KINEMATIC GAIT VARIABLES OF ELDERLY WOMEN WITH DIFFERENT LEVEL OF PHYSICAL ACTIVITY

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INTRODUCTION: The aging of populations is an international phenomena caused by the decline of birthrate and the progress of medical science. According to WHO individuals older than 65 years in developed countries and older than 60 years in developing countries are considered elderly. The aging process is characterized by the decrease of muscle mass, strength and power, one of the most important reasons for the decrease of functional abilities and the increase of falling risk (Zhong et al., 2007). Nevertheless, physical activity may retard this process. The principal changes in kinematic gait variables are the decrease of gait velocity, stride length and single support time with an increase of double support time (McGibbon,2003). These changes in gait pattern observed in the elderly population may arise from functional declines of aging and may be even more significant in the absence of appropriate regular physical exercises. Considering the higher proportion of women in the elderly population (WHO, 2002), it is important to understand the changes in gait patterns of elderly women related to physical activity. Therefore, the purpose of this study was to identify the effects of different intensities of physical activity on the cinematic gait variables in older women.

METHODS: Forty four women between 65 and 75 years old participated in the study and were divided into three groups: 15 sedentary women, 15 physically active women and 14 athlete swimmers (table 1). The sedentary women did not practice any regular physical exercise, whereas the physically active group participated in a special physical exercise and sport program for elderly (5 times per week at least 30 min of predominant aerobic exercise or 3 times a week vigorous exercise for at least 20 min) according to the recommendation of the ACSM for promotion and maintenance of health of the elderly (NELSON et al, 2007). The athlete swimmers were veterans who still participated in international competitions and they were trained systematically. All subjects were free from any musculoskeletal or neurological disorder in lower limbs, spine and pelvis that could alter their gait pattern.

Table 1. Characteristics of the three investigated groups (mean and sd).

Variables	**Groups** Sedentary (n=15)	Active (n=15)	Athletes (n=14)
Age [years]	69.07 ± 2.84	67.87 ± 3.23	69.64 ± 3,81
Height [m]	1.56 ± 0.10	1.55 ± 0.05	1.58 ± 0.07
Body mass [kg]	61.80 ± 13.04	63.36 ±10.28	62.80 ± 9.49
BMI [kg/m^2]	25.33 ± 3.63	26.05 ± 2.96	25.21 ± 2.75

The GAITRite® walkway system (*MAP/CIR INK, Haverton, PA, USA*) was used to record the following variables over a distance of 5.6 m: Step and stride duration, absolute and normalized velocity which is defined as the ratio between absolute velocity and leg length [leg length/sec], single and double support time, oscillation time, step and stride length, step width, relation between step length and leg length. The participants walked at self-determined speed.

The retest reliability of the applied system has been investigated by different authors and the coefficients are reported to be between .92 and .95 (Menz et al., 2004).

The data were analyzed by one-way ANOVA and non-parametric Kruskal-Wallis tests for those variables that were not normally distributed. If significant differences were found between the groups, the *post hoc* Bonferroni test and the non-parametric Mann-Whitney U test ($p<0.05$) were performed.

RESULTS: The main results are shown in table 2. Significant differences were found between the sedentary women and athletes for gait velocity (p=0.004), step length (p=0.004) and stride length (p=0.003). Between the groups of physically active women and athletes significant differences were found for step length (p=0.004) and stride length (p=0.004). No significant differences were found between all groups for stride frequency, single support time, and double support time. For the investigated variables no significant differences between the sedentary and the physically active groups were identified.

Table 2. Kinematic gait variables of sedentary, active and athlete group (mean and sd).

Variables	Groups Sedentary (n=15)	Active (n=15)	Athletes (n=14)
Step length [cm]	64.94 ± 6.17	67.43 ± 5.41	72.49 ± 4.32
Stride length [cm]	130.04 ± 12.32	134.98 ± 10.86	145.18 ± 8.66
Stride frequency [min^{-1}]	117.81 ± 11.96	121.87 ± 10.28	125.61 ± 8.75
Normalized velocity [leg length/s]	1.52 ± 0.26	1.62 ± 0.18	1.80 ± 0.19
Single support time [s]	0.39 ± 0.04	0.40 ± 0.06	0.38 ± 0.03
Double support time [s]	0.26 ± 0.09	0.25 ± 0.12	0.22 ± 0.08

DISCUSSION: The results of the present study corroborate the findings of Lopopolo et al. (2006) that strength training or aerobic training at high intensity leads to higher gait velocities and corresponding changes of kinematic variables (e.g. step length, step frequency, support times) in the elderly. The activity of the physically active group might also cause physiological and kinematic adaptations (table 2). Nevertheless, these differences between the sedentary and physically active group were not significant. Even though a sample calculation had been performed, a greater number of subjects in each group may result in significant differences between the sedentary and physically active group too.

CONCLUSION: It was concluded that unspecific physical activities at higher intensities, such as configured in the athletes group, result in an increase of gait velocity, step length and stride length compared to sedentary females. The practice of even unspecific regular physical activity should be emphasized for older people in order to improve physical capacities, well-being, quality of life and reduction of accidents during gait.

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