

## Sufficient activity is important for mobility of well-functioning elderly\*

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- Background** : *The number of the elderly has been increasing but most of them are not sufficiently active. Thus the information to confirm the importance of sufficient mobility is crucial in order to delay impaired movements and decrease the number of dependent individuals.*
- Objective** : *To investigate the differences of walking speed and distance, balance control and falls of sufficiently active (exercise and lifestyle active) and the elderly who are not sufficiently active.*
- Setting** : *Several communities in Khon Kaen province.*
- Research design** : *A cross-sectional study*
- Subjects** : *One-hundred and fifty well-functioning elderly, aged 65 – 80 years old.*
- Methods** : *The subjects were classified into 3 groups which were exercise, lifestyle active and insufficiently active groups (50 subjects/group) by using intensity and duration of performing activities per day, and frequency of doing activity a week. They were evaluated in terms of mobility, which included walking speed, walking distance in 6 minutes; functional balance, and incidences of fall. The differences were analyzed by using ANOVA with the level of significances at  $p < 0.05$ .*

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**Results** : *Subjects who regularly exercised had significantly better walking speed and dynamic balance control than those who were insufficiently active ( $p < 0.001$ ). The lifestyle of active subjects who walked the longest distance in 6 minutes was significantly different from insufficiently active subjects ( $p < 0.05$ ). The insufficiently active subjects also experienced falls about 2 times more frequent than those who were sufficiently active.*

**Conclusion** : *The findings suggested the importance of optimal physical activity or exercises delay a number of functional declines associated with mobility in the elderly.*

**Keywords** : *Elderly, exercise, physical activity, walking, balance.*

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- บทนำ** : ผู้สูงอายุมีจำนวนเพิ่มขึ้นแต่ส่วนใหญ่เคลื่อนไหวร่างกายไม่เพียงพอ ดังนั้น ข้อมูลยืนยันความสำคัญของการเคลื่อนไหวอย่างเพียงพอ จึงเป็นสิ่งสำคัญในการชะลอความบกพร่องด้านการเคลื่อนไหวและลดจำนวนประชากรกลุ่มพึ่งพาของประเทศ
- วัตถุประสงค์** : เพื่อศึกษาความแตกต่างของความเร็วและระยะทางในการเดิน การควบคุมการทรงตัว และการล้มของผู้สูงอายุที่เคลื่อนไหวอย่างเพียงพอโดยการออกกำลังกาย หรือเคลื่อนไหวร่างกายเป็นประจำและผู้สูงอายุที่เคลื่อนไหวไม่เพียงพอ
- สถานที่ที่ทำการศึกษา** : ชุมชนต่าง ๆ ในเขตจังหวัดขอนแก่น
- รูปแบบการวิจัย** : การศึกษาแบบภาคตัดขวาง
- อาสาสมัคร** : ผู้สูงอายุที่สามารถทำงานประจำวันได้เอง อายุระหว่าง 65 - 80 ปี จำนวน 150 คน
- วิธีการศึกษา** : แบ่งอาสาสมัครเป็น 3 กลุ่ม ๆ ละ 50 คน ได้แก่ กลุ่มที่ออกกำลังกายอย่างเพียงพอ กลุ่มที่เคลื่อนไหวโดยการทำงานประจำวันอย่างเพียงพอ และกลุ่มที่เคลื่อนไหวไม่เพียงพอ โดยใช้ระยะเวลาและความหนักในการทำกิจกรรมแต่ละวัน และความถี่ของการทำกิจกรรมต่อสัปดาห์ จากนั้นประเมินความสามารถด้านความเร็วในการเดิน ระยะทางในการเดิน 6 นาที การควบคุมการทรงตัวขณะทำกิจกรรม และอุบัติการณ์การล้มในระยะ 6 เดือนที่ผ่านมา แล้ววิเคราะห์ความแตกต่างระหว่างกลุ่มโดยใช้สถิติ ANOVA โดยกำหนดระดับนัยสำคัญที่  $p < 0.05$

- ผลการศึกษา** : อาสาสมัครที่ออกกำลังกายเป็นประจำมีความเร็วในการเดินและความสามารถด้านการควบคุมการทรงตัวดีกว่ากลุ่มที่เคลื่อนไหวไม่เพียงพออย่างมีนัยสำคัญทางสถิติ ( $p < 0.001$ ) อาสาสมัครที่เคลื่อนไหวโดยการออกกำลังกายเป็นประจำน้อยกว่าเพียงพอสามารถเดินได้ระยะทางไกลกว่ากลุ่มที่เคลื่อนไหวไม่เพียงพออย่างมีนัยสำคัญ ( $p < 0.05$ ) นอกจากนี้ อาสาสมัครกลุ่มที่เคลื่อนไหวไม่เพียงพอยังมีอุบัติการณ์การล้มมากกว่ากลุ่มที่เคลื่อนไหวอย่างเพียงพอประมาณ 2 เท่า
- วิจารณ์และสรุป** : ผลการศึกษาชี้ให้เห็นความสำคัญของการเคลื่อนไหวร่างกายอย่างเพียงพอ โดยการออกกำลังกายหรือทำกิจกรรมประจำวัน เพื่อชะลอความเสื่อมถอยในการหน้าที่ที่เกี่ยวข้องกับความสามารถในการเคลื่อนไหวของผู้สูงอายุ
- คำสำคัญ** : ผู้สูงอายุ, การออกกำลังกาย, กิจกรรมทางกาย, การเดิน, การทรงตัว.

By 2030, the number of individuals who are 65 years and over will be the fastest growing segment of the world population.<sup>(1)</sup> Adequate muscle strength of the lower-extremities, good balance and efficient walking are important contributors for independent mobility of the elderly.<sup>(2)</sup> Impaired balance and ambulatory capability increase the risk of fall, leading to the loss of independence, reduce the quality of life, and increase mortality.<sup>(2, 3)</sup>

It is widely accepted that walking speed is simple, but it is highly reliable and indicative parameter of ambulatory status.<sup>(4)</sup> Results of the test strongly correlate with lower limbs' force production, walking distance, and quality of walking.<sup>(5)</sup> The results also associate to other parameters such as balance, use of walking aids, and number of falls.<sup>(4)</sup> Usual walking speed of less than 1 m/s identifies individuals as having high risk of health-related outcomes.<sup>(6)</sup> In addition, the findings of the longest distance walk is significant to provide additional information regarding functional capacity.<sup>(7,8)</sup> The results of the test demonstrate the ability to undertake activities of daily living, and reflect changes in aerobic endurance, as well as improvement of mobility.<sup>(9,10)</sup>

Furthermore, the performance of everyday's activities also requires good balance control.<sup>(11)</sup> Changes of afferent systems, higher control center and efferent organs with advancing age have potential to affect the balance control and induce fall in the elderly.<sup>(1)</sup> The Timed Up and Go Test (TUGT) has been reported as a valid and reliable tool to measure dynamic balance control of community dwelling elderly.<sup>(11)</sup> Results of the test show moderate correlation with walking speed ( $r = 0.55 - 0.66$ ) due to the added tasks involved with the TUGT including

mobilizing from sit to stand and turning around.<sup>(12,13)</sup> Community-dwelling elderly between 65 and 85 years of age should be able to perform the TUGT in 12 seconds or less.<sup>(14)</sup>

Regular exercise confers health benefits, and improves physical functions and mental status of individuals.<sup>(10,15, 16)</sup> However, more than 60% of the elderly do not exercise regularly.<sup>(15)</sup> These individuals may conduct routine physical activities at different degrees of intensity, frequency and accumulated duration a day. Recently, the American Heart Association (AHA) and the American College of Sports Medicine (ACSM) suggested that the elderly should performed regular physical activity (3 - 5 times a week), at a moderate level of intensity for 30 minutes a day or at a vigorous level of intensity for 20 minutes a day.<sup>(17)</sup> According to this suggestion, there is an increase the number of the elderly who have insufficiently routine physical activity, particular those who are over 70 years of age and living in urban areas.<sup>(18)</sup> As more individuals live longer, it is crucial to emphasize the importance of sufficient exercise or physical activity in order to delay movement impairment and promote independent mobility of the elderly. Therefore, this study investigated the differences of walking speed and distance, balance control and falls of sufficiently active (exercise and lifestyle active) and insufficiently active elderly.

## Methods

### - Subjects

The study recruited 150 healthy community-dwelling adults, aged 65 - 80 years old, with a BMI of 20 - 30 kg/m<sup>2</sup> from several communities of the country. The patients were excluded if they had a significantly

clinical impairment and disease affecting their ability to participate the study such as pain in the joints of the lower limbs with pain scale more than 5, vestibular disorders, walking with walking devices, and unstable cardiovascular and metabolic diseases. Eligible subjects were interviewed in order to classify them into either sufficiently or insufficiently active groups by using intensity (Borg's rating of perceive exertion: RPE), accumulate duration of performing activity a day, and frequency of doing activity per week. Sufficiently active subjects were also arranged into 2 groups according to their routine activities i.e., regularly participated in exercise (exercise subjects) or physical activity (lifestyle active subjects)

Sufficiently active subjects (exercise and lifestyle active) needed to perform moderate intensity (12 to 14 on the RPE scale) of exercise or physical activity for 30 minutes or more a day (minimum a 10-min bouts accumulated throughout the day), at least 3 days a week, and at least 12 months continuously.<sup>(19, 20)</sup> In contrast, insufficiently active subjects were those who participated in exercise activities 0 - 1 times/week, with the duration of daily physical activity less than 30 minutes, or the intensity less than 10 on the RPE scale. The study has been approved by the institutions' human research ethics committees. An informed consent was obtained from every subject prior to participation in the study.

#### - Measures

The study employed the tests on walking and balance performances that were practical in communities. Details of the tests are as follows;

#### Walking test

Subjects' walking speed was monitored by using the 10-meter walk test (10MWT) and their walking distance by 6-minute walk test (6MinWT). The 10MWT measures time (in seconds), whereas 6MinWT measures the distance (in meters). The tests were performed on a flat, smooth and non-slippery surface. During the tests, the assessor walked alongside the subject for safety reasons and accuracy of measurement accuracy. The 10MWT performed with a 'flying start' (i.e., while the subject walked about 10 meters, the time was measured for the middle 3 meters) at a preferred and maximum speed. To reduce measurement error, subjects performed 3 trials at each speed. Then the average preferred and maximum speeds were recorded. The 6MinWT was performed in a hallway that the walking path contained as few turn as possible. Every minute, the subject was informed about the time left and encouraged to continue with a good manner; then the distance after 6 minutes was recorded.

#### Balance test

Balance performance of subjects was evaluated by using a timed functional balance test, the Timed Up and Go Test (TUGT). Subjects were instructed to 'walk at a fastest and secure paces'. The time was started on the command 'go' that the subjects stood up from an armchair, walked 3 meters, turned and returned to a fully seated position on the chair.

#### - Statistical analysis

All analyses were obtained by using SPSS for Windows version 12.0. The descriptive statistics were applied to explain demographics of the subjects and findings of the study. The one-way analysis of variance (ANOVA) was used to compare walking and balance abilities among the groups. All possible pair-wise comparisons were further analyzed by using the post-hoc (Scheffe) analysis. The levels of significant differences were set at  $p < 0.05$ .

### Results

In order to control baseline characteristics of the subjects, the study recruited 19 males in each group. Table 1 presents demographics of the subjects. There were no significant differences of age and BMI among the groups ( $p > 0.05$ ). The intensity of activities of lifestyle active and exercise of the subjects was significantly higher than that of insufficiently active subjects ( $p < 0.001$ ). The subjects with active lifestyle conducted the longest duration a day of rather slow physical activities such as household chores, gardening, farming, intertwining, care giving, stair climbing, walking, and other volunteer works. In contrast, exercise subjects participated in an exercise program about half an-hour a day that included a more rapid activity such as brisk walk, jogging, bicycling, Tai Chi, aerobic exercise, and Thai Wand exercise.

Table 2 presents the findings of the study. The exercise subjects walked at the greatest preferred and fastest speed, whereas insufficiently active subjects walked at the lowest paces. The preferred speed of exercise subjects was significantly faster than that of those with active lifestyle ( $p < 0.05$ ) and

the insufficiently active subjects ( $p < 0.001$ ). However, the maximum speed of exercise subjects was significant difference from only the insufficiently active subjects ( $p < 0.001$ ).

The subjects with active lifestyle achieved the longest distance while the insufficiently active subjects attained the shortest distance in 6 minutes (Table 2). The significant differences of 6MinWT were found between subjects with active lifestyle active and the insufficiently active subjects ( $p < 0.05$ ).

As for the TUGT, exercise subjects achieved the best result of the TUGT ( $10.35 \pm 1.67s$ ), followed by the active lifestyle ( $11.40 \pm 2.96s$ ) and the insufficiently active subjects ( $12.17 \pm 2.55s$ ) respectively (Table 2). The significant differences were demonstrated between the exercise and insufficiently active subjects ( $p < 0.001$ ).

Eleven insufficiently active subjects experienced falls during the former 6 months (range 1 – 3 times). The incidences were about 2 times greater than those with active lifestyle (5 subjects; 1 – 2 times/subject) and exercise subjects (6 subjects; range 1 – 2 times) (Table 2). All falls occurred during walking which the subjects expected to be caused by impaired balance control, hazard environment, inattention and rapid movement, inappropriate footwear and poor lighting. The consequences of all falls were reported as a mild injury such as scratch and bruise.

### Discussion

The study investigated the differences of walking and balance performance, as well as incidences of falls of sufficiently and insufficiently active well-functioning subjects (65 – 80 years old).

**Table 1.** Demographics of subjects.

Variables	Groups (50 subjects/group)						p-value**			
	Insufficiently active			Lifestyle active						
	Mean	SD	Range (Min:Max)	Mean	SD	Range (Min:Max)		Exercise Mean	SD	Range (Min:Max)
Age (year)	71.88	± 4.12	65 : 80	71.50	± 4.22	65 : 80	71.02	± 3.87	66 : 80	0.573
BMI (kg/m <sup>2</sup> )	24.58	± 2.81	20 : 30	24.45	± 2.78	20 : 29	24.85	± 2.96	20 : 30	0.787
Borg scores*	9	± 0.83	8 : 13	12	± 1.20	12 : 14	12	± 1.03	12 : 14	<0.001
Duration of activity (min)	29.40	± 21.82	5 : 80	161.56	± 116.83	45 : 360	38.40	± 10.74	30 : 60	<0.001

\* Borg score presented as median  $\pm$  S.E.

\*\* p-values are for the comparison across groups, using ANOVA for continuous variables

**Table 2.** Results of the study.

Variables	Groups (50 subjects/group)						p-value**			
	Insufficiently active			Lifestyle active						
	Mean	SD	Range (Min:Max)	Mean	SD	Range (Min:Max)		Exercise Mean	SD	Range (Min:Max)
Preferred Speed* (m/s)	0.93	± 0.14	0.93 : 1.16	0.99	± 0.12	0.99 : 1.16	1.06	± 0.11	1.06 : 1.16	<0.001
Maximum Speed* (m/s)	1.16	± 0.17	1.16 : 1.33	1.22	± 0.15	1.22 : 1.33	1.30	± 0.18	1.30 : 1.33	<0.001
6MinWT* (m)	367.59	± 71.90	367.59 : 439.49	400	± 60.16	400 : 460.16	392.86	± 59.65	392.86 : 452.51	0.032
TUGT* (s)	12.17	± 2.92	12.17 : 15.09	11.40	± 2.96	11.40 : 14.36	10.35	± 1.67	10.35 : 12.02	<0.001
Fall (n): range (times)	11		: 1 – 3	5		: 1 – 2	6		: 1 – 2	-

\* Data were presented as mean  $\pm$  SD

\*\* p-values are for the comparison across groups, using ANOVA for continuous variables



As for sufficiently active subjects, the study also analyzed whether there were any differences of the results between routinely physical active and subjects with regular exercise. The findings demonstrated that subjects who were engaged in sufficient exercise or physical activities had significantly better walking and balance performance with less incidences of fall than those who were less active (Table 2). Subjects who regularly exercised walked at the greatest speed and demonstrated the best dynamic balance control as measured by the 10MWT and TUGT respectively. Subjects with active lifestyle attained the longest distance in 6 minutes which was significantly different from that of the insufficiently active subjects ( $p < 0.05$ ). The insufficiently active subjects walked clearly slower than 1 m/s which was a clinical cutoff point to indicate that the individual is at a high risk of health-related outcomes in well-functioning elderly.<sup>(6)</sup> These subjects were able to walk at the shortest distance in 6 minutes which could be inferred that they had less ability to carry out daily activities and less aerobic capacity than the sufficiently active subjects.<sup>(9,10)</sup> Insufficiently active subjects also required the time to complete the TUGT more than 12 seconds which was suggested as a practical cut-off value to indicate normal versus below normal TUGT performance. The results of TUGT implied that the subjects may need further (in-depth) mobility assessment and early intervention such as prescription of a walking aid, home visit or physiotherapy evaluation.<sup>(14)</sup> The findings of the TUGT were consistent with the incidences of fall. The insufficiently active subjects experienced falls about 2 times higher than those subjects who were sufficiently active. (Table 2)

Clear differences of the findings between sufficiently and insufficiently active subjects may imply the importance of optimal physical activity in terms of intensity, duration and frequency of activity. However, the different findings in lifestyle activity and exercise subjects may also suggest the importance of types of activities on the delay of physical impairments of elderly. Both active lifestyle and exercise subjects had more intensive activities than the insufficiently active subjects on most days of the week. Thus, the sufficiently active subjects achieved better walking and balance performance with less incidences of fall than insufficiently active subjects. However, participation in rather rapid activities; such as brisk walk, jogging, and aerobic dance, at sufficient duration (at least 30 minutes) on most days of the week may be the reasons that exercise subjects walked at a faster speed and achieved better dynamic balance control than those with active lifestyle. In contrast, subjects with active lifestyle involved in relatively slower physical activities, such as household chores, gardening, farming and care giving; at a longer duration a day. This may explain that these subjects attained the best aerobic endurance as measured by the 6MinWT.

Results of this study confirm that optimal physical activity or exercise is crucial to reduce/prevent a number of functional declines associated with mobility in aging people. However, there are some noteworthy limitations of this study. Firstly, the small differences of sufficiently and insufficiently active subjects may be due to the criteria to recruit the subjects. The study applied the criteria that simulated lifestyles of the elderly. With the reasons of job

retirement or physical impairments, people over 65 years of age conducted a light activity at a long duration a day, or performed a rather intense activity at a short duration. Thus, the insufficiently active subjects still run their routine physical activities, but not at an optimal level as their mobility scores were lower than the sufficiently active groups and normal cutoff scores. Secondly, the information to classify subjects into the groups derived from interview the subjects, thus may contain some errors. However, the researchers tried to minimize the errors by deeply interview their daily activities with the confirmation from their friends or relatives. Thirdly, the findings were collected from several communities wherein the local geographical factors may affect the results of the study. However, the researchers attempted to randomly equitable select the subjects from every community for the groups. Finally, there were 3 physiotherapists were involved in the tests. However, each test was executed by the same tester who was not aware of the subjects' group assignment throughout the study in order to minimize bias of the tester.

### Conclusion

The study compared the mobility of sufficiently and insufficiently active elderly subjects. The findings confirmed that participation in an optimal physical activity or exercise program is effective to delay the deterioration of mobility of the well-functioning elderly. Thus, routine physical activity for the elderly should emphasize sufficient intensity, duration, and frequency, as well as types of activity according to the targeted ability.

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