Age and Gender Effects on Postural Stability and Static Balance in Thai Community Dwelling Adults

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Background : *A study of postural stability was undertaken to identify the effects of age and gender as a preliminary study in one Thai community dwelling adults. It will be useful to prevent falls in the future.*
Method : *The authors measured the postural stability in 120 males and females aged 30 -40, 60-70 years using a Balance Master 8.0, Neurocom,OR to perform the modified Clinical Test for the Sensory Integration of Balance (mCTSIB) and the Unilateral Test protocols.*
Results : *The authors found that the females aged 60 – 70 were more stable than the males at the same age.*
Conclusion : *Age and gender were significant variables that influence postural stability and static balance.*

Keywords : *Postural stability, Balance, Age, Gender*

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Postural stability is defined as the ability to maintain or control the center of mass in relation to the base of support to prevent falls and complete desired movements.

Balancing is the process by which postural stability is maintained [1]. The control of posture is known to be critical for both the acquisition and control of motor abilities and is an essential requirement for physical activities in daily life [2]. Balancing depends on feedback of sensory information from visual, vestibular and somatosensory sources. The central nervous system processes the information by comparing them to a 'postural' body scheme built by the subject's anterior experience, and on reflex motor activities [3].

Somatosensory and vestibular functions link to postural stability decline rapidly after the age of 65 years to the extent that it can impact balance and contribute to falls [4-15]. The reduction in proprioception and vestibular function could lead to an increased reliance on vision to maintain balance when the eyes were closed in bilateral stance and also on different support conditions [16].

There is a limitation in information that shows the aging effects on postural stability in a Thai population. The present study focused only on one urban community near Chulalongkorn University as a preliminary study comparing adults and older adults postural stability using standard equipment (Balance Master 8.0,Neurocom, OR) to get basic information that can lead to further study about the elderly fall prevention programs for primary health care in the future.

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Material and Method

The research group used an observational analytical study to assess postural stability and balance in community dwelling adults aged 30-40 years, 60-70 year both male and female.

Subjects

One hundred and twenty subjects living in the community for at least six months were randomized under the inclusion criteria (age 30-40 years, 60-70 years both males and females, are in good health, report no difficulties or need for help in performing self-care or instrumental activities of daily living, are able to walk for at least 400 meters) and exclusion criteria (no current or past medical diagnosis of injury affecting balance within the last 3 years; was taking no medication affecting the central nervous system or known to affect balance or coordination; had no current symptoms of dizziness or lightheadedness; had no orthopedic or neurologic diagnosis or symptoms suggestive of vestibular or neurologic disorders; had no history

of one or more unexplained falls related to loss of balance within the past 12 months; was able to stand for 10 minutes without the use of an assistive device; was able to raise and keep one arm parallel to the ground while leaning forward; had no pain that would limit their ability to stand or reach; and had normal vision or corrected vision) [20].

All subjects attended a one test session which began with a short interview to confirm the inclusion and exclusion criteria and then signed the inform consent. The authors measured height, weight and blood pressure. Then the height and age data were entered into the Neurocom Data Base System in preparation for testing balance.

Measurements

All subjects (120 for the mCTSIB and 105 for the Unilateral Stance Tests) performed 3 repetitions of 8 balance tasks.The modified Clinical Test for the Sensory Integration of Balance (mCTSIB) [17] and Unilateral Stance [18,19] protocols were selected because both protocols could be used without vision and the support surface (firm surface and foam block) could be altered. By the Unilateral Stance the authors could measure the sway velocity (degree per second) while standing on one leg on the firm surface.

Data Analyses

All data were analyzed using the SPSS 10.0 statistical package for Windows, Means and standard deviations were calculated for the outcome variables.

One way ANOVA was used to determine the effect of sway velocity (degree per second) between the four age groups. Post hoc analysis (Bonferroni multiple comparisons) were used as well.

Results

The descriptive statistics of demographic data for the subjects enrolled in this study are presented in Table 1. One hundred and twenty subjects were divided into four groups according to age and sex, i.e. females aged 30-40 years, females aged 60-70 years, males aged 30-40 years and males aged 60-70 years.

Results of the mCTSIB test are shown in Table 2 and Fig. 1. When standing on a foam block with eyes open there was a significant difference between males aged 60-70 years and 30-40 years at the p level of 0.013. When standing on a foam block with eyes closed there was a significant difference between females aged 60-70 years at the p level of 0.012.

The data of Unilateral Stance Test in Table 3 and illustrated in Fig. 2 are as follows. There was a significant difference between the older adults (females and males aged 60-70 years) and adult (females and males aged 30-40 years) at the level of < 0.001 when standing on the left leg with eyes open. When standing on the left leg with eyes closed there was a significant difference between the males aged 60-70 years and

Table 1. Demographic data of subjects in each group of this study

	F 30-40 year n = 30	F 60-70 year n = 30	M 30-40 year n= 30	M 60-70 year n = 30	P value
Age (yr)	35.67±3.03	64.37±3.53	35.37±3.25	63.93±2.89	<0.001*
Weight (kg)	55.29±9.83	57.19±13.08	68.54±8.63	62.83±10.27	<0.001*
Height (cm)	150.93±8.29	151.78±5.93	165.63±6.45	161.16±6.29	<0.001*
BMI(kg/m^2)	23.96±3.86	25.57±3.74	24.97±2.73	24.08±3.21	0.217

Data are shown as mean ± standard deviation * Significant different at 0.05 level by one way ANOVA

Table 2. Sway velocity (degree/sec) in the mCTSIB Test of each subject group at four conditions: firm surface, eye open (FEO), firm surface, eye closed (FEC), foam block, eye open (FOEO) and foam block, eye closed (FOEC)

	F 30-40 year n = 30	F 60-70 year n = 30	M 30-40 year n = 30	M 60-70 year n= 30	P value
FEO	0.03±0.01	0.03±0.01	0.03±0.02	0.03±0.01	0.575
FEC	0.03±0.01	0.03±0.01	0.03±0.01	0.03±0.01	0.074
FOEO	0.08±0.02	0.10±0.03	0.07±0.02	0.12±0.15	0.041*
FOEC	0.17±0.05	0.21±0.06	0.19±0.05	0.22±0.05	0.014*

Data are shown as mean ± SD * P (significant difference) at 0.05 level by one way ANOVA

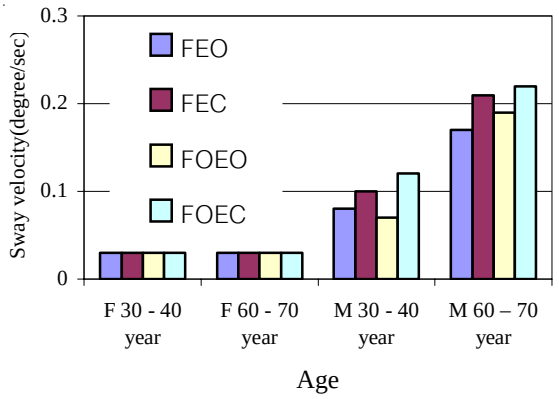

Fig. 1 Sway velocity (degree per second) (mean ± SD) for visual and support surface

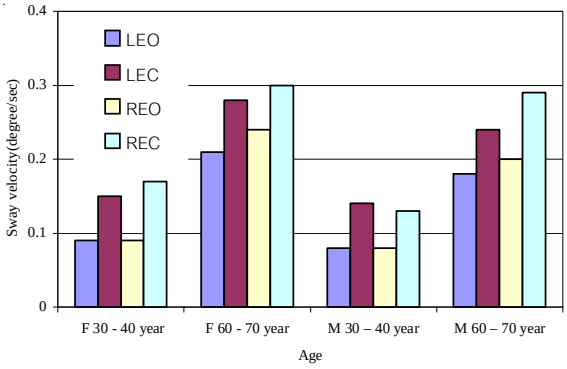

Fig 2. Sway velocity (degree per second) (mean ± SD) for standing on one leg

males age 30-40 years at the level of < 0.001 while there was a significant difference between the females aged 60-70 years and females aged 30-40 years at the p level of 0.003.

Standing on the right leg with eyes open demonstrated a significant difference between the older adults (females and males aged 60-70 years) and adults (females and males aged 30-40 years) at the p level of < 0.001.

When standing on the right leg with the eyes closed there was a significant difference between the males aged 60-70 years and males aged 30-40 years at the level of < 0.001 while there was a significant difference between the females aged 60-70 years and females aged 30-40 years at the level of 0.014.

Discussion

The modified Clinical Test for the Sensory Integration and Balance (mCTSIB) has been used to determine the fall risk in older Thai adults. This functional assessment tool was developed by Shumway-Cook and Horak [17] to help clinicians determine how patients use somatosensory, visual, and vestibular inputs for balance. The test was performed with the shoes off. There was no statistical difference in the sway velocity while standing on a firm surface observed in all groups with a different age range and gender (Table 2). The ankle strategic technique data on a firm surface was consistent with Shumway-Cook and Horaks[17] finding.

Hip strategy was used while standing on the foam block with eyes open (less stable than the firm surface). There was a significant difference between males aged 60-70 years and aged 30-40 years. With eyes closed there was a significant difference between females aged 60-70 years and females aged 30-40 years (Table 2). It means that without the help of visual sensation, there is a decline in somatosensory and vestibular function. Nancy et al [21] showed that there was a significant change of somatosensory and vestibular function in women aged between 20 to 80 years.

The mechanisms contributing to age-related increases in postural sway and falls in the elderly remains unclear. Brauer, et al[22] employed the postural stability measures to predict the elderly falls in a community. In the present study the unilateral stance

Table 3. Sway velocity (degree/sec) in the Unilateral Stance Test of each subject group at four conditions: stand on left leg with eye open (LEO), stand on left leg with eye close (LEC), stand on right leg with eye open (REO) and stand on right leg with eye close (REC)

	F30-40 yr n = 30	F60-70 yr n = 23	M 30-40 yr n = 30	M 60-70 yr n = 25	P value
LEO	0.09±0.02	0.15±0.05	0.09±0.03	0.17±0.10	<0.001*
LEC	0.21±0.05	0.28±0.08	0.24±0.07	0.30±0.10	<0.001*
REO	0.08±0.01	0.14±0.05	0.08±0.03	0.13±0.05	<0.001*
REC	0.18±0.05	0.24±0.08	0.20±0.07	0.29±0.10	<0.001*

Data are shown as mean and standard deviation, * Significant difference at 0.05 level by one way ANOVA

test was used to measure the speed of sway in different age and gender groups. The results showed that there was a statistical significant difference of speed of sway in males aged 60-70 years compared to males aged 30-40 years when the subject stood on the left leg with eyes open. Similar results were observed in the female group. This means that there was an increase sway velocity because of a decline in mediolateral stability in elderly adults. When standing on the left leg with eye closed, there was a significant difference observed in both males and females aged between 60-70 years and aged 30-40 years. The results showed that both older male and female adults were less stable in the mediolateral stability. The same results occurred when standing on the right leg with eyes open and closed. This study is comparable to the studies of Ekhdal et al in 1989 [23] and Suomi and Kojeca in 1994 [24]. Therefore, the authors work presents one of the tools that can be used to evaluate the physical parameters associated with fall risk in older adults.

Conclusion

The present study demonstrated that age, visual condition, and support surface were significant variables influencing postural stability and static balance in both Thai male and female community dwelling adults. The inability to stand on one leg could be used as an important predictor of serious fall risk in senior citizens.

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ผลของอายุและเพศที่มีต่อการทรงท่าและการทรงตัวแบบไม่มีการเคลื่อนที่ของประชากรไทยในชุมชน

วิยะดา ไรวา, วันทนีย์ วรรณเศษตา, สมนึก กุลสถิตพร, เสก อักษรานุเคราะห์

วัตถุประสงค์ : เพื่อศึกษาผลของอายุและเพศที่มีต่อการทรงท่าและการทรงตัวแบบไม่มีการเคลื่อนที่ของประชากรไทยในชุมชนแห่งหนึ่งเพื่อป้องกันการหกล้มที่จะเกิดขึ้นในอนาคต

วิธีการ : คัดเลือกกลุ่มประชากรโดยวิธีการสุ่มตัวอย่างจากผู้ที่มีคุณสมบัติตามเกณฑ์ที่กำหนดจำนวน 120 คน ชายและหญิง อายุ 30-40 ปี และ 60-70 ปี ทุกคนได้รับการทดสอบการทรงท่าโดยใช้เครื่อง Balance Master, Neurocom 8.0, OR ทำการทดสอบอัตราความเร็วของการเซ ด้วยแบบทดสอบ modified Clinical Test for the Sensory Integration of Balance (mCTSIB) และ Unilateral Stance Test

ผลการวิจัย : หญิงอายุ 60 - 70 ปี มีความมั่นคงในการทรงท่าดีกว่าชายในวัยเดียวกันเมื่อยืนบนพื้นที่ไม่มั่นคง และเมื่อยืนบนขาข้างเดียวทั้งซ้ายและขวา

สรุปผลการวิจัย : อายุ และเพศ มีผลต่อความมั่นคงในการทรงท่า (postural stability) และการทรงตัวแบบไม่มีการเคลื่อนที่ (static balance)