The Physical Fitness of Residents of Faculty of Medicine Siriraj Hospital, Mahidol University

Phakamas Tanvijit, M.D., Vilai Kuptniratsaikul, M.D.
Department of Rehabilitation Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

ABSTRACT

Objective: To study the physical fitness of residents of the Faculty of Medicine Siriraj Hospital and associated factors.

Methods: A cross-sectional study was performed to measure the physical fitness including percentage of body fat, grip strength, leg strength, flexibility and cardiovascular fitness. Cardiovascular fitness was evaluated by maximal oxygen consumption (VO_2 max), which was calculated by a sub-maximum exercise test on a bicycle ergometer (Astrand-Rhyming test). Possible physical fitness-associated factors were also analyzed.

Results: There were 160 residents; 61 male and 99 female including those in 1st to 5th years of residency training from 12 different departments in the academic year 2011. The mean age was 28.8 (SD 1.8) years. Approximately one third (26.9%) were overweight. Eighty percent engaged in exercise less than 1 time per week. Almost half (47.5%) of residents had poor to fair levels in cardiovascular fitness when compared with the standard value of Thai people in each age group. Mean VO_2 max was 34.8 ± 8.7 ml/kg/min. Being overweight (OR 7.5, 95% CI 3.1 to 18.2) and low exercise compliance (OR 4.6, 95% CI 1.7 to 12.2) were significant factors associated with poor to fair cardiovascular fitness.

Conclusion: Almost half of the residents had poor to fair levels in cardiovascular fitness that were associated with overweight and low exercise compliance. This health issue of residency should be attended to and solved.

Keywords: Exercise, physical fitness, residents

Siriraj Med J 2014;66:194-201
E-journal: http://www.sirirajmedj.com

INTRODUCTION

Background

Nowadays, health promotion is mostly emphasized in the public health care for preventing diseases. Physical fitness, has been defined as a set of characteristics that people have or application of the ability to perform physical activity, which are closely allied with disease prevention and health promotion and can be modified through regular physical activity and exercise.[1] It is clear that additional amounts of physical activity or increased physical fitness levels provide additional health benefits that can reduce the risk for chronic diseases including hypertension, diabetes, dyslipidemia and obesity.[1-3] These chronic diseases result in cardiovascular disease and death.[1-3] In addition, there was a consistent inverse activity-response relationship between physical activity levels and all–cause mortality, overweight, obesity and fat distribution, type 2 diabetes, colon cancer, quality of life, and independent living in older adults.[4] Exercise has benefit not only for physical health, but also for

Correspondence to: Vilai Kuptniratsaikul,
E -mail: vilai.kup@mahidol.ac.th
Received 13 December 2013
Revised 23 April 2014
Accepted 29 April 2014

psychological health. It can alleviate mental stress and mood disorders.[1,5-6]

Therefore, healthcare providers, including medical students, residents and doctors who are expected to be positive role models for good health, should perform regular exercise. Unfortunately, there are some evidences that almost all medical students and residents had a low physical fitness and did not exercise regularly,[7-10] due to their heavy academic workload. The previous studies showed that medical students of Faculty of Medicine Siriraj Hospital had poor cardiovascular fitness[7] and those of Chiang Mai University had poor to average cardiovascular fitness.[8] More than 90 percent of them performed exercise less than 3 times per week.[7] Roger et al.,[9] reported that 60% of internal medicine residents of the Medical College of Georgia had low physical fitness when compared with people of the same age. Moreover, Arora et al.,[10] found that the physical fitness of residents of the Department of Medicine of Tripler Army Medical Center had declined by the time they passed residency training. Education program, workloads and other factors of residents in Thailand are quite different from those in other countries. However, there is no study about physical fitness of residents in Thailand.

The objectives of the present study were to obtain the physical fitness of residents of the Faculty of Medicine Siriraj Hospital and to identify the exercise behaviors and factors associated with physical fitness and Quality of life (QOL).

MATERIALS AND METHODS

The present study was approved by the Siriraj Institutional Review Board (SIRB) and the approval number was Si. 633/2010. It was a cross-sectional study. The invited letters were sent to random number of residents and the announcements were posted. The first to fifth year of volunteer residents were included. Any subjects who had contraindication to exercise (e.g. known cardiovascular disease, cardiovascular symptoms, or recent significant musculoskeletal problems) and pregnancy were excluded.

The sample size calculation was based on the exercise behaviors by the residents of the Faculty of Medicine Siriraj Hospital (28 %)[17], which can represent the physical fitness and critical level of significance of 0.05. It was assumed that the standard deviation was 7%. The total sample size of 160 subjects was required.

Baseline data, exercise information and WHOQOL brief Thai questionnaire[11] were completed by each subject. Blood pressure, heart rate, body weight, height and waist circumference were measured and then participants performed the physical fitness test including body fat, grip strength, leg strength, flexibility and cardiovascular fitness.[1] Body fat was measured by skin fold caliper at triceps, biceps, subscapular and suprailiac areas to determine body composition. Grip and leg strength were measured by hand grip and leg dynamometer to evaluate muscular strength. Flexibility was measured by Sit and Reach test. Cardiovascular fitness was evaluated by maximal oxygen consumption (VO_2 max) calculated after sub-maximal exercise test on a bicycle ergometer (Astrand-Rhyming test).[12] Test duration was 6 minutes and pedal strokes were kept around 50 cycles per minute. The initial workload was selected for the bike based on gender and age. Then the load was adjusted until the heart rate reached over 120 beats per minutes. Exercise heart rates were recorded over every minute and the last two minutes (5^{th} and 6^{th} minutes) were averaged. Based on the average heart rate of the last 2 minutes and known workload, maximal oxygen uptake (VO_2 max) could be estimated. The values of all tests were compared with the standard value of Thai people at the same age from the Sports Authority of Thailand Simplified Physical Fitness Test (SATST).[13] Then, the correlations of cadiovascular fitness and various factors were examined.

Data was analyzed using SPSS version 16.0. Data was presented as a mean and standard variation (SD) for continuous variables such as age, sleep hours, waist circumference, BMI, WHOQOL data and physical fitness results. Categorical variables were presented as percentage (%) including sex, year of training, frequency of exercise, level of QOL and level of cardiovascular fitness. The comparison of the good and poor cardiovascular fitness group was performed by the Chi-square test for the qualitative data and the independent sample t-test for the quantitative data.

The multiple variables were analyzed by stepwise logistic regression and were used to clarify the associated factors of the poor cardiovascular fitness of residents. The p-value <0.05 was considered as statistically significant.

RESULTS

There were 61 male and 99 female residents with a mean age of 28.8 (SD 1.6) years. Eighteen residents were married and thirty have had underlying disease such as allergic rhinitis, thyroid disease etc. The percentage of 1st-5th year of training were 22.5%, 27.5%, 31.2%, 8.8% and 10%, respectively. The mean sleep hours per day were 6 (SD 0.9) hours. The present study found that 15.7% of the residents had normal BMI, 26.9% were overweight (BMI >23 kg/m^2) and 15.6% were underweight. Unfortunately, 13% of them were obese (BMI >25) and 2 residents (1.2%) were morbid obese (BMI >30 kg/m^2). Almost ten percent (9.4%) of them had higher waist circumference than the suggested waist circumference value in adult Asians with male predominance (male < 90 cm., female < 80 cm.).[14] (Table 1)

Table 2 showed most residents (84.4%) aim to exercise for good health. Almost eighty

TABLE 1. Baseline characteristic of residents of Faculty of Medicine Siriraj Hospital.

Variable	Case (%), mean ± SD		
	Total cases	Male	Female
Sex	160	61 (38.1)	99 (61.9)
Age, years	28.8 ± 1.6	29.2 ± 1.7	28.5 ± 1.4
Age range, years (min, max)	24, 34	24, 34	25, 32
Marital status			
Single	142 (88.8)	51 (83.6)	91 (91.9)
Married	18 (11.2)	10 (16.4)	8 (8.1)
Underlying disease			
No	130 (81.2)	49 (80.3)	81 (81.8)
Yes	30 (18.8)	12 (18.7)	18 (18.2)
Year of training			
1st year	36 (22.5)	13 (21.3)	23 (23.3)
2nd year	44 (27.5)	14 (23)	30 (30.4)
3rd year	50 (31.2)	18 (29.5)	32 (32.2)
4th year	14 (8.8)	10 (16.4)	4 (4)
5th year	16 (10.0)	6 (9.8)	10 (10.1)
Sleep (hours/day)	6 ± 0.9	5.8 ± 0.7	6.3 ± 0.9
Sleep, range (min, max)	4, 9	4, 8	4, 9
BMI† (kg/m^2)		23.5 ± 2.9	20.1 ± 2.2
Underweight (<18.5)	25 (15.6)	3 (4.9)	22 (22.3)
Normal (18.5-22.9)	92 (57.5)	23 (37.7)	69 (69.7)
Overweight (≥23)	43 (26.9)	35 (57.4)	8 (8.0)
At risk (23-24.9)	20 (12.5)	16 (26.2)	4 (4.0)
Obese I (25-29.9)	21 (13.2)	17 (27.9)	4 (4.0)
Obesity II (≥30)	2 (1.2)	2 (3.3)	0
Waist circumference† (cm.)		84.1 ± 8.5	70.9 ± 4.9
Male ≤ 90 cm., female ≤ 80 cm.	145 (90.6)	50 (82)	95 (96)
Male > 90 cm., female > 80 cm.	15 (9.4)	11 (18)	4 (4)

† International Association for the Study of Obesity, WHO Western Pacific Region. The Asia-Pacific Perspective: redefining obesity and its treatment. Melbourne: Health Communications Australia Pty; 2000.p.18-20.

percent of residents did exercise less than 1 time/ week. The top 3 reasons were no available time for exercise (87.5%), spend their free time on other relaxation modes (51.9%) and no available places for exercise (20%). The favorite modes of exercise were aerobic exercise including running, swimming and playing sports such as soccer, tennis etc. Most residents (60-97%) had a fair level of WHOQOL-BREF- THAI, which included physical health, psychological health, social relationships, environment and overall domains. (Table 3)

TABLE 2. Attitude of exercise and exercise behaviors of residents of Faculty of Medicine Siriraj Hospital.

Variable	Number (case)	Case (%)
Aim to exercise	160	
Good health		135 (84.4)
Good shape		23 (14.4)
Role model		1 (0.6)
Relax		1 (0.6)
Frequency of exercise	160	
High compliance		33 (20.6)
≥ 3 times/week		7 (4.4)
1-2 times/week		26 (16.2)
Low compliance (<1 time/ week)		127 (79.4)
Duration of exercise in high compliance exercise group	33	
10-30 minutes		12 (36.4)
30-60 minutes		16 (48.5)
> 60 minutes		5 (15.1)
Mode of exercise†	33	
Running		30 (91.0)
Swimming		14 (42.4)
Sports: soccer, badminton, etc		14 (42.4)
Fitness		12 (36.3)
Reason of low exercise compliance†	160	
No available time		140 (87.5)
Spend their free time on other relaxation modes		83 (51.9)
No available places for exercise		32 (20)
Don't have friend to do exercise with		31 (19.4)
Don't like exercise		9 (5.6)

†May choose more than one items

TABLE 3. Quality of life (QOL) of residents of Faculty of Medicine Siriraj Hospital assessed by WHOQOL – BREF – THAI.

Domains	Mean ± SD	Level: case (%)		
		Poor	Fair	Good
Physical health	21.5 ± 2.3	2 (1.2)	155 (96.9)	3 (1.9)
Psychological health	20.4 ± 2.4	2 (1.2)	134 (83.8)	24 (15)
Social relationships	10.9 ± 1.5	2 (1.2)	97 (60.6)	61 (38.1)
Environment	27.2 ± 3.6	1 (0.6)	112 (70)	47 (29.4)
Overall QOL†	86.6 ± 8.4	0	136 (85)	24 (15)

†Overall QOL: poor = 26-60, fair = 61-95, good = 96-130

TABLE 4. Physical fitness of residents of Faculty of Medicine Siriraj Hospital.

	Mean ± SD [min, max]	Cases (%)				
		Poor	Fair	Average	Good	Excellent
Cardiovascular endurance VO_2 max (ml/kg/min)	34.8 ± 8.7 [13.9, 66.0]	44 (27.5)	32 (20.0)	46 (28.8)	20 (12.5)	18 (11.2)
Body fat (%)	26.2 ± 5.8 [9.6, 39.1]	49 (30.6)	32 (20.0)	56 (35.0)	16 (10.0)	7 (4.4)
Grip strength (kg/BW)	0.5 ± 0.2 [0.3, 2.6]	77 (48.1)	34 (21.2)	39 (24.4)	7 (4.4)	3 (1.9)
Leg strength (kg/BW)	1.9 ± 0.6 [0.8, 3.7]	16 (10.0)	11 (6.9)	48 (30.0)	26 (16.2)	59 (36.9)
Flexibility (cm.)	2.7 ± 9.7 [-30, 24]	93 (58.1)	19 (11.9)	36 (22.5)	5 (3.1)	7 (4.4)

The physical fitness of participants has been summarized in Table 4. The present study found that 47.5%, 50.6%, 69.3% and 70% of the residents had poor to fair levels of cardiovascular fitness, body fat, grip strength, and flexibility, respectively, when compared with standard value of Thai people.[13] However, 83.1% of residents were average to excellent level of leg strength.

Using Univariate Analysis and Multiple Stepwise Logistic Regression Analysis, high BMI (OR 7.5, 95% CI 3.1 to 18.2) and low exercise compliance (OR 4.6, 95% CI 1.7 to 12.2) were significantly associated with poor cardiovascular fitness. (Table 5)

DISCUSSION

Health related physical fitness composed of cardiovascular fitness, body composition, muscular strength, endurance and flexibility, have strong relationships with good health.[1]

In the present study, most residents had poor to fair levels in almost all of the physical fitness components when compared with the standard value of the Thai population. Up to 50% of residents had poor to fair levels in cardiovascular fitness component, which was congruent with the previous studies.[9-10,15] Roger et al., reported that 60% of internal medicine residents had poor to fair levels in cardiovascular fitness.[9] This may due to high workload of the department of medicine. Suskin et al., reported that cardiovascular fitness of interns and residents in hard clinical rotation (>70 hours of hospital work per week) was less than in easy clinical rotation (<60 hours of hospital work per week).[15] Moreover, physical fitness significantly declined over time.[9-10]

This result is worrisome because cardiovascular fitness is strongly considered health-related. Poor cardiovascular fitness has been associated with a markedly increased risk of premature death from all causes and specifically from cardiovascular diseases.[1] On the other hand, high cardiovascular fitness can have a protective effect.[1] From these reasons, this study analyzed factors mainly correlated to cardiovascular fitness.

The important factors associated with the poor cardiovascular fitness group were high BMI and low compliance exercise. The correlation showed that the overweight group (BMI >23 kg/m^2) had risk about 7.5 times more than normal BMI group. Unfortunately, almost one third of residents were overweight. Over a half of those were obese. WHO in 2008 reported that increased mortality among the obese is evident for several life-threatening diseases including type 2 diabetes, cardiovascular disease, gallbladder disease, hormone sensitivity and gastrointestinal cancer.[16] Therefore, a campaign for weight management should be adopted.

Moreover, residents who had low exercise compliance, had risk about 4.6 times higher to be a poor cardiovascular fitness group when compared with residents who had high exercise compliance. Most residents (79.6%) had performed exercise less than 1 time per week. There were only 4.4%

TABLE 5. Cardiovascular fitness (VO_2 max) related with baseline characteristic and exercise behavior and QOL of residents of Faculty of Medicine Siriraj Hospital.

	Cases (%)		Crude	Adjusted
	Good fitness group† (n=84)	Poor fitness group†† (n=76)	OR (95% CI)	OR (95% CI)
Sex				
Male	22 (36.1)	39 (63.9)	2.9*(1.5-5.8)	-
Female	62 (62.6)	37 (37.4)	1.0	
Year of training				
1st year	20 (55.6)	16 (44.4)	1.0	
2nd year	19 (43.2)	25 (56.8)	1.6 (0.7-3.9)	
3rd year	27 (54)	23 (46)	1.1 (0.5-2.5)	
4th year	7 (50)	7 (50)	1.3 (1.3-0.4)	
5th year	11 (68.8)	5 (31.2)	0.6 (0.2-1.9)	
Sleep (hours/day)				
< 6 hours/day	21 (63.6)	12 (36.4)	1.8 (0.8-3.9)	
≥ 6 hours/day	63 (49.6)	64 (50.4)	1.0	
Frequency of exercise				
Low compliance	60 (47.2)	67 (52.8)	2.9* (1.3-6.9)	4.6* (1.7-12.2)
High compliance	24 (72.7)	9 (27.3)	1.0	
BMI (kg/m^2)				
< 23	105 (89.7)	12 (10.3)	1.0	
≥ 23	20 (46.5)	23 (53.5)	5.7* (2.6-12.7)	7.5* (3.1-18.2)
Waist (cm.)				
Men < 90 cm, Women < 80 cm	80 (55.2)	65 (44.8)	1.0	
Men > 90 cm, Women > 80 cm	4 (26.7)	11 (73.3)	3.4* (1.1-11.1)	-
Overall QOL				
Poor	0	0		
Fair	70 (51.5)	66 (48.5)	1.3 (0.5-3.2)	
Good	14 (58.3)	10 (41.7)	1.0	

The data was expressed as number (%), mean ± SD

†Good fitness group including average to excellent level of cardiovascular endurance (VO_2 max) level, ††Poor fitness group including poor to fair level of cardiovascular endurance (VO_2 max)

*Statistical significant, $p < 0.05$

of residents who exercised regularly according to the ACSM guideline, which is more than or equal to 3 times per week by questionnaire. Sirisopon et al., reported that 8.5% of residents exercised more than 3 times/week[17] and the National Statistical Office of Thailand in 2007 reported that 38.2% of the population aged more than or equal to 11 years met the ACSM guideline.[18] Roger et al.,[9] reported that 41% of internal medicine residents in Georgia met recommendations for physical activity guidelines. However, the results of frequency of exercise in the present study seemed to be less in than previous studies. Therefore, this evidence indirectly indicated that the frequency of exercise in residents showed a declining trend.

The main problem, for residents who had low exercise compliance, was no available time. This was not different from the previous studies.[15,17]

Suskin et al.,[15] reported that there was also a significant difference in the amount of exercise training performed between the two rotations, with subjects averaging 1 hour less effective aerobic training per week during the hard clinical rotation as compared with the easy clinical rotation. The curriculum or workload in training programs should thus be considered. The second reason was that residents spent their free time on other relaxation modes. Interestingly, the third reason was no available place for exercise. However, Siriraj Hospital has many places for exercise such as Siriraj fitness center, tennis court, basketball stadium and swimming pool, etcetera. Yet it might be insufficient for the personnel of Siriraj Hospital. This problem should be of concern and explored by in depth interviews as to whether it is a real reason for not performing exercise.

Residents had fair to good QOL in overall and all domains, even though, they had hard work and had no time to exercise. However, the present study showed no correlation between cardiovascular fitness and overall QOL.

Muscular strength is determined by leg and grip strength which may maintain the following: bone mass, glucose tolerance, and musculotendinous integrity. It is related to a lower risk of injury, the ability to carry out activities of daily living, Fat Free Mass and resting metabolic rate.[1] Although, eighty percent of the residents had average to good levels of leg strength, almost 70% of residents had poor to fair levels of hand grip strength. Therefore, increasing muscular strength of upper extremities should be encouraged.

Two thirds of the residents had a poor to fair level of flexibility. The sit and reach test has commonly been used to assess low back (trunk), hip and hamstring flexibilities, which are important to the prevention of chronic low back pain and the promotion of a healthy lifestyle.[19] Therefore, exercise for improving flexibility ought to be emphasized.

There are limitations of the present study, mainly due to its cross-sectional design, which does not completely reflect the training effect of physical fitness in residents.

Moreover, the sample size in the present study was not calculated by year of training and department. Thus, the distribution of subjects may be biased. Finally, physical activities, which also had a strong effect on cardiovascular fitness[1,3], were not recorded. Therefore, self reported physical activity by a diary or using the pedometer would be recommended.

The residents play a key role in health service. However, their health issue seems to be one of inattentiveness. The results in this present study should wake us up to the fact that health issues in residents must be attended to and solved.

CONCLUSION

Most residents had only poor to fair levels of physical fitness in almost all of the components compared with the standard value of the Thai population. Particularly in the cardiovascular fitness component, nearly half had poor to fair levels. The important factors related to the poor cardiovascular fitness group were overweight and low exercise compliance. Health promotion in residents, such as implementing exercise courses in residency curriculum, or campaign for weight management, should be considered. In addition, the physical fitness evaluation of all residents should be performed every year.

ACKNOWLEDGMENTS

This study was funded by the Faculty of Medicine Siriraj Hospital, Mahidol University.

Conflicts of interest

The authors have no conflicts of interest.

REFERENCES

1. American College of Sports Medicine. ACSM's guidelines for exercise testing and prescription. Baltimore (MD): Lippincott, Williams & Wilkins; 2009.p. 2-102.
2. Reiner M, Niermann C, Jekauc D, Woll A. Long-term health benefits of physical activity – a systematic review of longitudinal studies. BMC Public Health. 2013 Sep 8;13:813.

3. Anderssen SA, Hiermann I. Physical activity—a crucial factor in the prevention of cardiovascular diseases. Tidsskr Nor Laegeforen. 2000 Oct 30;120(26):3168-72.
4. Kesaniemi YK, Danforth E Jr, Jensen MD, Kopelman PG, Lefèbvre P, Reeder BA. Dose-response issues concerning physical activity and health: an evidence- based symposium. Med Sci Sports Exerc. 2013 Feb;45(2):351-8.
5. Daley AJ. Exercise therapy and mental health in clinical populations: is exercise therapy a worthwhile intervention? Adv Psychiatr Treat. 2002;8:262-70.
6. Strohle A. Physical activity, exercise, depression and anxiety disorders. J Neural transm. 2009;116:777-84.
7. Kulthanan T, Soparat K, Chanhom N. Physical fitness and physical activities profiles of second-year medical student : Faculty of Medicine Siriraj Hospital, Mahidol University. Siriaj Med J. 2001;53:797-804.
8. Tongprasert S, Wattanapan P. Aerobic capacity of fifth-year medical Students at Chiang Mai university. J Med Assoc Thai. 2007 Jul;90(7):1411-6.
9. Roger LQ, Gutin B, Humphries MC, Lemmon CR, Waller JL, Baranowski T, et al. Evaluation of internal medicine residents as exercise role models and associations with self-reported counseling behavior, confidence, and perceived success. Teach Learn Med. 2006 Summer;18(3):215-21.
10. Arora R, Lettieri C, Clavbaugh JR. The effects of residency on physical fitness among military physicians. Mil Med. 2004 Jul;169(7):522-5.
11. Mahatnirundrkul S, Tantipiwatanasakul W, Pumpaisalchai W, Wongsuwan K, Promanajirungkul R. Comparison of the WHOQOL-100 and the WHOQOL-BREF (26 items). J Ment Health Thai. 1998; 5: 4-15.
12. Astrand PO, Rhythming l. A nomogram for calculation of aerobic capacity (physical fitness) from pulse rate during submaximal work. J Appl Physiol. 1954 Sep;7(2):218-21.
13. Sports science department in Sports Authority of Thailand. Physical Fitness Norms of Thai Population. Bangkok: Sports Authority of Thailand; 2000.p.1-115.
14. International Association for the Study of Obesity, WHO Western Pacific Region. The Asia-Pacific Perspective: redefining obesity and its treatment. Melbourne: Health Communications Australia Pty; 2000.p.18-20.
15. Suskin N, Ryan G, Fardy J, Clarke H, McKelvie R. Clinical work load decreases in the level of aerobic fitness in house staff physician. J Cardpulm Rehabil. 1998;18:216-20.
16. Kantachuvessiri A. Obesity in Thailand. J Med Assoc Thai. 2005 Apr;88(4):554-62.
17. Sirisopon D, Leewanun C, Kuptniratsaikul V. The Attitudes and Behavior of Exercise of Residents of Faculty of Medicine, Siriraj Hospital. J Thai Rehabil Med. 2011;21: 50-5.
18. National Statistical Office [Internet]: Thailand: Ministry of Information and Communication Technology; c2004-2013 [cited 2012 October 10]. The 2007 Exercise Behavior Survey; [about 1 screen] Available from: http://web.nso.go.th/survey/keystat/keystat08.pdf.
19. Guthrie J. Cardiorespiratory and health related physical fitness assessment. In: Franklin BA, Whaley MH, Howley ET, editors. ACSM's resource Manual for Guidelines for exercise testing and prescription 6. Philadelphia: Lippincott Williams & Wilkins; 2000:p. 328-29.