Gait Variability and Quality of Life in Postmenopausal Women

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1 OBJECTIVES

The study of gait variability offers a complementary way of quantifying locomotion and its changes with aging (Hausdorff, 2005) and may contribute to improving the quality of life of women after menopause. The aim of this study was to describe gait variability at usual walking speed in postmenopausal women and to evaluate the influence of this variability in the quality of life.

2 METHODS

2.1 Subjects

The sample include 31 postmenopausal women physically active. Before inclusion in the study the reproductive and medical history of each woman was collected and the following inclusion criteria been observed: (a) absence of premature menopause (Shuster et al., 2010); (b) nonexistence of acute pain or foot deformities; (c) no surgery of the lower limbs as the application of prosthesis of the hip, knee or foot; (d) absence of visual and auditory disorders that may compromise the testing and; (e) no peripheral neuropathy related to diabetes. The marked discrepancy in the length of legs and the presence of cognitive impairment were considered exclusion criteria of the study. The survey was conducted in accordance with the Declaration of Helsinki (WMA, 2013) and approved by University of Trás-os-Montes and Alto Douro. An informative written consent was obtained from each participant.

2.2 Procedures

Quality of life was measured using the Menopause-Specific Quality of Life (MENQOL) questionnaire (Hilditch et al., 1996). This questionnaire is a 29-item validated instrument that assesses the effects of the items, divided into 4 domains, physical (16 items/11-26), vasomotor (3 items/1-3), psychosocial (7 items/4-10) and sexual (3 items/27-29) on quality of life in postmenopausal women. The reliability of this questionnaire was evaluated in Portuguese postmenopausal women by Serrão (2004). Mini Mental State was used to assess the cognitive state of participants (Folstein et al., 1975).

Height (H) was determined by a stadiometer (SECA 220, Seca Corporation, Hamburg, Germany) and trochanteric height (right and left limb) was evaluated with the segmometer (Rosscraft, Blaine, USA), being complied with the procedures described in the literature (Heyward & Wagner, 2004). The body mass index (BMI) was calculated using the formula: BMI (kg/m^2) = W/H^2.

Gait data were collected using a portable wireless system of inertial sensors (BTS G-WALK; BTS Bioengineering Corp., Brooklyn NY, USA), with sample rate of 100 Hz, that when positioned around the patient's waist (on L5 vertebrae) allows for a valid, reliable and accurate functional gait analysis (Bugane et al., 2012). The subjects were asked to stand up and remain in the up-right posture for a few seconds, and then to walk barefoot along a 9-m horizontal pathway, at a self-selected speed. This entailed 9–10 steps, according to the subject's natural cadence; the central three, for the right and left full gait cycles, were analysed. Six trials were collected for each participant. From the collected

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signals, spatial-temporal gait parameters are then obtained.

2.3 Intra-Individual Variability

The Coefficients of Variation (COV), was used to quantify the intra-individual variability of the spatial-temporal gait parameters obtained. Both right and left gait parameters were used because they were not statistically different. The COV, [Standard Deviation (SD) / mean] 100%, was determined over the six successive trials to express the percentage variation in a subjects' gait between successive trials.

3 RESULTS

The Table 1 express the descriptive analysis of the data.

Table 1: Descriptive analysis of age, time since menopause, quality of life and anthropometric parameters. (n=31).

Variables	*Mean±SD*	*Range*
Age (years)	61.20±4.96	52.61 – 72.56
Time of Menopause (years)	12.61±6.45	12.61 – 28.00
Anthropometry		
Weight (kg)	65.88±8.41	44.87 – 83.38
Height (m)	1.56±0.04	1.45 – 1.63
Body Mass Index (kg/m^2)	27.02±3.37	19.01 – 33.83
Quality of Life		
Total of Scale (points)	80.87±27.94	33.00 – 150.00

The spatio-temporal gait parameters are shown in Table 2.

Table 2: Descriptive analysis of the spatio-temporal gait parameters.

Spatio-Temporal Gait Parameters	*Mean±SD*	*Range*
Speed (m/s)	1.58±0.27	1.02 – 2.03
Cadence (steps/min)	113.65±7.80	98.61 –133.89
Stride Length (m)	1.53±0.21	1.10 – 1.92
Stride Length/Height (%)	97.60±12.96	67.92 –121.19
Stride Duration (sec)	1.06±0.07	0.90 – 1.20
Stance Phase Duration (%)	63.26±2.55	58.37 – 69.34
Swing Phase Duration (%)	36.74±2.55	30.66 – 41.63
Double Support Duration (%)	13.36±2.45	8.30 – 18.60
Single Support Duration (%)	36.76±2.32	32.12 – 41.72
Single Support Slope (º)	7.32±1.25	4.96 – 10.41
Variability of Speed (%)	24.07±6.51	7.11 – 35.54
Variability of Cadence (%)	3.45±1.18	1.44 – 6-01
Variability of Stride Length (%)	21.06±5.97	8.31 – 31.82
Variability of Stride Length/Height (%)	21.06±5.97	8.29 – 31.81
Variability of Stride Duration (%)	3.60±1.14	1.47 – 6.44
Variability of Stance Phase Duration (%)	2.85±1.41	1.01 – 7.09
Variability of Swing Phase Duration (%)	5.12±3.07	1.65 – 14.62
Variability of Double Support Duration (%)	12.12±5.39	4.14 – 24.73
Variability of Single Support Duration (%)	5.38±3.18	1.49 – 14.15
Variability of Single Support Slope (%)	14.44±6.36	5.28 – 29.30

The correlations of spatial-temporal parameters of walking with the quality of life is shown in Table 3.

Table 3: Correlation of spatio-temporal gait parameters with the total scale for assessing quality of life.

Spatio-Temporal Gait Parameters	*Correlation*
Speed (m/s)	-0.40*
Cadence (steps/min)	-0.65**
Stride Length (m)	-0.24
Stride Length/Height (%)	-0.24
Gait Cycle Duration (sec)	0.68**
Stance Phase Duration (%)	0.33
Swing Phase Duration (%)	-0.33
Double Support Duration (%)	0.31
Single Support Duration (%)	-0.31
Single Support Slope (º)	-0.28
Variability of Speed (%)	-0.08
Variability of Cadence (%)	0.47**
Variability of Stride Length (%)	-0.13
Variability of Stride Length/Height (%)	-0.13
Variability of Stride Duration (%)	0.40*
Variability of Stance Phase Duration (%)	0.44*
Variability of Swing Phase Duration (%)	0.47**
Variability of Double Support Duration (%)	0.21
Variability of Single Support Duration (%)	0.40*
Variability of Single Support Slope (%)	0.25

*p≤ 0.05, **p≤ 0.01

4 DISCUSSION

There is a "younger" behaviour of the sample of this study. The positive association between quality of life and variability of spatio-temporal gait parameters which have small variability should be investigated in future studies examining stability of performance in activities of daily living to avoid the falls. Therefore, is necessary a theoretical framework to understand those results.

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