

# EFFECT OF AGE AND GENDER ON BALANCE CAPACITY AFTER SUDDEN PERTURBATION

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**Abstract:** *The goal of research was to analyse the effect of age and gender on dynamic equilibrium ability. The dynamic equilibrium was modelled by sudden unidirectional perturbation. On basis of our research it can be established the gender and age significantly influence the dynamic equilibrium ability.*

**Key words:** *equilibrium ability, perturbation, gender, age.*

## 1. Introduction

Measurement of balance capacity is an important issue for both elderly and young subjects. A high level of complex coordination is required to regain balance after a sudden impulse or a change in direction, either in a static posture or during motion. An unstable oscillatory platform can be used for modelling balance capacity. Our aim was to determine the effects of age and gender on balance capacity after sudden perturbation in 143 healthy subjects.

## 2. Subjects and method

In this research the effect of age and gender was examined in 22 subject between 25-34 yrs, in 20 subjects between 35-44 yrs, 21 subjects between 45-54 yrs, in 20 subjects between 55-64 yrs, 20

subjects 65-69 yrs, in 20 subjects in 70-74 yrs and 20 subjects between 75-80yrs. The body mass index of all subjects was normal ( $25 \leq \text{BMI} \leq 30 \text{ kg/m}^2$ ).

Sudden changes in direction were modelled using the commercially available PosturoMed© device. The motions of the rigid plate of the device were recorded using a ZEBRIS CMS10 ultrasound-based motion analysis system, with single individual markers attached to the side of the rigid plate. The plate has 20mm of translation relative to the medium position and can also be fixed in position by the provocation unit (Figure 1). By releasing the unit, the rigid plate can be set into motion because the platform swings back into its resting position, simulating sudden disturbances during stance. Participants were asked to counterbalance the sudden disturbances

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simulated by the rigid plate, using compensatory equilibrium reactions during double limb and single limb stance. Having a participant stand on the oscillated rigid platform damps the system, a phenomenon which can be characterized by the Lehr's damping ratio ( $D$ , %). To analyse the influence of gender, the two-sample t-test was used, and to analyse the influence of age, the Pearson product-moment correlation coefficient ( $r$ ) was applied. The significance level was  $p \leq 0.05$ .



Fig. 1. *Measurement setup*

### 3. Results

In the comparison between males and females, in all three trials in all age-matched groups the Lehr's damping ratio measured on females significantly higher than the values measured on males. In both males and females, the Lehr's damping ratio significantly decreased with increasing of age in all three trials (Table 1).

### 3. Discussion, Conclusion

Gender significantly influenced balance capacity after sudden perturbation. Women's superior balance capacity can be attributed to better anthropometrical ratios and women having more flexible joints. The significant gender-related differences observed among elderly subjects can be caused by the different decline rates of the motor and sensory systems with age between genders. The decreasing balance capacity associated with advancing age can be attributed to slower muscle response, longer response time and deterioration in vestibular and somatosensory functions.

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*Lehr's damping ratio (D, %) calculated from the provocation test  
 (unidirectional perturbation) results (mean ± SD)*

Table 1

Age	Males			Females		
	<i>stance on both legs</i>	<i>stance on dominant leg</i>	<i>stance on non-dominant leg</i>	<i>stance on both legs</i>	<i>stance on dominant leg</i>	<i>stance on non-dominant leg</i>
25-34 yrs	5.38±0.21	5.29±0.24	4.09±0.13	5.45±0.18	5.39±0.20	4.28±0.14
35-44 yrs	5.31±0.23	5.23±0.21	3.99±0.18	5.31±0.20	5.24±0.24	4.25±0.19
45-54 yrs	5.24±0.24	5.18±0.27	3.79±0.24	5.27±0.24	5.18±0.25	4.14±0.27
55-64 yrs	4.91±0.25	4.82±0.28	3.21±0.38	5.24±0.26	5.12±0.28	3.74±0.28
65-69 yrs	4.63±0.30	4.47±0.29	2.89±0.39	4.97±0.29	4.80±0.30	3.40±0.38
70-74 yrs	4.39±0.31	4.30±0.35	2.71±0.29	4.81±0.34	4.58±0.33	3.21±0.35
75-80 yrs	4.21±0.33	4.14±0.34	2.48±0.41	4.59±0.30	4.48±0.33	2.97±0.36