A Survey of Metabolic Syndrome and Its Components in Thai Medical Cadets

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Objectives: *To determine the prevalence of the metabolic syndrome (MS) and its components in Thai medical cadets.*
Material and Method: *The study was conducted at Phramongkutklao College of Medicine. Ninety six participants (78 men and 18 women) were the healthy medical cadets class 34 who firstly enrolled as the second year medical students in the academic year 2008. Data on anthropometry, blood pressure and blood studies were collected. The MS was defined using the age-specific NCEP ATP III criteria with a modified waist circumference by WHO.*
Results: *The prevalence of the MS in the second year Thai medical students was 1.04%. The high percentage of MS components was attributed to low HDL-cholesterol and high blood pressure. In addition, the prevalence rates of one and two abnormalities of MS components were 31.25% and 8.33%, respectively. Overweight and obesity were found at the percentage of 21.88 and 15.62, respectively and significantly more prevalent among men than among women.*
Conclusion: *This study shows that the metabolic syndrome exists among second year medical cadets with the prevalence of 1.04%. This group is under the military rules and regulations. Though the prevalence of MS among this group is not high, the study reveals that the prevalence of one abnormality of MS components is very high up to 31.25%. These findings call for attention for developing appropriate intervention programs for early detection and promotion of proper health behaviors and lifestyles. These programs may help to decrease the incidence and morbidity associated with cardiovascular disease and diabetes in Thai young adults.*

Keywords: *Metabolic syndrome, Thai medical cadets, Prevalence, NCEP ATP III, WHO*

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Over the past century, progression in science and technology have brought about significant changes in the environment, society, behaviors and lifestyles. These transformations have led to increase in obesity and diabetes[1] as well as cardiovascular diseases[2]. Nowadays, we found that the incidence of overweight children and adolescents has been increasing rapidly in many industrial and developing countries, including Asia[3-5]. The 2004 report of the International Obesity Task Force showed that, worldwide, 1 in 10 children is overweight and at least 155 million school-aged children around the globe were overweight or obese[6]. In Thailand, the prevalence of overweight and obesity among children and adolescents has increased dramatically during the past 20 years[7] and is likely to carry increased risk of cardiovascular disease into adulthood[8]. Obesity, abdominal obesity in particular, plays a central role in the development of the metabolic syndrome (MS) which is a cluster of risk factors associated with adverse cardiovascular outcomes[9-11].

The third National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) defines the metabolic syndrome as the presence of at least three of the following risk factors in an individual: central or abdominal obesity, hypertriglyceridemia, hypertension, low HDL-cholesterol and high fasting glucose levels. Components of the metabolic syndrome are present in children and adolescents, as well as in adults[12].

The clinical definition of MS in children has been debated in recent years, although several authors have estimated its prevalence based on the ATP III definition, and the criteria have been modified, considering different cutoffs for waist circumference, blood pressure and blood lipids[13-15]. In 2007, Jolliffe

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and Janssen proposed the age-specific adolescent metabolic syndrome criterias that were linked to the health-based Adult treatment Panel III (ATP III)[16]. The typical parameter for meeting this first requirement is the waist circumference but the cutoff for waist circumference in the NCEP ATP III definition is inappropriate for Thai population because Asians had a higher percentage of body fat at the lower BMI compared with Caucasians[17-19].

In Asia, the cutoff criteria was redefined by the Steering Committee of the Regional office for the Western Pacific Region of WHO, the International Association for the Study of Obesity and the International Obesity Task Force where cutoffs for waist circumference change from 102 and 88 cm to 90 and 80 cm, respectively[20].

Recent studies have indicated the prevalence of MS among adults population both in urban[21,22] and rural area[23-25] of Thailand, but there is complete lack of data regarding young adult groups. Moreover, although there are many studies on the health status of medical students, a target group of particular interest as they are future physicians[26-28] but the occurrence of MS has not been extensively examined.

Phramongkutklao College of Medicine, the only military medical school in Thailand, has established for more than 34 years. The medical students, ages ranging from 18 to 23 years both males and females, live under the military rules and regulations since the beginning of the second year. Nevertheless, it was found that most of them, especially males, have tendency to gain weight as they have to study hard in the clinical years and have no time to do the usual exercise. The more they gain weight, the high tendency of MS they have.

The aim of this study was to determine the prevalence of MS and its components among Thai military medical cadets (class 34) who firstly enrolled as the second year medical cadets at Phramongkutklao College of Medicine in the academic year 2008.

Material and Method

Subjects and setting

This present study was conducted at Phramongkutklao College of Medicine in June 2008. The setting was the healthy medical cadets in class 34 which were first enrolled as the second year medical student. The study protocol was approved by the Ethics Committee of Phramongkutklao Hospital. Written informed consent was obtained from each individual before starting the study. A total of 96 students (78 men and 18 women) were included in this study.

Measurements

Anthropometric data

Body weight (including light indoor clothing) was measured using an electronic balance (accuracy 0.1 kg) and standing height (without shoes) using a stadiometer (nearest 0.1 cm). The individual waist circumference (at umbilical level in standing position) was also measured. Body mass index (BMI) was calculated the ratio of weight in kg divided by height in m^2.

Blood pressure

Systolic blood pressure was measured and recorded, using desk type spygomanometer (Spirit), in the left arm in the seated position after each participant had been rested for at least 5 minutes.

Laboratory measurements

Serum samples were collected in the morning after a participant has fasted overnight. Measurements included fasting plasma glucose (FPG), total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C). FPG levels were measured by hexokinase method. TC and TG were measured by enzymatic colorimetric methods. HDL-C was measured by direct-enzymatic colorimetric method using an automatic autoanalyzer (Hitachi; Roche Diagnostics, USA). LDL-C was calculated using the Friedewald equation. Blood chemistry was analysed at the Armed-Forced Reseach Instituted of Medical Science (AFRIMS).

Definition of the metabolic syndrome

The age-specific NCEP ATP III criterias for adolescent proposed by Jolliffe and Janssen in 2007[16] and WHO modified criteria for waist circumference[20] were used. According to these criterias, an individual has MS if three or more of the following five diagnostic criterias are present: 1) waist circumference $\geq$ 90 cm in men and $\geq$ 80 cm in women; 2) hypertriglyceridemia: $\geq$ 146.03-150.45 mg/dL in men and $\geq$ 142.49-150.45 mg/dL in women 18 to 20 years of age or more; 3) low high-density lipoprotein (HDL) cholesterol: < 39.83 mg/dL in men 18-20 years of age or more and < 49.50-< 50.27 mg/dL in women 18-20 years of age or more; 4) hypertension: > 129/84-> 130/85 mmHg in both men and women 18-20 years of age or more; or 5) hyperglycemia: > 100.97 mg/dL both in men and women

(18-20 years of age or more).

Statistical analyses

Descriptive statistic including frequency, percentage, mean and standard deviation were used. For comparing difference between groups, t-tests were used for continuous variables and χ^2-tests were used for categorical variables. The difference was taken as statistically significant if the p-value < 0.05. Data analyses were carried out using SPSS version 11.5 for Windows (SPSS, Chicago, Illinois).

Results

The anthropometric and metabolic data was shown in Table 1. Ninety six subjects were included in this study, 78 were men and 18 were women. The mean age was 19.64 $\pm$ 0.70 for men and was 19.50 $\pm$ 0.51 for women (range, 18-21 years) which was shown no significant difference. However, as commonly observed, men were significantly taller and heavier than women and had a higher BMI ($p < 0.05$). Although waist circumference and systolic blood pressure were significantly higher in men, women had significantly higher HDL-cholesterol than men. No significant difference was found in the fasting plasma glucose, triglyceride level and diastolic blood pressure between men and women. In addition, overweight and obesity were found at the percentage of 21.88 and 15.62 in our population, respectively (Table 2).

Considering components of MS, the abnormalities were prevalent with the high waist circumference of 7.29%, high blood pressure 10.42%, high fasting plasma glucose 2.08% and low HDL-cholesterol 13.54%. No prevalence of high triglyceride was found (Table 3). The prevalence of MS based on the age-specific NCEP ATP III and modified WC by WHO (*i.e.* at least 3 abnormalities) was 1.04% of total participating medical cadets and the prevalence rates of one and two abnormalities of MS components were 31.25% and 8.33%, respectively (Table 4). When the data were analyzed by gender, it was shown that the MS was found only in male medical cadets with the prevalence of 1.28% (Table 4). Moreover, among male medical cadets, when they were classified using BMI,

Table 1. Anthropometric and metabolic data of participating medical cadets (mean $\pm$ SD)

	Men (n = 78)	Women (n = 18)	p-value
Age (year)	19.64 $\pm$ 0.702	19.50 $\pm$ 0.514	0.393
Weight (kg)	67.26 $\pm$ 11.28	52.86 $\pm$ 6.69	< 0.001*
Height (cm)	171.33 $\pm$ 5.50	159.93 $\pm$ 5.36	< 0.001*
WC (cm)	78.24 $\pm$ 8.71	68.27 $\pm$ 5.54	< 0.001*
BMI (kg/m^2)	22.87 $\pm$ 3.35	20.67 $\pm$ 2.38	0.004*
FPG (mg/DL)	83.85 $\pm$ 20.19	77.72 $\pm$ 7.97	0.136
TG (mg/dL)	60.00 $\pm$ 19.00	55.00 $\pm$ 24.00	0.302
HDL-C (mg/dL)	61.85 $\pm$ 11.58	72.61 $\pm$ 12.04	0.001*
SBP (mmHg)	116.71 $\pm$ 13.31	106.11 $\pm$ 8.07	< 0.001*
DBP (mmHg)	71.79 $\pm$ 8.83	69.61 $\pm$ 5.27	0.208

* Statistically significance at $p < 0.05$

Table 2. Prevalence of obesity stratified by gender

Characteristics (BMI kg/m^2)	Total (n = 96)		Men (n = 78)		Women (n = 18)	
	n	%	n	%	n	%
Underweight (< 18.5)	9	9.38	7	8.97	2	11.11
Normal (18.5-20.9)	51	53.13	39	50.00	12	66.67
Overweight (21.0-24.9)	21	21.88	18	23.08	3	16.67
Obese I (25.0-29.9)	13	13.54	12	15.38	1	5.56
Obese II ($\geq$ 30.0)	2	2.08	2	2.56	0	0.00

Table 3. Prevalence of components of MS according to age-specific NCEP ATPIII criteria with modified WC by WHO among participating medical cadets stratified by gender

Characteristics	Total (n = 96)		Men (n = 78)		Women (n = 18)	
	n	%	n	%	n	%
High WC	7	7.29	7	8.97	0	0.00
High TG	0	0.00	0	0.00	0	0.00
Low HDL-C	13	13.54	13	16.67	0	0.00
High blood pressure	10	10.42	10	12.82	0	0.00
High FPG	2	2.08	2	2.56	0	0.00

Table 4. Prevalence of one or more abnormalities of metabolic syndrome components

Number	Normal		1 abnormality		2 abnormalities		3 abnormalities	
	n	%	n	%	n	%	n	%
Men (n = 78)	39	50.00	30	38.46	8	10.26	1	1.28
Women (n = 18)	18	100.00	0	0.00	0	0.00	0	0.00
Total (n = 96)	57	59.38	30	31.25	8	8.33	1	1.04

Table 5. Prevalence of abnormal components among male medical cadets according to age-specific NCEP ATPIII and modified WC by WHO stratified by BMI

BMI (kg/m^2)	Total		normal		1 abnormality		2 abnormalities		3 abnormalities	
	n	%	n	%	n	%	n	%	n	%
Men (n = 78)										
Underweight (< 18.5)	7	8.97	6	85.71	1	14.29	0	0.00	0	0.00
Normal (18.5-20.9)	39	50.00	26	66.67	12	30.77	1	2.56	0	0.00
Overweight (21.0-24.9)	18	23.08	7	38.89	7	38.89	4	22.22	0	0.00
obesity I (25.0-29.9)	12	15.39	0	0.00	9	75.00	3	25.00	0	0.00
obesity II (≥ 30.0)	2	2.56	0	0.00	1	50.00	0	0.00	1	50.00
Total	78	100.00	39	50.00	30	38.46	8	10.26	1	1.28

MS was found only in obese men (Table 5).

Discussion

Thailand, a typical developing country moving towards changes in lifestyle and behaviors similar to that of western cultures, is likely to face increasing challenges of preventing chronic disease including cardiovascular disease and diabetes. The prevalence of Thai children and adolescent overweight and obesity has increased[7]. However, little information exists on the prevalence of MS among these groups of people. To the best of our knowledge, this is the first study to assess the prevalence of MS in a population of medical students.

The present study found that the prevalence of MS has existed in medical cadets. The prevalence is 1.28% among men and absent in women when using the age-specific NCEP ATP III and modified WHO criteria for waist circumference of ≥ 90 cm in men and ≥ 80 cm in women. The prevalence of MS found in the present study was attributed to low HDL-cholesterol and high blood pressure in men. These components may increase risk of CHD among these subjects. The study of McNeill et al[29] indicated that the individual

components for elevated blood pressure and low HDL-cholesterol have the strongest effect on CHD risk.

The present study also found that MS was likely found in being obese men even in young individuals. There is evidence that there is tracking of overweight and the variables associated with the MS from adolescent to adulthood[30-31]. It has been previous described that even moderate weight loss has been beneficial effect on cardiovascular risk factors in overweight people when combined with exercise and is associated with improvement of all aspects of the MS[32,33]. Intervention during the transition from adolescence to adulthood may be a target period for prevention of the MS[34].

Conclusion

This is the first study to determine the prevalence of metabolic syndrome in Thai medical cadets. This study shows that the metabolic syndrome exists among second year medical cadets with the prevalence of 1.04%. This group is under the military rules and regulations. Though the prevalence of MS among this group is not high, the study reveals that the prevalence of one abnormality of MS components is very high up to 31.25%. These findings call for attention for developing appropriate intervention programs for early detection and promotion of proper health behaviors and lifestyles. These programs may help to decrease the incidence and morbidity associated with cardiovascular disease and diabetes in Thai young adults.

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ความชุกของภาวะกลุ่มอาการทางเมตาบอลิซม และปัจจัยที่ทำให้เกิดกลุ่มอาการในนักเรียนแพทย์ทหารไทย

กมลทิพย์ นิลคุปต์, นันทพร วีรวัฒน์

วัตถุประสงค์: *หาความชุกของภาวะกลุ่มอาการทางเมตาบอลิซม และปัจจัยที่เป็นองค์ประกอบทำให้เกิดกลุ่มอาการทางเมตาบอลิซมในนักเรียนแพทย์ทหารของไทย*

วัสดุและวิธีการ: *ทำการศึกษาในผู้ที่มีสุขภาพดีซึ่งเข้ามาเป็นนักเรียนแพทย์ทหารชั้นปีที่ 2 รุ่นที่ 34 ของวิทยาลัยแพทยศาสตร์พระมงกุฎเกล้า จำนวน 96 คน เป็นผู้ชาย 78 คน และผู้หญิง 18 คน อายุระหว่าง 18 ถึง 21 ปี ทำการตรวจร่างกาย วัดความดันโลหิต และเจาะเลือดเพื่อตรวจทางห้องปฏิบัติการ*

ผลการศึกษา: *พบความชุกของกลุ่มอาการทางเมตาบอลิซมในนักเรียนแพทย์ทหาร ร้อยละ 1.04 และพบว่าการมีระดับ HDL-cholesterol ที่ต่ำกว่าเกณฑ์ และความดันโลหิตสูงเป็นปัจจัยที่ทำให้เกิดกลุ่มอาการทางเมตาบอลิซมที่พบมาก 2 อันดับแรก นอกจากนี้ยังพบว่า ในกลุ่มของนักเรียนแพทย์ทหารที่ทำการศึกษายังมีความผิดปกติของปัจจัยที่ถือว่าเป็นองค์ประกอบของกลุ่มอาการทางเมตาบอลิซมอย่างน้อย 1 และ 2 ปัจจัยร้อยละ 31.25 และ 8.33 ตามลำดับ อีกทั้งยังพบภาวะน้ำหนักเกินและภาวะอ้วนในกลุ่มนักเรียนแพทย์ทหารร้อยละ 21.88 และ 15.62 ตามลำดับโดยจะพบในเพศชายมากกว่าในเพศหญิง*

สรุป: *พบความชุกของภาวะกลุ่มอาการทางเมตาบอลิซมในนักเรียนแพทย์ทหาร ซึ่งมีความเป็นอยู่ภายใต้กฎระเบียบของทหารประมาณร้อยละ 1.04 อีกทั้งยังพบความผิดปกติของปัจจัยที่เป็นองค์ประกอบทำให้เกิดกลุ่มอาการทางเมตาบอลิซมอย่างน้อย 1 องค์ประกอบสูงถึงร้อยละ 31.25 การพบนี้ทำให้เห็นถึงความสำคัญในการพัฒนาโปรแกรมในการเฝ้าระวัง และการส่งเสริมพฤติกรรมเพื่อป้องกันภาวะกลุ่มอาการทางเมตาบอลิซม ซึ่งจะเป็นการช่วยลดอุบัติการณ์ที่เกี่ยวข้องกับโรคหัวใจและหลอดเลือด และโรคเบาหวานในคนหนุ่มสาวไทย*