ANALYSIS OF BIOMECHANICAL PARAMETERS VARIANCE BY WEIGHT FOR ELDERLY WOMEN IN ROMANIA

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The paper presents the results of a fieldwork study conducted in order to analyze the variation of different biomechanical parameters of elderly women in Romania. The study has an exploratory and descriptive nature and uses quantitative methodology. The sample consisted of 100 elderly women from Romania, ranging from 55 to over 75 years of age. The collected data was analyzed using a statistic analysis software program. The analysis of variance demonstrated significant differences across weight groups in terms of biomechanical parameters such as toe off phase and support phase in the case of elderly women.

Keywords: elderly, biomechanical parameters, force platform.

INTRODUCTION

Despite their specific needs, old people are currently constrained to accept the mass footwear that they are offered. Because of their foot deformities, their biomechanical characteristics are different than the rest of the population (Deselnicu *et al*., 2016a) and constitute important indicators for a better understanding and analysis of their particular footwear necessities (Deselnicu *et al*., 2016b; Deselnicu *et al*., 2008). The elderly people, with a lot of illnesses caused by age, are mainly disposed to osteopathy (Galasso *et al*., 2009). In the World Health Organization list of preventive activities, the major place is taken by the relevant orthopedic means, among them choosing and processing the correcting means for the normalization of the deformations of footwear and foot pathologies.

From a mechanical point of view, the human locomotor apparatus represents a complex system of levers acted upon by a force field. The biomechanics studies reveal the nature of these forces, their actions, as well as the loads acting upon the foot and, through it, on the footwear components (Vasilescu *et al*., 2010). These studies are used for offering information for the rational footwear manufacturing (Deselnicu *et al*., 2014), in particular, the shape of the insole, sole or heel. Since footwear represents a necessity nowadays (Zainescu *et al*., 2014), the constructive parameters of the pattern of the footwear product are very important (Mihai *et al*., 2005).

RESEARCH METHODOLOGY

The study used the quantitative methodology and an exploratory and descriptive approach. The research methods which best fit the objective of the study were the biomechanical gait measurement for ground reaction force, the questionnaire-based survey, and observation.

Data Collection

The data was collected in Bucharest over a period of 3 weeks in November 2015. The ground reaction force was measured using AMTI´s AccuGait System (www.amti.biz), with NetForce and NetForce/ BioAnalysis components. The respondents were also applied a short questionnaire consisting of questions referring to anthropometric and demographic data, enquiring about the respondents' age, height, weight and medical conditions.

Research Sample

The sample was composed of 100 elderly women. The main statistic indicators characterizing the sample are presented in Table 1:

Table 1. Statistic indicators for the main demographic and anthropometric parameters

		Height (cm)	Weight (kg)	Age (years)
N	Valid	100	100	100
	Missing	0	0	0
Mean		161.75	72.96	67.05
Median		163.00	71.00	64.00
Mode		165	80	59
Std. Deviation		6.663	11.414	8.916
Minimum		148	50	55
Maximum		184	112	87

Source: SPSS software

The age of the participants varied between 55 to 87 years, with the eldest female subjects (over 71 years) making the most of the sample (34%), followed by the subjects of the 60 – 64 years (27%) and 55 – 59 years (26%) age groups, respectively. The average height of the subjects of the studied sample was 161,75 cm, the average weight was 73 kg and the average age was 67 years.

DATA ANALYSIS AND INTERPRETATION OF RESEARCH RESULTS

Statistical processing of collected data used the statistical software SPSS for Windows, version 19.0, and descriptive and inferential statistical analysis was conducted in the following stages: the statistic summary of relevant information and the analysis of variance. In order to investigate the significant variance of the investigated variables, the participants have been divided into three weight groups, as presented in Figure 1:

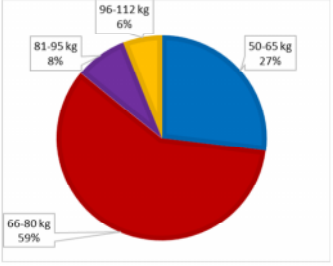

Figure 1. Sample structure by weight

The Analysis of Variance

The authors investigated the variance of the main biomechanical parameters of elderly women across the three weight groups. The most appropriate testing method was considered the One-Way ANOVA, which was performed using the SPSS software. Four working hypotheses were formulated as follows:

H_1: There are statistically significant differences between the three weight groups in terms of the travel speed.
H_2: There are statistically significant differences between the three weight groups in terms of the heel strike.
H_3: There are statistically significant differences between the three weight groups in terms of the toe – off phase.
H_4: There are statistically significant differences between the three weight groups in terms of the support phase.

The null hypotheses stated that there are no differences between the three weight groups in terms of these biomechanical parameters. The results can be consulted in Table 2:

Table 2. One-Way ANOVA test results for the variance of biomechanical parameters across weight groups

		Sum of Squares	df	Mean Square	F	Sig.
Travel speed	Between Groups	,191	3	,064	1,986	,121
	Within Groups	3,078	96	,032		
	Total	3,269	99			
Heel strike	Between Groups	,000	3	,000	,592	,622
	Within Groups	,002	96	,000		
	Total	,002	99			
Toe off phase	Between Groups	,867	3	,289	4,109	,009
	Within Groups	6,750	96	,070		
	Total	7,616	99			
Support phase	Between Groups	,861	3	,287	4,071	,009

Source: SPSS software

As the significance level is 0,121 (p= 0,121) which is greater than the significance level of 0,05 established for this analysis, hypothesis H_1 was rejected. Therefore, the null hypothesis was accepted, stating that there are no statistically significant differences between the three weight groups of elderly women in the investigated sample in terms of the travel speed.

The same decision applies for H_2 also (p= 0,622), resulting that there are no statistically significant differences between the three weight groups of women in terms of the heel strike.

The significance level for hypothesis H_3 is 0,009 (p= 0,009), which is smaller than the significance level of 0,05 established for the ANOVA analysis. Hypothesis H_3 was

therefore accepted, confirming that there are statistically significant differences between the three weight groups in terms of the toe off phase. Consequently, the null hypothesis was rejected.

The significance level for hypothesis H_4 is also 0,009 (p= 0,009) smaller than the significance level of 0,05 established for the analysis. This recommends that the working hypothesis H_3 should be accepted, confirming that there are statistically significant differences between the three weight groups of elderly women in the investigated sample in terms of the support phase.

As expected, weight is one of the most important factors that causes variations to the biomechanical parameters of elderly women.

CONCLUSIONS

In this research, the authors conducted a study in order to investigate the variance of various biomechanical parameters of elderly women across three weight groups. Four working hypotheses were formulated and tested using thee One – Way ANOVA test.

Following the testing, the first hypothesis H_1 was rejected, determining that there are no statistically significant differences between the three weight groups in terms of the travel speed.

Hypothesis H_2 was also rejected, showing that there are no significant differences between the three weight groups of elderly women in the investigated sample in terms of heel strike.

The working hypothesis H_3 was accepted, confirming that there are statistically significant differences between the three weight groups of elderly women in the investigated sample in terms of the toe-off phase.

Hypothesis H_4 was also accepted, confirming that there are statistically significant differences between the three weight groups of elderly women in the investigated sample in terms of the support phase.

Therefore, weight proved to be an important factor that influences important biomechanical parameters in the case of elderly women. Such biomechanical indicators include the toe off phase and support phase, while the travel speed and heel strike are not affected by the variation of subjects' weight.

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