Prevalence of Overweight and Obesity in Royal Thai Army Personnel

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Objective: *Determine the prevalence of overweight and obesity in the Royal Thai Army (RTA) personnel.*
Material and Method: *A cross-sectional study was performed on 4,276 RTA personnel aged 20-60 years between January and July 2005. They were interviewed for general health status, history of smoking, alcohol consumption, and physical activity. Blood pressure, weight, height, waist, and hip circumference were measured.*
Result: *The prevalence of overweight and obesity in RTA personnel were 27.1% and 4.9% respectively. The mean value of age, weight, body mass index, waist, and hip circumference, waist hip ratio, blood pressure in overweight, and obese personnel were significantly higher than those of non-overweight personnel. Logistic regression analysis showed that significant risks of being overweight were positively associated with age, male, and working in a combat unit. Current smoking was inversely associated with overweight and obesity, whereas physical activity ≥ 3 times/wk was inversely associated with obesity. Overweight and obesity were also associated with hypertension.*
Conclusion: *These baseline data are useful for future trends monitoring and may be used for health promotion planning to prevent obesity in RTA personnel.*

Keywords: *Overweight, Obesity, Army personnel, Body mass index*

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Obesity is a worldwide health problem that is related to increased risk of cardiovascular disease, type 2 diabetes mellitus, hypertension, dyslipidemia, cancer, and osteoarthritis[1-6]. It develops because of an imbalance between energy intake and energy expenditure that are affected by genetic and environmental factors such as sedentary lifestyle, high fat, and fast foods[1]. Of particular concern is that the World Health organization (WHO) reports an increased prevalence of overweight and obesity as well as an impact on increasing the costs of medical care for obesity and obesity-related conditions.

Estimates of the prevalence of military personnel overweight and obesity have been made in several countries during the last decade[7-9]. A few studies in Thailand indicated that the prevalence of overweight and obesity seemed to be increasing in the general population[10,11], whereas there was no study in Royal Thai Army (RTA) personnel. In order to plan the preventive strategies of obesity, it was necessary to assess the obesity situation in RTA personnel. The purpose of the present study was, therefore, to determine the prevalence of overweight and obesity in RTA personnel which would lead to prevention, surveillance and planning for health promotion.

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Material and Method

The analyzed data was part of the Thai Army physical fitness test survey and was approved by the Ethical Committee of the Medical Department of the Royal Thai Army. This cross-sectional study was performed from January to July 2005 in 11 Army posts. The study population consisted of 4,276 Army personnel including commissioned officers and non-commissioned officers aged between 20 to 60 years old from a combat unit and a non-combat unit.

A questionnaire was developed and used for interviewing participants for general health status, history of smoking, alcohol consumption, and physical activity. Blood pressure in the sitting position, body weight, and height were measured. Participants were asked to remove their shoes and empty their pockets before weighing. Waist circumference was measured at the level of the navel (usually the smallest diameter between the costal margin and the iliac crest) and hip circumference was measured at the level of greater trochanters (usually the widest diameter around the buttock) for calculating waist-hip ratio (WHR).

Body mass index (BMI) was calculated as weight/height^2 (kg/m^2). Overweight and obesity were classified according to WHO criteria. Obesity was defined as BMI $\geq$ 30 kg/m^2, overweight as BMI = 25-29.9 kg/m^2 and non-overweight as BMI < 25 kg/m^2. Hypertension was defined as having systolic blood pressure (SBP) $\geq$ 140 mmHg or having diastolic blood pressure (DBP) $\geq$ 90 mmHg.

Statistical analysis

Data were analyzed using SPSS for Windows version 11.5 (Chicago, IL). Reported values for continuous data were mean $\pm$ SD and for categorical data were percentage. ANOVA was used to determine the difference between groups. Logistic regression analysis was used to determine the association of sex, age, working unit, smoking habit, alcohol consumption, physical activity, and hypertension with overweight, and obesity. Odds ratios (OR) with 95% confidence intervals and p-values were calculated to compare outcomes among groups. A p-value less than 0.05 was considered a significant result.

Results

Demographic and anthropometric characteristics are shown in Table 1. Of the 4,276 subjects of Army personnel, 3,893 (91%) were male with an average age of 41.5 $\pm$ 8.5 years, and 383 (9%) were female with an average age of 38.5 $\pm$ 10.1 years. The mean BMI of

Table 1. The mean (SD) of age, anthropometric variables and blood pressure in non-overweight, overweight and obese Royal Thai Army personnel between male and female

	Male				Female			
	Total	Non-overweight	Overweight	Obesity	Total	Non-overweight	Overweight	Obesity
Age (yr)	41.5 (8.5)	40.6 (8.7)	43.1 (7.5)*	43.0 (8.0)*	38.5 (10.1)	38.2 (9.6)	45.2 (9.0)*	45.3 (7.6)*
Weight (kg)	68.6 (10.3)	63.8 (6.1)	76.5 (5.9)*	92.9 (8.8)*	55.5 (9.4)	53.6 (5.3)	67.1 (5.1)*	82.2 (6.6)*
Height (cm)	169.0 (5.1)	168.9 (5.0)	169.0 (5.3)	169.7 (5.3)	158.5 (5.1)	158.2 (5.1)	158.4 (4.7)	158.6 (5.3)
BMI (kg/m^2)	24.0 (3.3)	22.4 (1.7)	26.8 (1.3)*	32.2 (2.3)*	22.1 (3.6)	21.4 (1.7)	26.7 (1.3)*	32.7 (2.9)*
Waist (in)	33.2 (3.6)	31.7 (2.5)	35.9 (2.2)*	41.0 (3.3)*	28.8 (3.2)	28.2 (2.1)	33.0 (2.3)*	35.6 (2.0)*
Hip (in)	37.6 (2.7)	36.6 (1.9)	39.5 (1.8)*	43.1 (2.5)*	37.3 (2.9)	36.8 (2.0)	40.7 (2.4)*	43.4 (1.2)*
WHR	0.88 (0.06)	0.87 (0.05)	0.91 (0.05)*	0.95 (0.06)*	0.77 (0.06)	0.77 (0.05)	0.81 (0.06)*	0.82 (0.05)*
SBP (mmHg)	129.5 (16.7)	126.6 (15.0)	134.6 (17.4)*	142.2 (18.5)*	115.2 (15.5)	112.4 (12.2)	126.3 (16.4)*	143.1 (19.6)*
DBP (mmHg)	83.4 (11.6)	81.6 (10.9)	86.7 (11.9)*	90.4 (11.4)*	72.2 (10.8)	71.1 (9.7)	78.5 (11.9)*	84.9 (12.3)*

* Significantly different from non-overweight personnel, $p < 0.01$

males (24.0 ± 3.3 kg/m^2) was more than that of females (22.1 ± 3.6 kg/m^2). The mean value of age, body weight, BMI, waist and hip circumference, WHR, SBP, and DBP in overweight and obese personnel were significantly higher ($p < 0.01$) than those of non-overweight male and female. Table 2 shows that most of the participants 2,092 (49%) were 40-49 years. The overall prevalence of overweight and obesity in RTA personnel were 1,161 (27.1%) and 210 (4.9%) respectively, with a higher prevalence for older and male.

The results of univariate and multivariate analysis for overweight and obesity determination are shown in Table 3. Significant risk of being overweight increased with male gender and with increasing age. The personnel who worked in the combat unit were more likely to be overweight (adjusted OR = 1.30, 95%CI 1.10, 1.53) than the personnel who worked in the non-combat unit. Smokers were less likely to be overweight (adjusted OR = 0.73, 95%CI 0.61, 0.87) and obese (adjusted OR = 0.68, 95%CI 0.47, 0.99) than non-smokers. Physical activity levels showed no significant relationship with overweight status. However, obesity was more prevalent in the personnel who performed physical activity < 3 times/wk than in the personnel who performed physical activity ≥ 3 times/wk (adjusted OR = 0.48, 95%CI 0.33, 0.69). Personnel with hypertension were more likely to be overweight (adjusted OR = 2.00, 95%CI 1.69, 2.35) and obese (adjusted OR = 4.03, 95%CI 2.82, 5.76) than the personnel with normal blood pressure. Risk of overweight and obesity were not significantly different with alcohol consumption.

Discussion

The present study indicated that up to 30% of RTA personnel were considered overweight and obese. Therefore, it is essential to have serious concern and prevention in RTA personnel because overweight and obesity are health threats that tend to increase. Compared to the Second National Health Examination Survey in 1997[10], the prevalence of overweight and obesity in RTA personnel were slightly lower than those of Thai civilians (overweight 28.3% and obesity 6.8%). Because there were more male than female participants in the present study, overweight among the male army personnel (28.3%) was higher than in the general population (19.2%), whereas this was not likely for obesity. Overweight increased with increasing age[10,12]. Likewise, similar patterns have been observed in Army personnel. Thus, this age factor might affect the prevalence rate in the present study as nearly half

Table 2. Characteristics and prevalence of overweight and obesity in Royal Thai Army personnel

Characteristics	No. (%)	Overweight (%)	Obesity (%)
Overall	4276 (100%)	1161 (27.1%)	210 (4.9%)
Sex			
Female	383 (9.0%)	60 (15.7%)	14 (3.7%)
Male	3893 (91.0%)	1101 (28.3%)	196 (5.0%)
Age group (years)			
20-29	531 (12.4%)	69 (13.0%)	14 (2.6%)
30-39	1020 (23.9%)	234 (22.9%)	42 (4.1%)
40-49	2092 (49.0%)	631 (30.2%)	119 (5.7%)
50-60	629 (14.7%)	224 (35.6%)	34 (5.4%)
Unit			
Non-combat	2967 (69.4%)	768 (25.9%)	150 (5.1%)
Combat	1309 (30.6%)	393 (30.0%)	60 (4.6%)
Smoking history			
No smoking	2499 (69.5%)	711 (28.5%)	42 (3.8%)
Current smoking	1095 (30.5%)	273 (24.9%)	123 (4.9%)
Alcohol consumption			
No drinking	885 (24.6%)	219 (24.7%)	41 (4.6%)
Current drinking	2711 (75.4%)	764 (28.2%)	125 (4.6%)
Physical activity			
< 3 times/wk	2130 (60.5%)	598 (28.1%)	122 (5.7%)
≥ 3 times/wk	1388 (39.5%)	367 (26.4%)	40 (2.9%)
Hypertension	1470 (34.5%)	571 (38.8%)	139 (9.5%)

Table 3. Univariate and multivariate analysis for determinants of overweight and obesity in Royal Thai Army personnel

	Overweight		Obesity	
	Crude odds ratio (95%CI)	Adjusted odds ratio (95%CI)	Crude odds ratio (95%CI)	Adjusted odds ratio (95%CI)
Sex				
Female	1	1	1	1
Male	2.12 (1.60, 2.82)*	1.67 (1.16, 2.40)*	1.40 (0.80, 2.43)	1.69 (0.73, 3.88)
Age group (years)				
20-29	1	1	1	1
30-39	1.99 (1.49, 2.67)*	1.74 (1.27, 2.39)*	1.59 (0.86, 2.93)	1.16 (0.59, 2.30)
40-49	2.89 (2.21, 3.79)*	2.10 (1.56, 2.82)*	2.23 (1.27, 3.91)*	1.14 (0.60, 2.16)
50-60	3.70 (2.74, 5.00)*	2.54 (1.80, 3.57)*	2.11 (1.12, 3.98)*	0.76 (0.36, 1.62)
Unit				
Non-combat	1	1	1	1
Combat	1.23 (1.06, 1.42)*	1.30 (1.10, 1.53)*	0.90 (0.66, 1.23)	1.11 (0.79, 1.56)
Smoking history				
No smoking	1	1	1	1
Current smoking	0.84 (0.71, 0.98)*	0.73 (0.61, 0.87)*	0.77 (0.54, 1.10)	0.68 (0.47, 0.99)*
Alcohol consumption				
No drinking	1	1	1	1
Current drinking	1.19 (1.00, 1.42)*	1.10 (0.91, 1.34)	1.00 (0.69, 1.43)	0.81 (0.55, 1.20)
Physical activity				
< 3 times/wk	1	1	1	1
≥ 3 times/wk	0.92 (0.79, 1.07)	0.88 (0.75, 1.03)	0.49 (0.34, 0.70)*	0.48 (0.33, 0.69)*
Blood pressure				
Normal	1	1	1	1
Hypertension	2.39 (2.08, 2.75)*	2.00 (1.69, 2.35)*	3.99 (2.98, 5.36)*	4.03 (2.82, 5.76)*

* $p < 0.05$

of the Army personnel (49%) are aged 40-49 years.

Although the present study shows a negative association between current smoking and overweight and obesity, similar to other reports[10,13], it should be made aware that smoking is a serious risk factor regarding several health problems such as heart and lung diseases.

Work activity might reflect daily energy expenditure. Therefore, the authors assumed that Army personnel working in a non-combat unit might have a high risk of overweight due to more sedentary behavior, whereas those in a combat-unit might have a lower risk due to more regular training and activities that are more physical. In contrast with the authors' assumptions, Army personnel working in combat unit were more likely to be overweight than those working in a non-combat unit. The probable explanation was that BMI did not distinguish between body fat and lean body mass[3]. In particular, it cannot be used to measure the body fatness of some persons who have developed large amounts of muscle tissue, thus it may be misclassified as overweight. Another explanation was that military unit categorization might not reflect work activity. However, no evidence confirmed that Army personnel working in a combat unit had less body fat and more work activity than those working in a non-combat unit. It is suspected whether only BMI is an appropriate index for obesity determining in Army personnel. Further research is required in this prospective aspect.

Several studies have revealed that excessive weight or effects of BMI were associated with hypertension, coronary heart disease, stroke, and some metabolic disorders[14-17]. The same tendency was seen in the present study. A significant risk was found in hypertensive participants with overweight and obesity. Furthermore, the present study found a tendency for obesity to be less prevalent among personnel who performed physical activity ≥ 3 times/wk.

In conclusion, the present study provides information on the Army prevalence of overweight and obesity. These baseline data can be used to

monitor future trends and develop health promotion strategies to prevent obesity in RTA personnel.

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ความชุกของภาวะน้ำหนักเกินและโรคอ้วนในกำลังพลกองทัพบก

พรรณเพ็ญ นาประดิษฐ์, พรรณี ปานเทวัญ, นงพิมล นิมิตรอานันท์, ดังใจ สุวรรณกิตติ, ราม รังสินธุ์

การศึกษาภาคตัดขวางเพื่อศึกษาความชุกของภาวะน้ำหนักเกินและโรคอ้วนในกำลังพลกองทัพบก ดำเนินการระหว่างเดือนมกราคม-กรกฎาคม พ.ศ. 2548 กำลังพลจำนวน 4,276 นาย อายุ 20-60 ปี ได้รับการซักประวัติสุขภาพทั่วไป ประวัติการสูบบุหรี่ การดื่มสุรา และพฤติกรรมการออกกำลังกาย ตรวจวัดความดันโลหิต ชั่งน้ำหนัก วัดส่วนสูง วัดรอบเอว รอบสะโพก ผลการศึกษาพบว่ากำลังพลในกองทัพบกมีความชุกของภาวะน้ำหนักเกินร้อยละ 27.1 และโรคอ้วนร้อยละ 4.9 กำลังพลที่มีภาวะน้ำหนักเกินและโรคอ้วนทั้งชายและหญิงมีค่าเฉลี่ยของอายุ น้ำหนัก ค่าดัชนีมวลกาย ความยาวรอบเอว ความยาวรอบสะโพก สัดส่วนรอบเอวต่อรอบสะโพก ความดันโลหิต สูงกว่ากลุ่มที่มีค่าดัชนีมวลกายน้อยกว่า 25 กิโลกรัม/เมตร^2 อย่างมีนัยสำคัญทางสถิติ การวิเคราะห์แบบถดถอยพบว่าโอกาสที่จะเกิดภาวะน้ำหนักเกินมีความสัมพันธ์กับอายุ เพศชาย และอยู่ในส่วนกำลังรบ การสูบบุหรี่ทำให้โอกาสเกิดภาวะน้ำหนักเกินและโรคอ้วนลดลง การออกกำลังกาย $\geq$ 3 ครั้ง/สัปดาห์ ทำให้โอกาสเกิดโรคอ้วนลดลง ภาวะน้ำหนักเกินและโรคอ้วนมีความสัมพันธ์กับความดันโลหิตสูง การศึกษานี้ทำให้ทราบข้อมูลพื้นฐานและความชุกของภาวะน้ำหนักเกินและโรคอ้วนในกำลังพลกองทัพบก ซึ่งนอกจากจะใช้เพื่อติดตามแนวโน้มของโรคอ้วนของกำลังพลในอนาคต ยังเป็นประโยชน์ในการรักษา ป้องกัน เฝ้าระวัง และวางแผนส่งเสริมสุขภาพกำลังพล