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Effects of Thai dance on balance in Thai elderly

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Background : *The continuous progress in public health work results in an increasing number of the elderly, whose physical changes are unavoidable. The elderly also risk more of both chronic and acute illnesses, which in turn lead to loss of abilities in conducting their daily life, loss of physical equilibrium, and more risk of falling. Exercise has become an important element that can increase stability in balancing and decrease risks of falling. Thai dance is a type of exercise that is traditional and based on Thais' ways of living. Researchers, therefore, believe that Thai dance should be an appropriate form of exercise for the elderly that can be performed sustainably and continuously.*

Objectives : *This research is to study the effect of Thai dance on balancing ability in Thai elderly.*

Setting : *Noen-Muang Center, Amphur Maung, Khon Kaen, Thailand*

Design : *Randomized controlled trial*

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Methodology : *This is an experimental study on 38 female volunteers with an average age of 65.81 ± 5.09 years. They were divided into 20 participants in the Thai dance group and 18 participants in the control group. All participants were interviewed for their baseline information and examined according to the inclusion criteria before signing in as research participants. Then they underwent the Berg balance scale (BBS), the time up-and-go test (TUGT), and the functional reach test (FRT) prior to and 6 weeks after intervention. The Thai dance group practiced Thai dancing for a period of 40 minutes per session, 3 times per week for 6 weeks.*

Results : *The test on balance before and 6 weeks after Thai dancing exercise shows that the experimental group had a statistically significant increase in physical balance. BBS increased from 53.10 ± 1.97 points to 54.65 ± 1.35 points ($p = 0.001$), TUGT decreased from 10.21 ± 1.72 sec to 8.58 ± 1.37 sec ($p = 0.001$), and FRT increased from 23.68 ± 5.53 cm to 29.45 ± 5.77 cm ($p = 0.001$). The measurements of the control group were compared between before and 6 weeks after intervention. It was shown that the difference of physical balance was not statistically significant. BBS increased from 52.27 ± 1.77 points to 52.00 ± 1.97 points ($p = 0.350$), TUGT increased from 10.44 ± 1.58 sec to 10.72 ± 1.57 sec ($p = 0.390$), and FRT from 26.07 ± 3.94 cm to 26.17 ± 3.98 cm ($p = 0.860$). When the two groups were compared, the physical balance values were significantly different: BBS: from 52.00 ± 1.97 to 54.65 ± 1.34 points ($p = 0.001$); TUGT: from 10.72 ± 1.57 sec to 8.59 ± 1.37 ($p = 0.001$); and, FRT: from 26.17 ± 3.98 cm to 29.45 ± 5.77 cm ($p = 0.001$).*

Conclusion : *Thai dancing exercise can increase physical balance in the elderly.*

Keywords : *Traditional Thai dance, elderly, balance.*

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มณีพรรณ เหล่าโพธิ์ศรี, จตุรัตน์ กันทพิทยา, กิตติศักดิ์ สวรรยาวิสุทธิ, ภาณี เอื้อวิชาแพทย์, ตรีศักดิ์ จรรยาเจริญ. ผลของการรำไทยต่อการทรงตัวในผู้สูงอายุชาวไทย. จุฬาลงกรณ์เวชสาร 2556 พ.ศ. - มิ.ย.; 57(3): 345 - 57

บทนำ : ความก้าวหน้าทางด้านสาธารณสุขที่มีการพัฒนาอย่างต่อเนื่อง ส่งผลให้จำนวนผู้สูงอายุเพิ่มมากขึ้น เมื่อเข้าสู่วัยสูงอายุจะมีการเปลี่ยนแปลงทางสรีระวิทยาที่หลีกเลี่ยงไม่ได้และมีความเสี่ยงต่อการเจ็บป่วยทั้งแบบเฉียบพลันและเรื้อรังเพิ่มขึ้น ส่งผลให้เกิดการสูญเสียความสามารถในการใช้ชีวิตประจำวัน สูญเสียการทรงตัว และเสี่ยงต่อการล้มได้ง่าย ดังนั้นการออกกำลังกายถือเป็นปัจจัยสำคัญที่สามารถเพิ่มความมั่นคงในการทรงตัว และลดความเสี่ยงต่อการล้มในผู้สูงอายุได้ การรำไทยถือเป็นรูปแบบการออกกำลังกายที่เป็นประเพณีดั้งเดิม ตามวิถีการดำเนินชีวิตของชาวไทย ดังนั้นคณะผู้วิจัยจึงเห็นว่า การรำไทยน่าจะเป็นรูปแบบการออกกำลังกายที่สามารถทำได้ยั่งยืน ต่อเนื่องและเหมาะสมสำหรับผู้สูงอายุชาวไทย

วัตถุประสงค์ : เพื่อศึกษาผลของการรำไทยต่อการทรงตัวในผู้สูงอายุชาวไทย

สถานที่ที่ทำการศึกษา : ชุมชนโนนม่วง อ. เมือง จ. ขอนแก่น ประเทศไทย

รูปแบบการวิจัย : การวิจัยแบบสุ่ม

วิธีการศึกษา : การศึกษาครั้งนี้เป็นการศึกษาเชิงทดลอง โดยอาสาสมัครเป็นเพศหญิงจำนวน 38 คน อายุเฉลี่ย 65.81 ± 5.09 ปี แบ่งเป็นกลุ่มรำไทย 20 คน และกลุ่มควบคุม 18 คน อาสาสมัครทุกคนได้รับการสัมภาษณ์ข้อมูลพื้นฐานทั่วไป การตรวจประเมินตามเกณฑ์การคัดเลือกเข้าของงานวิจัยและลงนามให้ความยินยอมในการเข้าร่วมงานวิจัย ทำการทดสอบการทรงตัวด้วย Berg balance scale (BBS), Time up and go test (TUGT) และ Functional reach test (FRT) ซึ่งทำการทดสอบก่อนและหลัง 6 สัปดาห์ และกลุ่มรำไทยจะได้รับการออกกำลังกายแบบรำไทย 40 นาทีต่อครั้ง 3 ครั้งต่อสัปดาห์ เป็นระยะเวลา 6 สัปดาห์

ผลการศึกษา : ผลการทดสอบการทรงตัวก่อนและหลัง 6 สัปดาห์ พบว่าในกลุ่มทดลองหลังจากออกกำลังกายแบบรำไทย 6 สัปดาห์ การทรงตัวมีค่าเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ (BBS: เพิ่มขึ้นจาก 53.10 ± 1.97 คะแนน เป็น 54.65 ± 1.35 คะแนน ($p = 0.001$), TUGT: ลดลงจาก 10.21 ± 1.72 วินาที เป็น 8.58 ± 1.37 วินาที ($p = 0.001$), FRT: เพิ่มขึ้นจาก 23.68 ± 5.53 ซม. เป็น 29.45 ± 5.77 ซม. ($p = 0.001$)

ส่วนกลุ่มควบคุม เมื่อเปรียบเทียบการทรงตัวก่อนและหลัง 6 สัปดาห์ พบว่าการทรงตัวมีความแตกต่างกันอย่างไม่มีนัยสำคัญทางสถิติ สถิติ (BBS: จาก 52.27 ± 1.77 คะแนน เป็น 52.00 ± 1.97 คะแนน ($p = 0.350$), TUGT: จาก 10.44 ± 1.58 วินาที เป็น 10.72 ± 1.57 วินาที ($p = 0.390$), FRT: จาก 26.07 ± 3.94 ซม. เป็น 26.17 ± 3.98 ซม. ($p = 0.860$)

เมื่อเปรียบเทียบระหว่างกลุ่ม พบว่าค่าการทดสอบการทรงตัวของ ทั้งสองกลุ่มมีค่าแตกต่างกันอย่างมีนัยสำคัญทางสถิติ (BBS: จาก 52.00 ± 1.97 เป็น 54.65 ± 1.34 คะแนน ($p = 0.001$), TUGT: จาก 10.72 ± 1.57 วินาที เป็น 8.59 ± 1.37 ($p = 0.001$), FRT: จาก 26.17 ± 3.98 ซม. เป็น 29.45 ± 5.77 ซม. ($p = 0.001$)

วิจารณ์และสรุปผล : การออกกำลังกายโดยการรำไทยสามารถเพิ่มความสามารถในการทรงตัว ในผู้สูงอายุได้

คำสำคัญ : รำไทย, ผู้สูงอายุ, การทรงตัว.

The elderly are defined as those who are over 65 years old.^(1,2) In Thailand, WHO defines the elderly as those who aged over 60 years old.⁽³⁾ The advancement in public health leads to longer life spans of the population.⁽⁴⁾ It is expected that Thai elderly will increase from 35 million in 2000 to 72 million in 2030.⁽⁵⁾

When one becomes old, his physical changes are unavoidable. The elderly also risk developing more chronic and acute diseases, resulting in losses.⁽⁶⁾ A US report in 2004 shows prevalence of at least 3 diseases among the elderly of over 75 years that require medical treatment and medication.⁽⁷⁾ Developing these diseases causes less ability to perform daily life activities and lessens physical performance.⁽⁸⁾ A factor important to the elderly's ability to perform their daily life activities is physical balance.⁽⁹⁾ Ability to balance is the co-function of the sensing nervous system, the central nervous system, and the muscular structure.⁽¹⁰⁾ These systems deteriorate with age, causing defects in the elderly to control their balance. Many studies show that decreasing physical performance results in loss of balance and risk of falls.⁽¹¹⁻¹³⁾ Exercise is an important factor that can increase stability and balance, and reduce risk of falls among the elderly.^(14,15)

Presently, the elderly can exercise in many different styles, e.g., Taichi, Qi-gong, club dance, yoga, aerobic dance, ect. Mostly, these are other nations' culturally-based exercises. Effects of these exercises have been studied and clearly demonstrated, so that each exercise can be used according to one's needs. However, these exercises are still not popular and not sustainable. The enhancement of health and exercise in the elderly

should be adjusted to correlate to their lifestyles, cultural context, traditions, ways of living, values, and needs of the elderly in each community in order to enable the elderly to exercise on their own correctly, appropriately, and sustainably.⁽¹⁶⁾

Thai dance is a kind of social performance accompanied by rhythmic classical music. The rhythms are slow, delicate, regular, with various dancing poses. It is a continual exercise that requires little load on the knee and ankle joints. Thus, it should be suitable for the elderly. Thai dance also correlates to community's cultural context; it is possible to do in daily life and should be a kind of exercise that the Thai elderly want.

Thus, the objective of this research is to study the effects of Thai dance on balancing ability in the Thai elderly.

Methods

Subjects

This study was a double-blinded randomized controlled trial in which both volunteers and variable raters were not informed of the volunteer groups. There were 41 people who volunteered to participate, including 2 males and 39 females from two sampled communities around Khon Kaen. There were 22 participants in the Thai dance group (1 male and 21 females) and 19 participants in the control group (1 male and 18 females). The inclusion criteria included: a male or female over 60 years of age who is able to walk by themselves without any assisting tool, able to lead the daily life independently, having no congenital disease that prevents exercise, and having no regular exercise during the past 2 months. The exclusion criteria included having neurological

disease that prevents physical exercise, e.g., stroke, epilepsy, pulmonary obstruction, lung disease, infection, uncontrollable metabolic-related disease, uncontrollable hypertension, and aches that prevent exercise.

The volunteers were divided into 2 groups: experimental group and control group. The volunteers were sampled according to their community of affiliation, i.e, similar in terms of living condition, social, economic and cultural condition. The volunteers who passed the inclusion criteria and were happy to join and listen to the explanation and sign the consent form. Then the volunteers were interviewed on baseline characteristics and tested in physical balance. The experimental group exercised the Thai dance for 40 minutes per session, 3 times a week for 6 weeks. The control group received instructions on general exercising and correct daily practices so that they would apply in their daily life. After 6 weeks, both groups were tested on their balance again. The volunteers could resign from the project at any time they wished without any effect.

This research has been approved by the Human Research Ethics Committee, Khon Kaen

University according to the Declaration of Helsinki and the Good Clinical Practices (ICHGCP), and numbered HE542308.

Intervention: Traditional Thai dance

The Thai dance performed by the volunteers was the Thai standard circle dance. Experts in Thai dance trained the volunteers three times and physical therapists tended to them with VDO about standard Thai dance during their exercise. The rhythm of the Thai dance used is slow, beautiful, consistent and easy to perform. It is also a group exercise.

The intervention included physical warming up by stretching muscles for 5 minutes followed by Thai dancing exercise for 30 minutes, and relaxing by stretching muscles for another 5 minutes. This was done 3 times a week for 6 weeks, 18 times all together.

The poses used in the Thai standard circle dances consist of raising-lowering-bending-stretching arms, raising left and right arms alternately, raising and lowering legs, bending and stretching the knees, standing on toes and full feet, turning left-right, and turning around oneself (Figure 1).



Figure 1. Type of Thai dance.

Outcome measurements

Tests were performed prior to and 6 weeks after the intervention. The tests included basic physical values: weight, height, body mass index, heart rate, and blood pressure; physical balance: applying the timed up-and-go test (TUGT) Berg's balance scale (BBS) and functional reach test (FRT). Each test was performed by one therapist who monitored one kind of test for all volunteers in order to achieve validity of the test. The therapists did not know which group each volunteer belonged to.

Balance test

Timed up-and-go test is the test of balancing by timing from standing up from a chair, walking for a distance of 3 meters with the safest highest speed, and turning around a point before going back to the seat. Each volunteer underwent the test twice and the average values were recorded.⁽¹¹⁾

Berg's Balance Scale is the test of balancing ability by performing 14 seating and standing activities. As for each activity, the score ranges from 0 – 4, depending on the volunteer's ability, the level of their needs of assistance, and time spent, totaling 56 points.⁽¹⁷⁾ Those getting lower than 45 points have a high risk of falling.⁽¹⁸⁾ Reports indicate that BBS is a highly valid and reliable test.⁽¹⁹⁾ Most research works apply BBS as a 'gold standard' to evaluate the validity of other balance evaluation form.⁽²⁰⁾

Functional Reach Test

The FRT determines how far the elderly are able to move within the limits of anterior stability. It is widely used to identify the risk of falls. A measuring tape is attached to the wall, parallel to the floor, and positioned at the height of the volunteer's acromion.

A barefoot subject is positioned with the feet comfortable, parallel, perpendicular to the wall and near the beginning of the measuring tape. With the wrists in the neutral position, arms straight and shoulder in 90° of flexion, the volunteer is instructed to perform a forward bending without touching the tape. Then, the displacement on the measuring tape should be verified.⁽²¹⁾

The test result is represented in averages, after three attempts, of the difference between the initial and the final positions recorded on the measuring tape. Displacements that are smaller than 15 cm indicate frailty and risk of falls.^(22, 23) Baseline characteristic measures included weight, height, BMI, HR, and BP.

Statistical analysis

The data obtained were normal distribution and analyzed by SPSS 17 computer software, and pair *t* test to compare the averages in the groups before and after the intervention. Then, independent pair *t* test was applied to compare the averages of the two groups, before and after the intervention with $p \leq 0.05$.

Results

All of the 41 female volunteers were divided: 22 into the experimental group, and 19 the control group. Three volunteers resigned before the end of the research (2 from the experimental group and 1 the control group). The volunteers in the experimental group were ill, while the volunteer in the control group had to go upcountry on the test date. Finally, 38 volunteers remained and provided the information for analysis (20 in the experimental group and 18 the control group) (Fig.2).

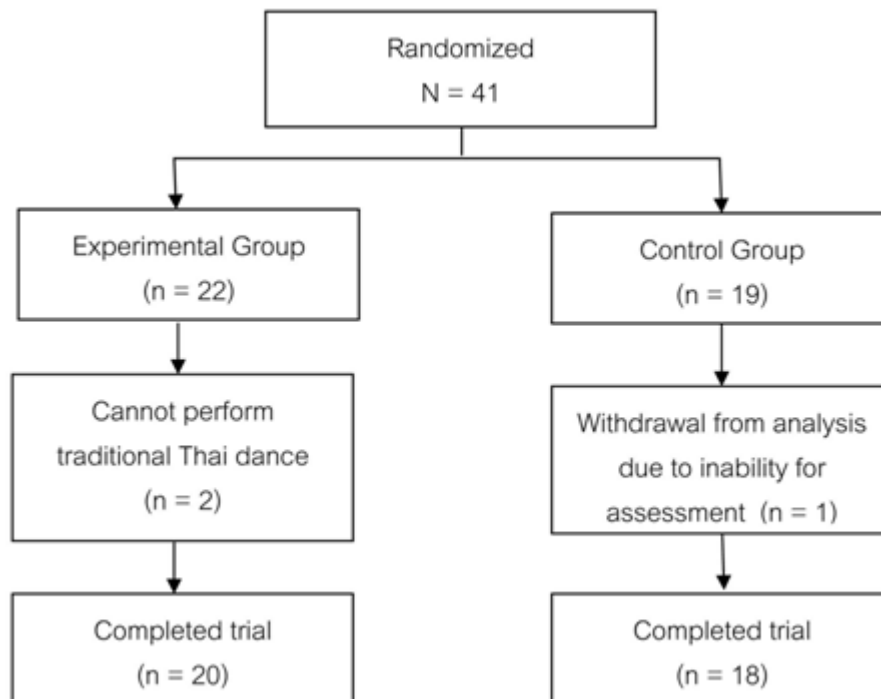


Figure 2. Diagram of subjects.

Table 1. Anthropometric and baseline characteristics of subjects.

Variables	Control group n = 18	Experimental group n = 20
Age (years)	66.83 ± 6.03	64.90 ± 4.02
Weight (kg)	59.05 ± 11.13	59.65 ± 8.17
Height (cm)	153.27 ± 5.08	153.43 ± 5.40
BMI (kg/m ²)	25.61 ± 4.35	25.54 ± 3.07
SBP (mmHg)	135.33 ± 16.23	142.00 ± 19.34
DBP (mmHg)	73.00 ± 7.36	83.10 ± 13.13
HR (beat/minute)	74.16 ± 11.44	76.35 ± 11.44

Note: Values are mean ± SD, kg; kilogram, cm; centimeter, m; meter, mmHg; millimetermercury, BMI = body mass index, SBP = systolic blood pressure, DBP = diastolic blood pressure, HR = heart rate

Table 2. Results of BBS, TUGT, FRT in control (n = 18) and experimental groups (n = 20) before and after 8 weeks compared in group and between group.

Variables	Group	Before	After	Difference	95%CI	p-value
BBS (scales)	CG	52.28 ± 1.78	52.00 ± 1.97	0.28 ± 1.23	-0.33 to 0.89	0.350
	EG	53.10 ± 1.97	54.65 ± 1.34 [#]	1.55 ± 1.36	-2.18 to -0.92	0.001
GT (sec)	CG	10.43 ± 1.58	10.72 ± 1.57	-0.28 ± 1.37	-0.99 to 0.40	0.390
	EG	10.21 ± 1.73	8.59 ± 1.37 [#]	1.63 ± 1.26	1.04 to 2.22	0.001
FRT	CG	26.06 ± 3.94	26.17 ± 3.98	0.10 ± 2.47	-1.33 to 1.13	0.860
	EG	23.68 ± 5.53	29.45 ± 5.77 [#]	5.77 ± 4.79	-8.01 to -3.53	0.001

Note: Values are mean ± SD, CG; control group, EG; experimental group, sec; second, BBS; Berg's Balance scale, TUGT; Time Up-and-Go Test, FRT; Functional Reach Test, 95% CI; 95% confidence interval of the difference. *p* - value in table shows the comparison between before and after

*Significant differences from corresponding before period (*p* < 0.05)

[#]Significant differences from corresponding control group (*p* < 0.05)

Statistical analysis shows that the differences between the baseline characteristics of the volunteers in each group (age, weight, height, and body mass index) were not statistically significant (*p* > 0.05).

The balance tests, prior to and 6 weeks after the intervention, show a statistically significant improvement in balance in the Thai dance group as compared to the control (BBS: increased from 53.10 ± 1.97 points to 54.65 ± 1.35 points (*p* = 0.001); TUGT: decreased from 10.21 ± 1.72 sec to 8.58 ± 1.37 sec (*p* = 0.001); FRT: increased from 23.68 ± 5.53 cm to 29.45 ± 5.77 cm (*p* = 0.001).

In the control group, their balance ability was compared before and after the 6-week intervention. No statistically significant difference was found. (BBS: increased from 52.27 ± 1.77 points to 52.00 ± 1.97 points (*p* = 0.350); TUGT: from 10.44 ± 1.58 sec to

10.72 ± 1.57 sec (*p* = 0.390); and, FRT: from 26.07 ± 3.94 cm to 26.17 ± 3.98 cm (*p* = 0.860).

Comparing between the two groups, the balance test scores were significantly different. (BBS: from 52.00 ± 1.97 to 54.65 ± 1.34 points (*p* = 0.001); TUGT: from 10.72 ± 1.57 sec to 8.59 ± 1.37 (*p* = 0.001); and, FRT: from 26.17 ± 3.98 c, to 29.45 ± 5.77 cm (*p* = 0.001).

Discussion

This research was conducted to evaluate the effect of Thai dance on the balancing ability in 60-84 years old female elderly who are able to perform daily activities. The findings from TUGT, BBS and FRT show the volunteers in the Thai dance group had better balance than the volunteers in the control group with statistical significance at *p* < 0.05.

FRT, BBS and TUGT are popular tools used for balancing in both at the international and national levels.⁽²⁴⁾ These tools were used in this study since they are easily adjusted for clinical use, inexpensive, having good reliability, and can be simply applied in the community.⁽²¹⁾ They are, therefore, considered appropriate to assess the balance of the elderly in communities.

We applied FRT to test the control of posing retention with only forward mobility. A distance smaller than 25 cm indicates risk of falls, while a distance less than 17 cm indicates a medium level of falling risk and a distance less than 15 cm indicates a higher level of falling risk.

BBS is the balance test involving activities resembling the elderly daily living. The scores between 46 – 53 indicate a medium level of falling risk and stipulated scores less than 45 as a high level of risk.^(25,26) The volunteers in our study showed a medium level of falling risk.

TUGT is a highly sensitive test of balance of the well-functional elderly. A previous study explained that if an elderly achieved a higher score than 10 seconds, then he or she has no risk of falls:⁽²⁷⁾ 11-12 seconds is considered a falling risk and periodical dependence; 20 seconds indicates that the person has a high risk of falls and should be taken care appropriately. This correlates to other studies that indicate risk of falls starting from the score of 12 seconds.⁽²¹⁾

In our study, even though FRT, BBS and TUGT scores before the intervention were under the no-risk range, there were differences after Thai dancing practices during the 6 weeks-a statistically significant difference. This indicates that Thai dancing

exercise can enhance the ability to balance in the elderly and can prevent risk of falling.

Previous studies show that exercising can increase balance in the elderly.^(28,29) The exercise and regular movements assist in slowing down deficiencies in various physical systems including the structural and muscular systems related to balance. This correlates to our study which shows that Thai dance can increase balance in the elderly.⁽³⁰⁾ Thai dance involves multi- and continuous movements, with alternate raising of legs, turning of the body to the left and right, bending and stretching the knees, stepping to the front and backward, bending towards the left and right, and alternate raising of the arms, all corresponding to musical rhythms Thai dance predominantly involves contracting and exercising large muscles of the legs for certain duration. Hence, it also increased in balance and improved dynamic movements of the lower limbs, such as endurance and strength of lower limbs. Therefore, Thai dance can be another option for training of bodily balance.

Moreover, Thai dance in this study is the art and culture of Thai people, which is standard Thai dance, soft, smooth, slow and graceful. There are various pattern, easy to practice at home and suitable for the elderly. The limitations of this study included the fact that Thai dance is a type of exercise popular only among females. Men are not generally interested to join the study. The results, therefore, do not cover all of the elderly. Furthermore, the practice of 3 exercises per week could be a problem for the volunteers in terms of transportation. Hence, the study should be conducted in communities where the volunteers live.

Conclusion

Thai dance for a period of 40 minutes per session, 3 times a week for 6 weeks, or all together 18 times can increase the elderly's ability to balance themselves. The researchers hope that the results should be useful in conserving Thai dancing culture and tradition for future studies.

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References

1. Akyol Y, Durmus D, Dogan C, Bek Y, Canturk F. Quality of life and level of depressive symptoms in the geriatric population. *Turk J Rheumatol* 2010; 25(4): 165-73
2. Clark GS, Siebens HC. Geriatric rehabilitation. In: De Lisa J, ed. *Physical Medicine and Rehabilitation*. Philadelphia: Lippincott Williams Wilkins, 2005: 1531-60
3. Bongaarts J, Zimmer Z. Living arrangements of older adults in the developing world: an analysis of demographic and health survey household surveys. *J Gerontol B Psychol Sci Soc Sci* 2002 May; 57(3): S145-57
4. Brach JS, Simonsick EM, Kritchevsky S, Yaffe K, Newman AB. The association between physical function and lifestyle activity and exercise in the health, aging and body composition study. *J Am Geriatr Soc* 2004 Apr; 52(4): 502-9
5. Cabinet Office, Government of Japan. White Paper on the Aging Society FY2007 [online]. 2007 [cited 2008 Dec 3]. Available from: <http://www8.cao.go.jp/kourei/english/annualreport/2007/2007.pdf>
6. Kupper NM, Schreurs H, Ten Klooster PM, Bode C, van Ameijden EJ. Prevention for elderly people: Demand-oriented or problem-oriented. *Health Policy* 2011 Sep; 102(1): 96-103
7. Hardman A, Stensel DS. *Physical Activity and Health: The Evidence Explained*. London: Routledge, 2003
8. Penninx BW, Rejeski WJ, Pandya J, Miller ME, Di Bari M, Applegate WB, Pahur M. Exercise and depressive symptoms: a comparison of aerobic and resistance exercise effects on emotional and physical function in older persons with high and low depressive symptomatology. *J Gerontol B Psychol Sci Soc Sci* 2002 May; 57(2): P124-32
9. Huxham FE, Goldie PA, Patla AE. Theoretical considerations in balance assessment. *Aust J Physiother* 2001; 47(2): 89-100
10. American College of Sports Medicine Position Stand. Position stand exercise and physical activity for older adults. *Med Sci Sports Exerc* 1998 Jun; 30(6): 992-1008
11. Podsiadlo D, Richardson S. The timed "up and go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc* 1991 Feb; 39(2): 142-8
12. Tinetti ME, Williams TF, Mayewski R. Fall risk

- index for falls for elderly patients based on number of chronic disabilities. *Am J Med* 1986 Mar; 80(3): 429-34
13. Toraman NF, Ayceman N. Effects of six weeks of detraining on retention of functional fitness of old people after nine weeks of multicomponent training. *Br J Sports Med* 2005 Aug; 39(8): 565-8
 14. Rogers ME, Rogers NL, Takeshima N, Islam MM. Method to assess and improve the physical parameters associated with fall risk in older adults. *Prev Med* 2003 Mar; 36(3): 255-64
 15. Thiwaporn T, Sugalya A, Punnee P, Lugkana M. Balance, fall and quality of life in active and inactive elderly. *J Med Tech Phys Ther* 2010 Sep-Dec; 22(3): 271-79
 16. Kulsatitporn S, Ariyapitipan T. Modified the transtheoretical model in health behavior modification for prevention of chronic disease in rural community dwelling elderly: a case study in Dongruay District, Damnoensaduak, Ratchburi. Bangkok: Chulalongkorn University, 2008:1-7
 17. Lusardi MM, Pellecchia GL, Schulman M. Functional performance in community living older adults. *J Geriatr Phys Ther* 2003 Dec; 26(3): 14-22
 18. Hawk C, Hyland JK, Rupert R, Colonvega M, Hall S. Assessment of balance and risk for falls in a sample of community-dwelling adults aged 65 and older. *Chiropr Osteopat* 2006 Jan;14:3
 19. Bogle Thorban LD, Newton RA. Use of the Berg balance test to predict falls in elderly persons. *Phys Ther* 1996 Jun; 76(6): 576-83
 20. Newton RA. Validity of the multi-direction reach test: a practical measure for limits of stability in older adults. *J Gerontol A Biol Sci Med Sci* 2001 Apr; 56(4): M248-52
 21. Karuka AH, Silva JA, Navega MT. Analysis of agreement of assessment tools of body balance in the elderly. *Rev Bras Fisioter* 2011 Nov-Dec; 15(6): 460-6
 22. Berg KO, Maki BE, Williams JI, Holliday PJ, Wood-Dauphinee SL. Clinical and laboratory measures of postural balance in an elderly population. *Arch Phys Med Rehabil* 1992 Nov; 73(11): 1073-80
 23. Duncan PW, Weiner DK, Chandler J, Studenski S. Functional reach: a new clinical measure of balance. *J Gerontol* 1990 Nov; 45(6): M192-7
 24. Figueiredo OB, Lima KC, Guerra RO. Instrumentos de avaliacao de equilibrio corporal em idosos. *Rev Bras Cineantropom Desempenho Hum* 2007; 9(4): 408-13
 25. Shumway-Cook A, Baldwin M, Polissar NL, Gruber W. Predicting the probability for falls in community-dwelling older adults. *Phys Ther* 1997Aug; 77(8): 812-9
 26. Berg KO, Wood-Dauphinee SL, Williams JI, Maki B. Measuring balance in the elderly: validation of an instrument. *Can J Public Health* 1992 Jul-Aug;83 Suppl 2: S7-11
 27. Bischoff HA, Stahelin HB, Monsch AU, Iversen MD, Weyh A, von Dechend M, Akos R, Conzelmann M, Dick W, Theiler R. Identifying a cut-off point for normal mobility: a comparison of the timed 'up and go' test in community-dwelling and institutionalised

- elderly women. *Age Ageing* 2003 May; 32(3): 315-20
28. Hui E, Chui BT, Woo J. Effects of dance on physical and psychological well-being in older persons. *Arch Gerontol Geriatr* 2009 Jul-Aug; 49(1): e45-50
29. Bongaarts J, Zimmer Z. Living arrangements of older adults in the developing world: an analysis of demographic and health survey household surveys. *J Gerontol B Psychol Sci Soc Sci* 2002 May; 57(3): S145-57
30. Eyigor S, Karapolat H, Durmaz B, Ibisoglu U, Cakir S. A randomized controlled trial of Turkish folklore dance on the physical performance, balance, depression and quality of life in older women. *Arch Gerontol Geriatr* 2009 Jan-Feb; 48(1): 84-8
31. Paterson DH, Jones GR, Ric CL. Ageing and physical activity: evidence to develop exercise recommendations for older adults. *Can J Public Health* 2007; 98 Suppl 2: S69-108