STUDIES IN PHYSICAL CULTURE AND TOURISM
Vol. 13, Supplement, 2006

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DIFFERENCES IN THE SPEED OF LOCOMOTION AND ROTATION MOVEMENTS BETWEEN MOTOR ACTIVE AND INACTIVE ELDERLY PEOPLE

INTRODUCTION

The present study focuses on daily motor activities which very often require locomotion and whole body rotation movements to be performed. The speed of one's movements depends on mental (psychical) and motor speed capabilities. In locomotion and rotation movements mental factors are connected with balance control and arm and leg coordination. The composition of muscles (proportion of white and red motor fibers) determines the motor speed abilities. The aging process causes changes in our brain and muscles [2, 6]. These changes impair human motor control and the execution system. The effectiveness of cooperation of the systems can be treated as psychomotor efficiency. People try to slow down the aging process by different kinds of motor activity, e.g. by walking, jogging, biking, hiking and practicing different sports.

The purpose of this study was to study the differences in the speed of locomotion and rotation movements between elderly people who lead a motor active style of life and those who do not. We have treated the elderly people who declared two and more hours of different motor activities per week as an active group. The inactive subjects declared less than two hours of motor activity per week. In other studies the speed of locomotion (walking) has been measured by means of different techniques such as opto-electronics and video-technique, treadmills [8]. These methods need special and relatively complex equipment and a great deal of space (treadmills). Whole body rotation movements were tested using laser, video technique and goniometers [1].

29 active (14 male and 15 female with the mean age of 69.6 years) and 29 inactive (13 male and 16 female with the mean age of 72.1 years) elderly subjects participated in the study.

METHODS

In the presented study we used a psychomotor efficiency timer [3] consisting of a computer, a controller and a measurement station (Fig. 1).

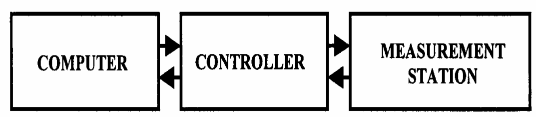

Figure 1. The block diagram of psychomotor efficiency timer

The measurement station consisted of two tactile sensors located 3.5 m (locomotion, Fig. 2a) and 0.5 m (rotation, Fig. 2b) from one another.

The speed of three different motor tasks was tested: speed of locomotion during a walk with no breaks (LW), speed of locomotion during a walk with breaks (walk from one to another standing position, LS) and half-turns (180 degrees) to the right (HTR) and to the left (HTL), turns (360 degrees) to the right (TAR) and to the left (TAL). The walks with breaks and half-turns were performed as one motor task.

In locomotion without stopping the walk (LW) the subjects performed three walking trails between two tactile sensors located on the start and end lines. In the instant of placing a foot in the first step on the start line a subject touched and released the first sensor and walked as fast as possible to the other sensor and touched it without interrupting the walk. The speed of locomotion without stopping the walk was measured by the time from the release of the hand from the first sensor to the touching of the second one.

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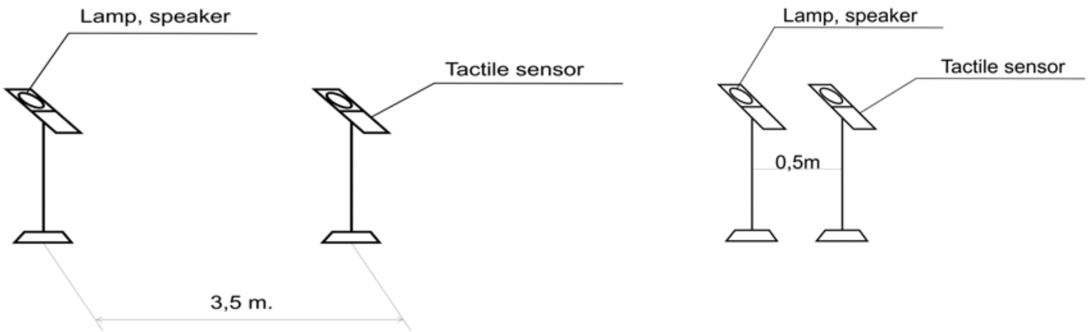
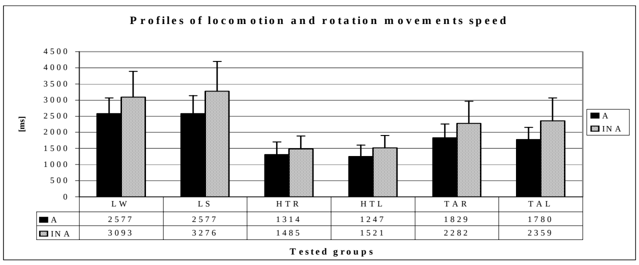


Figure 2. The measurement station of locomotion and rotation movement speed

The second task was a combination of walks and half-turns. A subject was standing on the start line holding the right hand on the sensor. On signal she/he walked as fast as possible to the other sensor, stopped on the line by the sensor, touched it and performed half-turns back in the direction of the free (not touching the sensor) hand. The task was performed in one trail, which consisted of eight walks between two tactile sensors (3.5 m) and three half-turns (180 degrees) back to the right and to the left. In the third task the subjects performed three turns (360 degrees) to the right and the left. A subject kept his/her both hands on the sensors located in the distance of 0.5 m from each other. On signal the subject performed full turns to the right or to the left by displacing the feet (not turning the body on the heel). This way the performance of rotation movements was quite safe for elderly people. The time of turns (TAR and TAL) was measured from activating the sensors to touching them again.

RESULTS

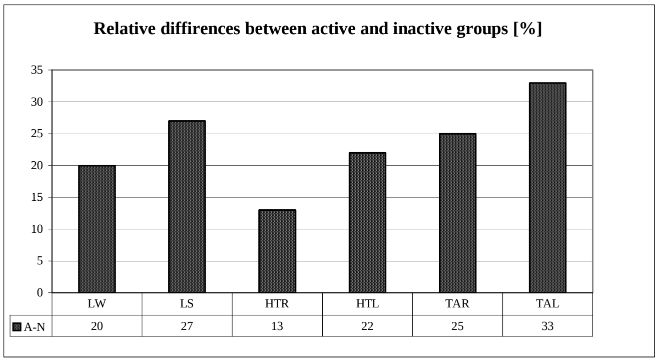
A two-way ANOVA (2 groups and 2 conditions of locomotion: walking with and without breaks and rotation movements to the right and to the left) was used to analyze the differences in locomotion and rotation movement speed between the active (A) and the inactive (INA) groups. The obtained results are presented in Figure 3 [7].



	LW	LS	HTR	HTL	TAR	TAL
A	2577	2577	1314	1247	1829	1780
INA	3093	3276	1485	1521	2282	2359

Figure 3. The profiles of tested times for active (A) and inactive (INA) groups

We also calculated the relative differences in the tested movements speed between the active and the inactive groups (Fig. 4). The differences show how much slower the inactive group performed the examined movements as compared with the active group.



	LW	LS	HTR	HTL	TAR	TAL
A-N	20	27	13	22	25	33

Figure 4. The relative differences in the speed of tested movements between the active (A) and inactive (INA) groups

DISCUSSION

The study showed that the inactive group was slower by 23% in locomotion, 17.5% in half-turns and 29% in full turns. In locomotion the differences were greater for locomotion with stopping (27%) than without stopping (20%) the walk. The findings indicate that inactive subjects not only walk slower than active elderly people, but they also initiate locomotive movements in a slower manner. We found greater differences between the active and inactive subjects. Motor activity greatly improves the speed of rotation movements to the left than to the right (greater differences). A detailed analysis showed the greatest difference between the inactive and active women. The inactive women were slower by 30.5% in locomotion and by 40.5% in full turns than their active counterparts. These results indicate that inactivity primarily impairs the psychomotor efficiency in locomotion and performance of rotation movements by women. Our study has shown that an active lifestyle improves the speed of locomotion and rotation movements (significant differences at $p<0.05$). The increase in this speed allows us to be more efficient in daily motor activities. It was found that the locomotion [5] and rotation movement [4] speed had an influence on the balance control ability. The higher the speed, the better the ability is. Faster locomotion and rotation movements allow us to maintain our body in balance easier when performing movements of the whole body. The psychomotor efficiency timer used in the study is a small device and can be located in public health centers as well as in private homes. The timer can measure our locomotion and rotation speed easily and quickly, which is important in daily life. The timer can also be used to improve the speed. The presented study is a part of our wider research on application of a battery of psychomotor tests for evaluation of daily activities.

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