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VALIDITY OF A MARKERLESS 3D MOTION ANALYSIS SYSTEM FOR ASSESSING GAIT KINEMATICS IN ACTIVE OLDER PEOPLE: THE INFLUENCE OF CLOTHING

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1 INTRODUCTION

Gait studies are crucial for understanding movement changes due to normal aging [1]. Quantitative gait analysis methods can be invasive or non-invasive and markerless systems have emerged as a promising approach since they allow the collection of data in the field using everyday clothing [2].

The determination of 3D bone POSE in a markerless system is based on deep-learning algorithms applied to image-processing techniques and thus, may be affected by subjects' clothing. Specifically, loose clothing, such as long trousers or overlapping garments, can interfere with the accuracy of the data collected [3, 4]. The aim of this study is therefore to verify the influence of the clothing worn on sagittal plane lower limb joint ranges of motion, obtained using a markerless system, during gait in healthy older people [1].

2 METHODS

The study used an observational cross-sectional design with a sample of 30 active and healthy elderly participants aged 65 or older. The exclusion criteria involved any medical conditions, medications or impairments that could affect walking ability. Data collection began with questionnaires and cognitive assessments, followed by gait analysis in a laboratory. Gait data collection was performed using 8 Miqus cameras (Qualysis, SE) at 85Hz. Participants walked back and forth on a 12-meter walkway twice, once using self-selected clothing and once using minimal clothing.

Markerless video data (8 cycles from each subject) were processed with Theia3D (Markerless Inc, CA, v2023,1,0,310), using an IK 3D pose estimation (8Hz filter). Joint angles were calculated using an XYZ Cardan sequence for the lower limbs and ZYX for the pelvis in Visual 3D (Has-Motion, Inc, CA). The Range of motion (ROM) in the sagittal plane was computed for both conditions (self-selected clothing and minimal clothing). The absolute difference between conditions was also computed.

3 RESULTS

Differences between clothing conditions were all inferior to 3º. The highest differences were found for ankle ROM in the sagittal plane (**Table 1**).

Table 1 ROM of each lower-limb joint. ROM: Range of Motion.

	MINIMAL CLOTHING		SELF-SELECTED CLOTHING		DIFFERENCE
	MEAN	STD	MEAN	STD	
HIP ROM SAG PLANE	47,0	4,0	47,5	4,6	-0,6
KNEE ROM SAG PLANE	62,7	3,0	62,3	3,7	0,5
ANKLE ROM SAG PLANE	28,0	3,8	30,6	4,3	-2,5

4 DISCUSSION AND CONCLUSIONS

In this study, the influence of clothing on lower limb ROM during gait analysis in active older people was evaluated using a markerless system. The results showed that differences between self-selected and minimal clothing conditions were minimal, with all variations in joint ROM being less than 3º. Given that previous studies have considered errors below 5º acceptable [5], these findings suggest that the type of clothing worn does not significantly impact the accuracy of gait measurements in active older individuals. Therefore, markerless systems can be effectively used in real-world conditions with everyday clothing.

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