยังคงสูบอยู่ เฉลี่ย.....มวนต่อวัน

3.ท่านดื่มเครื่องดื่มแอลกอฮอล์หรือไม่

( ) ดื่ม ( )ไม่ดื่ม

4. ความบ่อยครั้งโดยประมาณของท่านที่ดื่มเป็นอย่างไรดังต่อไปนี้

( ) ดื่ม 1-3 ครั้ง/สัปดาห์ ( ) ดื่ม 1-3 ครั้ง/ 2 สัปดาห์

( ) ดื่ม 4-6 ครั้ง/สัปดาห์ ( ) ดื่ม 1-3 ครั้ง/ เดือน

( ) ดื่มทุกวัน

5. โปรดเลือกชนิดของเครื่องดื่มแอลกอฮอล์ที่ท่านดื่ม และเติมตัวเลขซึ่งจะแทนปริมาณที่ท่านดื่มในแต่ละครั้งลงในช่องว่าง

( ) สุราผสม.....แก้ว/ครั้ง

( ) ไวน์.....แก้ว/ครั้ง

( ) วิสกี้ , บรั่นดี.....แก้ว/ครั้ง

( ) เบียร์.....กระป๋อง/ครั้งหรือ……ขวด/ครั้ง

6. ท่านนอนหลับประมาณ.....ชั่วโมง/วัน

ส่วนที่ 3 แบบสอบถามเกี่ยวกับพฤติกรรมการบริโภค

โปรดพิจารณาว่าที่ผ่านมาท่านรับประทานอาหารต่อไปนี้บ่อยเพียงใด โดยทำเครื่องหมาย √ ลงในช่องว่าง

ชนิดอาหาร	ทุกวัน	3-4ครั้ง/สัปดาห์	1-2ครั้ง/สัปดาห์	นานๆครั้ง/ไม่บริโภค
1.เนื้อสัตว์ติดมันหรือหนัง				
2.ผลิตภัณฑ์เนื้อสัตว์ เช่น เบคอน,แฮม,กุนเชียง,ไส้กรอก,แหนม ฯลฯ				
3.ไข่แดง				
4.อาหารที่ใส่กะทิ				
5.อาหารประเภทผัด/ทอด เช่นก๋วยเตี๋ยวผัด หมูทอด ทอดมัน ปอเปี๊ยะ หอยทอดฯลฯ				
6.ปู,กุ้ง,หอย,ปลาหมึก				

ชนิดอาหาร	ทุกวัน	3-4ครั้ง/สัปดาห์	1-2ครั้ง/สัปดาห์	นานๆครั้ง/ไม่บริโภค
7.เครื่องในสัตว์เช่นตับ ไต สมอง หัวใจ				
8.อาหารหรือผัก/ผลไม้ที่หมักหรือดองเค็มเช่นปลาเค็ม,เนื้อเค็ม,เต้าหู้ยี้, ผักกาดดองฯลฯ				
9.ผักสด/ผักต้ม/ผัดผัก/แกงส้ม ฯลฯ				
10.ผลไม้ต่างๆเช่น ฝรั่ง มะละกอสุก สัปปะรด กล้วย ชมพู่ ส้ม ฯลฯ				
11.ธัญพืชเช่นข้าวกล้อง, ข้าวซ้อมมือ,ถั่วฯลฯ				
12.น้ำหวาน,น้ำอัดลม, เครื่องดื่มชงที่ใส่นมและน้ำตาล/นมข้นหวาน				

ส่วนที่ 4 แบบประเมินความเครียด

ในระยะเวลา 2 เดือนที่ผ่านมานี้ ท่านมีอาการ พฤติกรรมหรือความรู้สึกต่อไปนี้มากน้อยเพียงใด โปรดทำเครื่องหมาย √ ลงในช่องที่แสดงอาการที่เกิดขึ้นกับตัวท่า ตามความเป็นจริงมากที่สุด

อาการ พฤติกรรมหรือความรู้สึก	ไม่เคยเลย	เป็นครั้งคราว	เป็นบ่อยๆ	เป็นประจำ
1.นอนไม่หลับเพราะคิดมากหรือกังวลใจ				
2.รู้สึกหงุดหงิด รำคาญใจ				
3.ทำอะไรไม่ได้เลยเพราะประสาทตึงเครียด				
4.มีความวุ่นวายใจ				
5.ไม่อยากพบปะผู้คน				
6.ปวดหัวข้างเดียว หรือปวดบริเวณขมับทั้ง 2 ข้าง				
7.รู้สึกไม่มีความความสุขและเศร้าหมอง				
8.รู้สึกหมดหวังในชีวิต				
9.รู้สึกว่าชีวิตตนเองไม่มีคุณค่า				
10.กระวนกระวายอยู่ตลอดเวลา				
11.รู้สึกว่าตนเองไม่มีสมาธิ				
12.รู้สึกเพลียจนไม่มีแรงจะทำอะไร				
13.รู้สึกเหนื่อยหน่ายไม่อยากทำอะไร				
14.มีอาการหัวใจเต้นแรง				
15.เสียงสั่น ปากสั่น หรือมือสั่นเวลาไม่พอใจ				
16.รู้สึกกลัวผิดพลาดในการทำสิ่งต่างๆ				
17.ปวดหรือเกร็งกล้ามเนื้อบริเวณท้ายทอย หลังหรือไหล่				
18.ตื่นเต้นง่ายกับเหตุการณ์ที่ไม่คุ้นเคย				
19.มึนงงหรือเวียนศีรษะ				
20.ความสุขทางเพศลดลง				

เลขที่แบบสอบถาม.....
วันที่.....

<u>ส่วนนี้สำหรับเจ้าหน้าที่ห้องตรวจสุขภาพเป็นผู้บันทึกข้อมูล</u>

- เส้นรอบเอว.....นิ้ว.
- BP……. mmHg
- FBS…….mg/dl
- Triglyceride……mg/dl
- HDL-C…….mg/dl

ขอขอบคุณทุกท่านที่ให้ความร่วมมือเป็นอย่างดียิ่งในการบันทึกข้อมูลครั้งนี้

นาวาตรีหญิง ดวงกมล ฉัตรเงิน
นิสิตปริญญาโท หลักสูตรโรคติดเชื้อและ
วิทยาการระบาด (สาขาระบาดวิทยา)
คณะสาธารณสุขศาสตร์ มหาวิทยาลัยมหิดล

APPENDIX C

QUESTIONNAIRE

Part 1 Personal information.

1.Rank

( ) Petty Officer 1st Class (PO1) - Master chief Petty Officer

( ) Ensign (ENS) – Lieutenant (LT)

( ) Lieutenant Commander (LCDR)-Captain (CAPT)

( ) Rear Admiral Upper Hay (RADM) – Admiral (ADM)

2. Age _ _ _ _ years.

3. Department _ _ _ _ _ _ _ _

4. Characteristic of the work

( ) In staff unit and in staff position of unit every rank

( ) Officer in auxiliary unit and education unit who doesn't work in staff position and captain in forced unit

( ) Non-officer in auxiliary unit and education unit who doesn't work in staff position

( ) Commander-CPO who works in forced unit and doesn't work in staff position

5. Marital status

( ) Couple ( ) Couple ( ) Widowed ( ) Divorce ( ) Separate

6. Education Level

( ) lower bachelor's degree ( ) Bachelor's degree

( ) Master's degree ( ) Doctorate

7. Income

( ) 10,000 – 20,000 Bath/Month ( ) >20,000 – 30,000 Bath/month

( ) 30,000 – 40,000 Bath/Month ( ) >40,000 Bath/Month

8. Residence in present time

( ) Bangkok ( ) Samutprakarn

( ) Nonthaburi ( ) Pathumthani

( ) Nakonphatom ( ) Samutsakorn

( ) Others

9. Have you ever diagnosed or treated for disease of these? (You can choose more than one choices)

( ) Diabetes Meletus ( ) Hypertension

( ) Hyperlipidemia ( ) Overweight

( ) nerves

10. If you have ever diagnosed for disease, how do you do?

( ) treated by using medicine / follow doctor's advice

( ) didn't use medicine or follow up to see doctor

11. Are there any history of diseases such as diabetes mellitus, hypertension, hyperlipidemia and overweight in your family?

( ) Yes ( ) No

Part 2 History behaviors data

Please answer by using behaviors in the past for 1 year ago.

1. Which is your physical activity?

Type1. You usually spent the time for sedentary working didn't do any housework or any physical activity in leisure time.

Type2. You usually engage in at least 30 minutes of moderate-intensity physical activity 5 days per week that refers to activity some increase in breathing or heart rate .

Type3. You usually engage in 20 minutes of vigorous-intensity physical activity that refers to activity with large increase in breathing or heart rate (conversation is difficult or broken)

Please choose the type of the physical activity which you do.

( ) Type 1 ( ) Type 2

( ) Type 3 ( ) Type 2 & 3

2. Have you ever smoked any cigarette?

( ) Never

( ) Ex-smoker (age of started smoking…….years old, average…….rolls/day and age of smoking cessation……. years old.)

( ) Current- smoker (age of started smoking…….years old, average of current smoking …….rolls/day)

3. Do you drink alcohol beverages?

( ) Never

( ) Yes or social drinking

4. How often do you drink alcohol beverages ?

( ) 1-3 times/week ( ) 1-3 times/2 weeks

( ) 4-6 times/week ( ) 1-3 times/month

( ) Every

5. Please choose the type of your alcohol beverages and full the number of glass/time in the blank.

( ) Mixed liquor ……. glasses/time

( ) Wine……. ……. glasses/time

( ) Whisky/ Brandy ……..glasses/time

( ) Beer ……... glasses/time

6. How long do you sleep/night ? ……. hours/ night.

Part 3 Dietary Pattern

Which is your dietary pattern? 1 month ago

Food Item	Everyday	3-4 meals/wk.	1-2 meals/wk.	Never or Seldom
Fat-rich food				
1. Pork/meat or fowl with ex-skin				
2.Bacon, ham, mooyor, cinease sausage, sausage or mincemeat mixed rice				
3. Egg (whole)				
4. Food with coconut cream				
5. Fried food/deep fried food (fried noodle, fried rice, fried pork, fried shell or Pat tai.				
6.Sea food				
7.Giblet, animal brain				
Salty-food				
8.All kinds of salted preservable food				
High-fiber food				
9. Freash vegetable /food with main of vegetable				
10.Fruit				
11. Cereals, grains				
High energy beverage				
12. Coffee/tea with sugar/sweetened condensed milk, soda pop				

Part 4. Stress Assessment

How often do you have any signs, behaviors or feeling for instance as following in 2 months ago?

Signs, behaviors or feeling for instance	Never	Sometimes	Often	Constant
1.Insomnia from worried or anxieties				
2.Moody, irritable, bad-tempered or feel annoyed				
3.Can not do any thing cause of strained				
4. feel to be anxious about something				
5.Avoid meeting				
6.Has migraine/pain on both sides of temples of the head				
7.Feel unhappy and sorrow				
8.Feel hopeless /disappointment				
9.Feel valueless life				
10. Always agitate				
11.Feel diffuse				
12.Can not do anything , feel exhaustive				
13.Feel tired to do anything				
14. Forceful heart beat				
15. Lips-shake/ sound-shake/ hand-shake when angry				
16.Afraid to make midtake				
17.Muscle pain or strain at area of occipitalbone, back or shoulder				
18.feel easy excite in unfamiliar event				
19.Feel to be stupefied or dizziness				
20.Feel happy less in sex				

APPENDIX D

Classification for adults (≥18 years) in JNC-7 (23)

Blood pressure classification in JNC-7	SBP (mmHg)		DBP (mmHg)
Optimal	<120	and	<80
Normal	120-129	or	80-84
Borderline	130-139	or	85-89
Hypertension			
-Stage I	140-159	or	90-99
-Stage II	160-179	or	100-109
-Stage III	≥180	or	≥110

BIOGRAPHY

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