

Older Adults Vs Middle-Aged Adults: Heel Velocity

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ABSTRACT—The objective of the present study was to evaluate heel contact velocity of middle-age adults and older adults. Ten adults (5 middle age adults and 5 older adults) were recruited from a local community. They were all physically healthy and not injured in the last 6 months. Their heel position data were collected during subsequent 5-minute walking on a straight track (15m long). The results indicated that heel contact velocity of middle-age adults were faster than that of older adults during their natural gait. The study concluded that middle-age adults' heel contact velocity could be faster suggesting that their slip propensity could be higher compared to older adults while walking on a leveled floor.

Keywords—HCV, Middle age, Older, Foot force

I. INTRODUCTION

For adults over 65 years of age, slips and falls are major health threat due to their dreadful effects of the quality of their life [1].

Older adults with falls experiences tended to be the bed-bound and subsequently performed less daily activities such as house works or/and family care [1]. And, they were less likely to participate in social activity resulting in functional and physical declines [2].

Horizontal foot force (shear force, F_h) at heel contact may be a cross product of foot mass and foot's horizontal acceleration. With a given body mass and the constant contact time during the heel contact phase of a gait cycle, horizontal heel contact velocity would be directly proportional to horizontal foot force (impulse-momentum relationship [3]). Heel slips or foot slips happened if the horizontal foot force was larger than the available friction of the floor at the heel contact phase of a gait cycle [4].

Age-associated muscular strength reduction was found [5]. Center for Disease Control(CDC) suggested that middle-age adults were vulnerable to injuries [6]. Middle-age adults were found to be at a higher risk of musculoskeletal injuries compared to older adults [7].

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There have been a little study looking in the heel contact velocity of middle-age adults even though middle-age adults were very vulnerable to adult disease and muscular skeletal diseases such as obesity, high blood pressure, diabetes, MSDs etc.

The present study was to compare heel contact velocity of older adults to that of middle-age adults.

II. METHOD

A. Participants

Ten adults from local community participated. Five were classified in older adults and another five were classified in middle-age adults. They were recruited from a local community.

They had no history of musculoskeletal injuries in the previous 6 months prior to the examinations. Older adults were all over 65 years of age and middle-age adults ranged from 40 to 51 years of age (Table 1).

Table 1: Age, Height, Weight of Two Groups

Group	Age(years)	Height(cm)	Weight(kg)
Middle-age	46.5	179.2	78.7
Older	71.3	176.6	73.4

B. Procedure

One heel marker was place on the skin at the calcaneus bone of the right foot. They were instructed to initiate walking by standing with feet together. In order for examiners to access proper heel contact velocity of all adults, a force plate was used to identify the heel-contact instance during a gait cycle.

The position data of the heel marker was evaluated using eight-camera Prime 17W system (NaturalPoint, Inc, DBA Optitrack). Position data were sampled and recorded at 120Hz. Ground reaction forces during heel contact phase were sampled at a rate of 1200Hz.

They walked for about 5 minutes. When their right feet consistently stroke on the force plate, position data were collected for 1 seconds. They were instructed to walk as natural as possible.

C. Heel contact velocity

The heel contact was identified when the vertical ground reaction force from a force plate (AMTI, #4767, Type OR-6-7-1000, AMTI, INC. USA) was larger than 7 newton. The instant horizontal heel contact velocity(HCV) was computed using the formula:

$$HCV = [X_{(i+1)} - X_{(i-1)}] / 2 \Delta t$$

X: heel position in horizontal direction

i: frame number

III. RESULTS

One-way ANOVA results suggested that there was a significant difference (p=0.02, F=7.7, Table 2) in HCV between older adults and middle-age adults. The results indicated that HCV in middle age adults was higher than that in older adults (Figure 1).

Table 2: Data and ANOVA Summary in HCV of Two Groups

Data Summary			
Groups	N	Mean	SD
Middle-Age Adults	5	87.84	14.00
Older Adults	5	64.29	12.88

ANOVA Summary					
Source	Degrees of Freedom	Sum of Squares	Mean Square	F-Stat	P-Value
	DF	SS	MS		
Between Groups	1	1386.04	1386.04	7.65	0.024
Within Groups	8	1449.17	181.146		
Total:	9	2835.2			

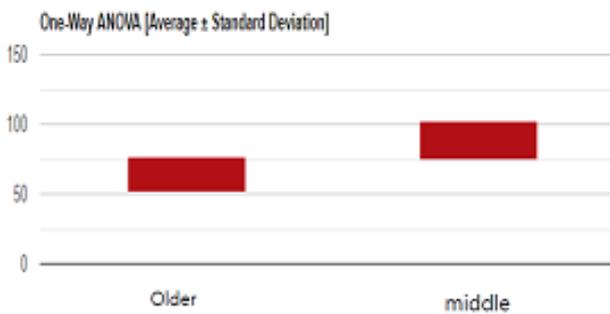


Fig 1: One-Way ANOVA (Mean and SD)

IV. DISCUSSION

The study objective was to compare HCV between middle age adults and older adults while walking on the leveled floor. Leg strength measures from a previous study suggested that middle age adults were not different from older adults [6]. The results from the study [6] may be suggesting that middle age adults' HCV should be similar to older adults' HCV because muscular strength should be

proportionally associated with HCV [8,9]. In the present study, HCVs of middle age adults were higher than that of older adults. This could suggest that leg muscular strength level was not the only factor in predicting HCV while walking. In future, there should be some study looking into factors influencing HCV.

V. CONCLUSION

The study concluded that middle age adults' HCV was not different from older adults' HCV.

VI. RESEARCH QUESTION

1. What will be other factors influencing HCV velocity besides age factor?
2. Why middle-age adults' HCV is higher than older adults?
3. Will middle-age adults' slip propensity be higher than older adults?

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