

การทดสอบเดิน 6 นาที ในผู้สูงอายุไทยสุขภาพดีช่วงอายุ 60-80 ปี Six-Minute Walk Test in Healthy Thai Elderly Aged 60-80 Years

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บทคัดย่อ

การศึกษาในครั้งนี้มีวัตถุประสงค์เพื่อหาค่าระยะทางปกติของการทดสอบเดิน 6 นาทีในผู้สูงอายุไทยสุขภาพดีช่วงอายุ 60-80 ปี และระบุถึงปัจจัยที่สัมพันธ์กับระยะทางที่ได้ในการทดสอบ ผู้สูงอายุ 150 คนรับการทดสอบเดิน 6 นาทีด้วยวิธีมาตรฐาน ปัจจัยอื่นที่ประเมินได้แก่ สัดส่วนของร่างกาย, ระดับการทำกิจกรรม, คุณภาพชีวิต, สมรรถภาพปอด, ความแข็งแรงของกล้ามเนื้อและการทรงตัว

ค่าเฉลี่ยของระยะทางการเดิน 6 นาทีของผู้สูงอายุไทยในการศึกษานี้เท่ากับ 434 ± 75 เมตร ปัจจัยที่สัมพันธ์กับระยะทางที่เดินได้แก่ อายุ ($r=-0.390$, $p < 0.01$) ค่าดัชนีมวลกาย ($r=-0.215$, $p < 0.01$) ความสูง ($r=0.196$, $p < 0.05$) ระยะเอื้อมมือขณะทดสอบทรงตัว ($r=0.630$, $p < 0.01$) แรงบีบมือ ($r=0.447$, $p < 0.01$) ค่าปริมาตรอากาศที่หายใจออกเต็มที่หลังจากหายใจเข้าเต็มที่ (FVC) ($r=0.429$, $p < 0.01$) ค่าปริมาตรอากาศหายใจออกอย่างแรงใน 1 วินาทีแรก (FEV_1) ($r=0.417$, $p < 0.01$) และคะแนนคุณภาพชีวิตจากแบบประเมิน SF-36 ส่วนสมรรถภาพทางกาย ($r=0.319$, $p < 0.01$) เมื่อวิเคราะห์หาค่าความสัมพันธ์โดยใช้ Stepwise multiple regression พบว่าระยะเอื้อมมือขณะทดสอบทรงตัว, คะแนนคุณภาพชีวิตจากแบบประเมิน SF-36 ส่วนสมรรถภาพทางกาย และค่าปริมาตรอากาศหายใจออกอย่างแรงใน 1 วินาทีแรก (FEV_1) เป็นปัจจัยทำนายระยะทางการเดิน 6 นาทีโดยสามารถอธิบายผลได้ 54 % ของความแปรปรวนทั้งหมด

การศึกษาในครั้งนี้ ได้ค่าระยะทางการเดิน 6 นาทีในผู้สูงอายุไทยซึ่งมีค่าใกล้เคียงกับผลการศึกษาที่ผ่านมาในเอเชีย แต่ต่ำกว่าเมื่อเปรียบเทียบกับผลการศึกษาของยุโรป ดังนั้นการเพิ่มระดับความสามารถในการทรงตัว สมรรถภาพทางกาย และสมรรถภาพปอด อาจเป็นปัจจัยสำคัญที่จะเพิ่มระดับความสามารถในการเดิน 6 นาทีในผู้สูงอายุไทย

คำสำคัญ : การทดสอบด้วยการเดิน 6 นาที ผู้สูงอายุ สมรรถภาพทางร่างกาย ระดับความสามารถในการออกกำลังกาย

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ABSTRACT

This study was aimed to measure the six-minute walk distance (6MWD) in population-based healthy Thai elderly sample and to identify the factors related to the walk distance. One-hundred and fifty elderly aged 60-80 years performed 6MWT using a standardized protocol. Other measurements included anthropometric data, physical activity level, quality of life, pulmonary function, strength and balance.

The average 6MWD observed in this study was 434 ± 75 m. Age ($r = -0.390$, $p < 0.01$), BMI ($r = -0.215$, $p < 0.01$), height ($r = 0.196$, $p < 0.05$), functional reach test ($r = 0.630$, $p < 0.01$), hand grip strength ($r = 0.447$, $p < 0.01$), FVC ($r = 0.429$, $p < 0.01$), FEV_1 ($r = 0.417$, $p < 0.01$) and SF-36 physical functioning part ($r = 0.319$, $p < 0.01$) were significantly correlated with 6MWD. Stepwise multiple regression analysis showed that functional reach distance, SF-36 physical functioning score and FEV_1 were the independent predictors of 6MWD ($p < 0.05$), explaining 54 % of the variance.

The 6MWD in this study was close to the values previously reported in Asia but less than ones from the European studies. Therefore, increase balance ability, physical performance and pulmonary function might be important for improving six-minute walk ability in Thai healthy elderly.

Keywords : Six-minute walk test, Elderly, Functional status, Physical performance

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INTRODUCTION

In Thai population, the change of aging structure is rapidly leading the country toward elderly society (1-2). As a person gets older, many systems of body, such as musculoskeletal, neurological and cardiopulmonary systems change. These factors are the main causes that make the elderly having considerable risk of health problems and often limit their capacity to fulfill functional activities of daily living. These may force the elderly to have independent lifestyle and decreased quality of life (3-4).

Six-minute walk test (6MWT) is a test commonly used for assessing the cardiopulmonary performance in the rehabilitation program. Furthermore, it is a useful instrument for evaluating the exercise capacity of elderly person (5-14). The norm value of walking distance is necessary for interpretation of the test in individuals with abnormal conditions (15-16). There is also no study to identify the factors related to six-minute walk distance. The aims of this study, therefore, were to measure the six-minute walk distance in Thai healthy elderly and to identify the factors that related to six-minute walk distance.

MATERIALS AND METRODS

Subjects are healthy males and females, aged between 60 to 80 years. The researcher performed physical examination i.e., blood pressure, heart rate, and pulmonary function test to screen the subjects according to exclusion criteria set. The volunteer who does not have any exclusion criteria received the explanation about the procedures, then read and signed a consent form. The subjects then followed the following procedures.

The interview session: The participants were interviewed about general health status, medical history, physical activity and quality of life.

The pulmonary function test: after the interview session, the subjects were tested the pulmonary function using spirometer. The pulmonary function data included forced vital capacity (FVC), forced expiratory in one second (FEV_1) and ratio of FEV_1/FVC . The test was performed 3 times with at least 1 second of rest period. The maximal value was recorded.

Leg length: The subjects were measured the leg lengths in a standard standing position i.e. standing upright with legs spreading of shoulder width, feet in neutral. The leg lengths were measured with flexible tape from the greater trochanter of the femur to the lateral border of the calcaneum. The average data of left and right sides was used in the data analysis.

Handgrip strength: The subjects sat on a chair and held the dynamometer close to their body with the arm vertical and squeezed the grip with maximal force. Grip strength was measured three times for the dominant hand. The maximum value was used in the analysis.

Balance test: The functional reach test was used for evaluating the balance ability. The subject was asked to stand comfortably, make a fist, and raise their arm parallel to the yardstick. Subject was instructed, "Reach forward as far as you can without taking a step". The position of the end of the third metacarpal was recorded. Each subject was given 3 trials, one for practice, and the other two were averaged for data analysis.

Six-minute walk test: To perform the six-minute walk test, subjects were instructed to "Walk as quickly as you can for six minutes so that you cover as much ground as possible". The walk way was 30 meters in length. At each end of the walk way was a cone to mark the turning point. The subjects were instructed that they could slow down or rest if necessary. Every minute, the subjects were given the feedback with the standardized statements such as "you're doing well, keep it up" and "do your best" and feedbacked on the elapsed time. The walk distance in six minutes was recorded for the analysis.

RESULTS AND DISCUSSION

Demographic Characteristics

The characteristics of the 150 subjects are presented in Table 1.

Table 1 Demographic characteristics of the subjects

Characteristic	Mean±SD (range) or number/ percentages
Males/females	12/138
Age (years)	70.06±5.81 (60-90)
Weight (kg.)	57.89±9.57 (35-90)
Height (cm.)	154.16±6.32 (140-178)
BMI (kg/m ²)	24.33±3.58 (15.98-35.56)
Leg length (cm.)	80.63±8.61 (66-102)
Marital status	
Married	77 (51.3%)
Single	25 (16.7%)
Widowed	46 (30.7%)
Divorced	2 (1.3%)
Physical activity level	
Inactive	2 (1.3%)
Moderate active	75 (50%)
Active	73 (48.7%)

Health status

From the interviewed, the numbers of aging who had hypertension and diabetes mellitus were 67 (44.7%) and 30 (20%) respectively. More than half of the subjects reported to have musculoskeletal problems, i.e., knee osteoarthritis and osteoporosis. More than half of the subjects (59.3%) regularly took medications for controlling the levels of blood pressure, blood sugar and maintaining the bone density.

Physical examination

The outcomes of physical examination were described using descriptive statistics. Table 2 summarizes these data.

Table 2 Outcomes of physical examination

Outcomes	Mean±SD (range) or number/ percentages
Hand grip strength (kg.)	22.30±5.25 (11-40.9)
Functional reach (inch)	10.87±2.17 (4-15)
Pulmonary function test variables	
FVC(L)	1.97±0.46 (1.22-3.64)
FEV ₁ (L)	1.66±0.39 (0.92-3.06)
FEV ₁ / FVC (%)	83.98±6.27 (70-98)
SF-36 Quality of life scores	
Physical functioning	76.06±18.51 (25-100)
Role-Physical	79.33±34.24 (0-100)
Bodily Pain	67.34±16.64 (22-90)
General Health	60.17±15.68 (15-92)
Vitality	66.4±15.19 (20-100)
Social Functioning	85.58±18.07 (37.5-100)
Role-Emotional	77.78±38.36 (0-100)
Mental Health	78.78±14014 (28-100)
Reported Health Transition	
Much better now than one year ago	7 (40.7%)
Somewhat better now than one year ago	21 (14%)
About the same	81(54%)
Somewhat worse now than one year ago	41 (27.3%)
Much worse than one year ago	0 (0%)
Six-minute walk distance (m.)	434.37±75.44 (240-638)

Associations between six-minute walk distance and other variables

Table 3 shows the associations between 6MWD and other variables of this study. Age and BMI were associated with the distance walked in this analysis. The observed association between age and 6MWD was consistent with previous studies. In this study, the inverse relationship between BMI and 6MWD was found. Obesity increased the workload for a given amount of exercise, probably was the explanation of the shorter distance walked in participants with a higher body weight or BMI. The muscle strength is a critical component of walking ability, therefore in this study, significant positive correlation was found between 6MWD with grip strength. Enright et al found that grip strength was an independent (linear) predictor of 6MWD in their models for both women and men. The results indicated that muscle strength was an important factor to determine gait performance. About pulmonary function test, FVC and FEV₁ in healthy elderly aged 60-80 years in this study were significantly correlated with 6MWD.

Moreover FEV₁ was an independent predictor of 6MWD. This result was similar to a study by Camarri *et al.*

For balance, a moderate correlation between functional reach test and 6MWD was found in this study. The possible reason was that in older adults who had good postural stability represented by longer functional reach distance had self-confidence to preserve walking ability so they had longer 6MWD. The significant correlation about SF-36 Physical Functioning scale and 6MWD was also found. The average decreases in SF-36 Physical Functioning score associated with muscle weakness, pain and shortness of breath at rest. The corresponding about SF-36 Physical Functioning in healthy aging is the factor that related to quality of walking in 6MWD better than other part of the questionnaire.

Table 3 Correlation coefficients (r) for 6MWD and other variables

Subject variables	6MWD (m)	P value
Age (years)	-0.390 ^{**}	< 0.01
Weight (kg.)	-0.076 ^{**}	NS
Height (cm.)	0.196 ^{**}	0.016
BMI (kg/m ²)	-0.215 [*]	< 0.01
Leg length (cm.)	0.158 ^{**}	NS
Physical activity level	0.016 ^{**}	NS
Hand grip strength (kg.)	0.447 ^{**}	< 0.01
Functional reach (inch)	0.630 [*]	< 0.01
FVC(l)	0.429 [*]	< 0.01
FEV ₁ (l)	0.417 [*]	< 0.01
FEV ₁ / FVC (%)	-0.074 [*]	NS
SF36 _Physical functioning	0.319 ^{**}	< 0.01
SF36_Role-Physical	0.035 ^{**}	NS
SF36_Bodily Pain	0.048 ^{**}	NS
SF36_General Health	0.186 [*]	0.023
SF36_Vitality	0.174 [*]	0.033
SF36_Social Functioning	-0.013 ^{**}	NS
SF36_Role-Emotional	0.038 ^{**}	NS
SF36_Mental Health	-0.142 [*]	NS

NS: not significant at p < 0.05

* Pearson correlation coefficients

** Spearman correlation coefficients

Predictors of six-minute walk distance

Forward stepwise multiple regression analysis revealed that functional reach distance, SF-36 Physical Functioning score and FEV₁ were the independent predictors (p < 0.05) and all of these 3 variables explained 54 % of the variability in 6MWD. The regression equation for this relationship is as follows:

$$6MWD (m) = 40.008 + 20.581(\text{Functional reach distance, inch}) + 1.103(\text{SF-36 Physical Functioning, score}) + 54.94 (\text{FEV}_1, L)$$

Functional reach distance alone accounted for 46 % of the variance, SF-36 Physical Functioning and FEV₁ explained an additional 8 % of the variance in 6MWD.

For this study, the mean 6MWD in the healthy participants was 434 m. This result was remarkably closed to other reports in Asian populations (17,18) but less than the predicted 6MWD from regression equations derived in Caucasian populations. About the reference equation, the previous studies showed that height, sex, age and weight were the predictors of in 6MWD. While the functional reach distance, SF-36 quality of life questionnaire and FEV₁ were the predictors of 6MWD in this Thai healthy aging group in this study.

CONCLUSION

The study revealed that 6MWD in the population surveyed was similar to ones in the previously reports of Asian population. The significant predictors of 6MWD in this study were functional reach test distance, SF-36 physical functioning score and FEV₁.

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