อาการเมตาบอลิคของเจ้าหน้าที่โรงพยาบาลมหาราช นครศรีธรรมราช: การพบความชุกสูงขององค์ประกอบในอาการเมตาบอลิค 1 ถึง 2 ชนิด

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ผลตรวจสุขภาพประจำปี มีความสำคัญในการประเมินสุขภาพของเจ้าหน้าที่โรงพยาบาลมหาราช นครศรีธรรมราช จากผลการตรวจสามารถพบความเสี่ยงของกลุ่มอาการเมตาบอลิคโดยประเมินจากความผิดปกติของ 3 ใน 5 องค์ประกอบ ได้แก่ ดัชนีมวลกายสูง ความดันโลหิตสูง ระดับน้ำตาลในเลือดสูง ระดับไขมันชนิดไตรกลีเซอไรด์สูงและระดับไขมันชนิดเฮชดีแอลต่ำ หากพบความผิดปกติน้อยกว่า 3 ใน 5 องค์ประกอบเรียกกลุ่มไม่มีอาการเมตาบอลิค ซึ่งแบ่งย่อยออกเป็น 2 แบบ ได้แก่ ภาวะก้ำกึ่งของกลุ่มอาการเมตาบอลิค และหากไม่พบความผิดปกติใดใน 5 องค์ประกอบเรียก กลุ่มไม่มีองค์ประกอบอาการเมตาบอลิค การศึกษาขั้นต้นพบ ภาวะก้ำกึ่งของกลุ่มอาการเมตาบอลิค มากในคนตรวจสุขภาพประจำปี การศึกษานี้มีวัตถุประสงค์คือศึกษาภาวะก้ำกึ่งของกลุ่มอาการเมตาบอลิคกับการกลายเป็นอาการเมตาบอลิค โดยการเก็บข้อมูลผลตรวจสุขภาพประจำปี 2551 ของเจ้าหน้าที่โรงพยาบาลมหาราช นครศรีธรรมราช จำนวน 1,373 ราย พบภาวะก้ำกึ่งของกลุ่มอาการเมตาบอลิค จำนวน 611 ราย (ร้อยละ 44.5) และมีเพียง 191 ราย (ร้อยละ 10.3) ที่มีผลการตรวจสุขภาพย้อนหลัง 3 ปี (ประจำปี 2548) ผลการศึกษาพบกลุ่มไม่มีองค์ประกอบอาการเมตาบอลิค จำนวน 78 ราย ในปี 2548 ที่กลายเป็นภาวะก้ำกึ่งของกลุ่มอาการเมตาบอลิค ในปี 2551 จำนวน 21 ราย (ร้อยละ 26.9) และพบกลุ่มภาวะก้ำกึ่งของกลุ่มอาการเมตาบอลิค จำนวน 94 ราย ในปี 2548 ที่มีอาการเมตาบอลิค ในปี 2551 จำนวน 10 ราย (ร้อยละ 10.6) โดยทั้ง 10 รายมีค่า BMI สูงกว่าปกติ สำหรับการเปลี่ยนแปลงของระดับสารชีวเคมีต่างๆ พบครีอะตินิน, กรดยูริค, ไขมันและฤทธิ์ของเอนไซม์ AST สูงขึ้นอย่างมีนัยสำคัญ และมีระดับ HDL-C ต่ำกว่าปกติ ($P < 0.05$) นอกจากนี้พบว่ากลุ่มที่ไม่มีองค์ประกอบอาการเมตาบอลิค ในปี 2548 ไม่มีการกลายเป็นอาการเมตาบอลิค ในปี 2551 การพบภาวะก้ำกึ่งของกลุ่มอาการเมตาบอลิคจึงสามารถใช้ทำนายการพัฒนาไปเป็นอาการเมตาบอลิคได้ภายในเวลา 3 ปี ผลตรวจสุขภาพประจำปีทำให้ทราบภาวะก้ำกึ่งของกลุ่มอาการเมตาบอลิคในช่วงเริ่มต้น อาจสามารถควบคุมให้อยู่ในกลุ่มไม่มีองค์ประกอบอาการเมตาบอลิคและอาจหลีกเลี่ยงการเป็นอาการเมตาบอลิคที่เป็นปัจจัยเสี่ยงของการเป็นโรคหัวใจและไตวายเรื้อรังได้อย่างน้อย 3 ปี

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Metabolic syndrome in staff of the Maharaj Nakhon Si Thammaraj Hospital: high prevalence of 1 to 2 metabolic components in population

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Background: The annual health check-up is important in the health assessment of staff at the Maharaj Nakhon Si Thammaraj Hospital. This check-up may reveal risk factors of several diseases, such as heart disease. One important risk factor that can be found is metabolic syndrome (MS). MS is composed of three in five components such as obesity, hypertension, insulin resistance and dyslipidemia. **Methods:** In this study, all data from the annual health check-up of staff was collected. Information about 1,373 subjects was collected for the year 2008 and 191 subjects had the previous three years' data of annual health check-ups from the year 2005. **Results:** From this three-year data, we found that 21 out of 78 subjects (26.9 %) without components of MS in 2005 had become intermediate MS by 2008. There were 10 out of 94 subjects (10.6 %) with intermediate MS in 2005 who became MS by 2008. Every subject was found with high BMI ($\geq 25kg/m^2$). Interestingly, we found a significant increase of AST, cholesterol, TG, glucose, creatinine, uric acid and decease of HDL-C levels ($P < 0.05$). **Conclusion:** From these results, we concluded that within three years those without components of MS in 2005 seem to be never became MS by 2008. It means that the annual health check-up may show early stages of intermediate MS and remind staff to control their lifestyle so that if there are without components of MS status they may avoid MS for at least 3 years.

Keyword: Intermediate metabolic syndrome

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Introduction

The prevalence of MS among Thai professional and office workers was as high as those observed in developed countries[1]. Metabolic syndrome (MS) is a combination of medical disorders that increase the risk of developing cardiovascular disease and diabetes[2]. The risks of MS are aging, obesity, genetic disorders, hypertension and lifestyle[3-6]. The three years of intensive lifestyle intervention produced long-term beneficial changes in diet, physical activity, and clinical and biochemistry parameters, and reduced the diabetes risk[7]. The annual health check-up is important in the diagnosis of MS, but there are varieties of definitions for MS, such as those of the World Health Organization (WHO), the National Cholesterol Education Program Third Adult Treatment Panel (NCEP-ATP III), the International Diabetes Federation (IDF), and the American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI)[8-11]. Most are small differences, so they may be overlooked as MS cases during the annual health check-up[10, 12]. Usually in NCEP-ATP III, MS was diagnosed when at least three of five of the following criteria were met for males and for females: body mass index or waist circumference or waist-to-hip ratio, blood pressure, fasting blood sugar, triglyceride, high density lipoprotein cholesterol. But if only one or two of those criteria were met, it was called non-metabolic syndrome (non-MS). In our preliminary study, we found that almost half of population (49.3 %) had non-metabolic syndrome (non-MS), that showing abnormality of one or two of the five components; we established these cases to intermediate metabolic syndrome (inter. MS) and this was the same prevalence as in another study[1, 13]. With these criteria, we could overlook a risk that they may develop into MS. So we propose that one or two of those five criteria of MS are important in diagnosing those at risk. This reason led us to the objective of our study about inter. MS, to study the risk of MS developing. We attempted to predict risk factors from the annual health check-up by using the criteria for inter. MS.

Materials and methods

1. Study subjects

We reviewed retrospectively the records of the annual health check-up for staff at the Maharaj Nakhon Si Thammaraj Hospital who had worked in the hospital in 2008. There were 1,373 subjects for 2008 and for the previous three years (from 2005) there were 191 subjects. All subjects had their blood tested for fasting blood sugar (FBS), blood urea nitrogen (BUN), creatinine, uric acid, cholesterol, triglyceride (TG), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP). Anthropometric variables were recorded: genders, age, body weight, height and blood pressure (BP).

2. Definition of metabolic syndrome

Metabolic syndrome was defined according to the guidelines of the USA's National Cholesterol Education Program (NCEP) Third Adult Treatment Panel III (ATP III) with modification of body mass index (BMI). Traditional BMI cut off of ≥ 30 kg/m^2 underestimated MS prevalence in Thai population while BMI ≥ 25 kg/m^2 was found to be suitable solution[14] The metabolic syndrome (MS) was diagnosed when at least three of the following criteria were met (**Table 1**). Non-metabolic syndrome was divided into 2 groups according to our preliminary data; 1) Intermediate metabolic syndrome (inter. MS) was diagnosed when at one or two of those criteria were present, 2) without components of MS (w/o MS) were diagnosed when those criteria were absent.

Table 1   Components of metabolic syndrome in the annual health check-up of staff in the Maharaj Nakhon Si Thammaraj Hospital, Thailand

Component of MS	Criteria of this study Any 3 of following 5 features	NCEP [21] Any 3 of following 5 features
1. Central obesity	BMI ≥ 25 kg/m^{2} [14]	Waist circumference: man ≥ 102 cm woman ≥ 88 cm
2. Lipids	TG ≥ 150 mg/dL	TG ≥ 150 mg/dL
	HDL-C: man < 40 mg/dL woman < 50 mg/dL	HDL-C: man < 40 mg/dL woman < 50 mg/dL
3. Blood pressure	Systolic ≥ 130 or diastolic ≥ 85 mmHg or both	≥ 130/85 mmHg
4. Glucose	Fasting plasma glucose: ≥ 110 mg/dL	Fasting plasma glucose: ≥ 110 mg/dL*

* ≥ 110 mg/dL may be applicable.

3. Data analysis

Continuous variables were summarized as mean ± SD and categorical data as percentages. Comparison of the changes occurring within each group was undertaken using paired t-test for all continuous variables; the P values were derived from the T-statistic calculated by MS-Excel.

Results

1. Characteristics of study subjects and metabolic syndrome

Baseline characteristics of the 1,373 subjects: MS was found in 133 subjects (10 %), inter. MS was found in 611 subjects (46 %) and w/o MS were found 629 subjects (44 %) (**Table 2**). The 223 male subjects, MS was in 41 subjects (18 %), inter. MS was in 125 subjects (56 %) and w/o MS were in 57 subjects (26 %). The 1,150 female subjects, MS was in 92 subjects (8 %), inter. MS was in 486 subjects (42 %) and w/o MS were in 572 subjects (50 %) (Table 2). To examine the effect of aging, they were divided into 2 categories as following the annual health check-up for staff with < 35 and ≥ 35 years old. First is < 35, where we found MS in 14 subjects (1 %), inter. MS in 144 subjects (11 %) and w/o MS in 231 subjects (16 %) (Table 2). Age group was < 35, with MS found in 119 subjects (9 %), inter. MS in 467 subjects (35 %) and w/o MS in 398 subjects (28 %) (**Table 2**). We found that the number of inter. MS cases was increased with age.

2. Predictive metabolic syndrome in three years

We checked the previous 3-year data (from 2005) and found that 191 in 1,373 subjects had an annual health check-up each year (13.9 % of the 2,008 total). The number of w/o MS showed a decrease from 78 to 69. The number of inter. MS was increased from 94 to 98. Those with MS were increased from 19

to 24. In the same case, subjects who changed from without components of MS to inter. MS were 21 out of 78 subjects. There were 3 male and 18 female subjects (age ≥ 38-58). A change from inter. MS to MS was seen in 10 out of 94 subjects, all were female (age ≥ 38-51) with abnormal BMI that may be important component for MS in Thai(15). But within three years, w/o MS seem to be unchanged to MS (**Table 3**).

Table 2　Age−sex specific prevalence of w/o MS, inter. MS and MS in the annual health check-up of staff in the Maharaj Nakhon Si Thammaraj Hospital, Thailand

Metabolic Syndrome status Number of subjects 1,373							
Non MS 1,240 (90 %)						MS 133 (10 %)	
w/o MS		Inter. MS					
0 in 5 components 629 (44 %)		1 in 5 components 390 (30 %)		2 in 5 components 221 (16 %)		≥ 3 in 5 components 133 (10 %)	
< 35 yr	≥ 35 yr	< 35 yr	≥ 35 yr	< 35 yr	≥ 35 yr	< 35 yr	≥ 35 yr
M / F	M / F	M / F	M / F	M / F	M / F	M / F	M / F
17 / 214	40 / 358	6 / 101	54 / 229	6 / 31	59 / 125	6 / 8	35 / 84
(16 %)	(28 %)	(8 %)	(22 %)	(3 %)	(13 %)	(1 %)	(9 %)

M; male F; female

Number (s) indicate number of subjects (percentage)

Table 3　Changes of w/o MS, inter. MS and MS from 2005 to 2008 in the annual health check-up of staff in the Maharaj Nakhon Si Thammaraj Hospital, Thailand

Year	Metabolic syndrome status								
2005	w/o MS			Inter. MS			MS		
	78 (100 %)			94 (100 %)			19 (100 %)		
2008	w/o MS	Inter. MS	MS	w/o MS	Inter. MS	MS	w/o MS	Inter. MS	MS
	57	21	0	12	72	10	0	5	14
	(73 %)	(27 %)	(0 %)	(13 %)	(76 %)	(11 %)	(0 %)	(26 %)	(74 %)

Number (s) indicate number of subjects (percentage)

3.　Changes of biochemical substances and anthropometric variables in metabolic syndrome

In this study we found some changes of biochemical substances, the 21 subjects who had w/o MS that became inter. MS showed a significant increase in creatinine and some components of MS: TG, BMI and body weight ($P < 0.05$) (**Table 1, Figure 1**). We also found that the 10 subjects who had inter. MS that became MS showed significant increases in creatinine, uric acid, cholesterol, AST and in a

component of MS: glucose, except decreased HDL-C ($P < 0.05$). We found AST changed from its normal level (12−32 U/L; that is 16.9 ± 3.8 U/L) increased to 21.1 + 5.5 U/L (**Table 4**). It means that we may detect an abnormal AST in MS people. We also found creatinine changes even in normal levels (< 1.2 mg %); which was increased from normal low (0.66 ± 0.07 mg/dL) increased to normal high (0.84 ± 0.09 mg/dL) (**Table 4**). This means that the kidney may have some changes in intermediate MS and MS.

Table 4 Changes of biochemical substances in w/o MS, inter. MS and MS from year 2005 to 2008 in the annual health check-up of staff in the Maharaj Nakhon Si Thammaraj Hospital, Thailand

Biochemical substances From year 2005 to 2008 *		From w/o MS to inter. MS (21 subjects)			From inter. MS to MS (10 subjects)		
		Mean	SD	*P* value	Mean	SD	*P* value
FBS (mg/dL)	Year 2005	85.9	6.9	NS	96.1	23.0	0.01
	2008	86.3	10.2		104.8	29.0	
BUN (mg/dL)	Year 2005	11.9	2.4	NS	12.3	3.2	NS
	2008	12.8	3.0		12.0	3.1	
Creatinine (mg/dL)	Year 2005	0.69	0.15	< 0.01	0.66	0.07	< 0.01
	2008	0.88	0.13		0.84	0.09	
Uric acid (mg/dL)	Year 2005	4.4	1.3	NS	5.1	1.1	0.02
	2008	4.8	1.1		4.6	1.0	
Cholesterol (mg/dL)	Year 2005	235.3	49.2	NS	256.1	46.7	0.01
	2008	230.6	41.9		233.0	45.0	
Triglyceride (mg/dL)	Year 2005	89.9	28.9	0.01	117.0	42.2	NS
	2008	119.1	58.2		144.9	46.3	
HDL-C (mg/dL)	Year 2005	63.4	8.0	0.01	57.3	9.4	< 0.01
	2008	57.8	10.2		50.8	10.8	
AST (U/L)	Year 2005	20.2	4.1	NS	16.9	3.8	0.02
	2008	22.2	7.8		21.1	5.5	
ALT (U/L)	Year 2005	19.3	7.9	NS	17.5	4.9	NS
	2008	20.2	7.1		22.7	9.1	
ALP (U/L)	Year 2005	65.0	26.1	NS	75.7	21.6	NS
	2008	60.3	13.4		67.8	12.9	
BMI (kg/m^2)	Year 2005	22.2	2.1	< 0.01	26.0	2.0	NS
	2008	22.7	2.4		26.3	1.6	
Body weight (kg)	Year 2005	54.9	8.2	< 0.01	66.9	4.6	NS
	2008	56.4	8.3		67.4	4.6	

*within the same subjects

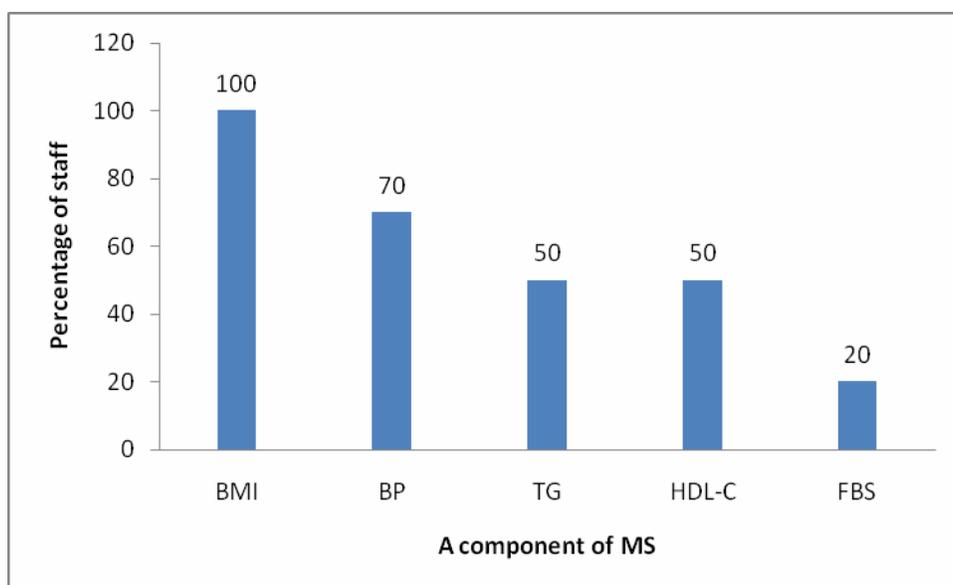NS = non significance, *P value* < 0.05 is significance

Figure 1 Changes of metabolic components of intermediate MS to MS (from 2005 to 2008) in the annual health check-up of staff in the Maharaj Nakhon Si Thammaraj Hospital, Thailand. All cases, 10/94 subjects, were female with BMI change.

Discussion

The annual health check-up is very important to define MS in a normal population; usually the prevalence of MS is low, so we may overlook early cases of MS. In our study we found that inter. MS has a high prevalence among hospital staff. It may be higher in the general population due to their lack of knowledge, attitude and behaviour. Inter. MS was found mostly in females suggesting that females are at high risk in this hospital, but we noticed that the number of male subjects was less that of female subjects, further survey in a large number of male subjects should be performed. However, Boonyavarakul et al showed that MS was significantly influenced by gender, BMI and age[16]. Within three years (2005–2008) we found changes from the w/o MS to inter. MS and from inter. MS to MS but not from w/o MS to MS, so it means that it takes at least 3 years to move from risk status to MS. The prevention and management of the metabolic syndrome should be started in those who are overweight, even childhood[14, 17], also in this population. Among Asian people, especially Korean

and Chinese, it was found that MS was also associated with CKD[18, 19]. In this study, creatinine and uric acid were increased in MS, that similar to another study, as hyperuricemia was prevalent among Thai men and women receiving routine health examinations, serum uric acid is positively associated with MS[20]. In conclusion, we found that inter. MS may be enough to predict an abnormality in our staff even when they usually look healthy, but have underlying some diseases.

Acknowledgments

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