

Japanese elderly persons walk faster than non-Asian elderly persons: a meta-regression analysis

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Abstract. [Purpose] The purpose of this study was to clarify ethnic differences in walking speed by comparing walking speed in both Japanese and non-Asian elderly individuals and to investigate the necessity of consideration of ethnic differences in walking speed. [Subjects and Methods] Articles that reported comfortable walking speeds for community-dwelling elderly individuals were identified from electronic databases. Articles that involved community-dwelling individuals who were 60 years old or older and well functioning were included in the study. Articles that involved Asians were excluded. Weighted means for 5-m walking times were calculated as walking speeds from the Japanese and non-Asian sample data. The effects of age, gender, and ethnicity on 5-m walking times were then investigated using meta-regression analysis. [Results] Twenty studies (34 groups) were included for Japanese, and 16 studies (28 groups) were included for non-Asians. The weighted mean 5-m walking time was estimated to be 4.15 sec (95% confidence interval [CI]: 3.87–4.44) for Japanese and 4.24 sec (95% CI: 4.09–4.40) for non-Asians. Furthermore, using meta-regression analysis adjusted for age and gender, the 5-m walking time was 0.40 sec faster (95% CI: 0.03–0.77) for Japanese than for non-Asian elderly individuals. [Conclusion] Walking speed appeared faster for Japanese community-dwelling elderly individuals than for non-Asian elderly individuals.

Key words: Meta-regression analysis, Walking speed, Ethnicity

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INTRODUCTION

Measurement of walking speed has been widely used to evaluate the physical function of elderly individuals. In addition, walking speed is an index that can predict falls¹⁾, decreased activities of daily living (ADLs)²⁾, and life expectancy³⁾ in the elderly; it has also been recently used as one of the diagnostic criteria for sarcopenia^{4, 5)}. Therefore, walking speed is a useful and convenient index that accurately reflects the health status of elderly individuals.

To evaluate the walking speed of the elderly in the clinical setting, walking speed reference values are required; this has been investigated in previous studies^{6–8)}. Although ethnic differences have been suspected in physical function measures for the elderly such as walking speed⁹⁾, no ethnic differences have been identified in previously reported reference values^{6–8)}, and studies that address this issue have been insufficient. Therefore, whether ethnic differences exist in the walking speed of the elderly currently remains unclear. If ethnic differences in walking speed do exist, walking speed

reference values that take ethnicity into account are needed.

The purpose of this study was to clarify ethnic differences in walking speed by comparing walking speed in both Japanese and non-Asian elderly individuals such as black, white and Hispanic individuals and to investigate the necessity of consideration of ethnic differences in walking speed.

SUBJECTS AND METHODS

In this study, relevant research articles that reported data on walking speeds of community-dwelling elderly individuals were retrieved from electronic databases, and a systematic review that reported walking speed reference values. For relevant research articles, peer-reviewed articles published until December 2011 that reported data for 5-m or 10-m walking times were searched. Data for walking speed measured under comfortable conditions were collected for further statistical analysis. In order to obtain sufficient data for analysis, articles on walking speed were identified using different search strategies for Japanese and non-Asian elderly individuals.

For articles on the walking speed of Japanese elderly individuals, relevant research articles were identified from the MEDLINE, EMBASE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Igaku Chuo Zasshi (ICHUSHI) electronic databases. The terms “gait speed/Hokou Sokudo (in Japanese),” “gait velocity,” “walking speed,” “walking velocity,” “walking time/Hokou Jikan

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(in Japanese),” and “elderly/*Koureisha* (in Japanese)” were used in combination in the search. Retrieved articles were examined based on the following inclusion criteria: 1) the articles involved Japanese people; 2) the articles involved community-dwelling individuals who were 60 years old or older; 3) the articles involved well-functioning individuals; 4) the articles did not involve frail elderly individuals or patients who had specific diseases such as neuromuscular disease and hip fracture; and 5) the articles described the sample size, mean, and standard deviation (SD) for walking time or speed measured under comfortable conditions. Well-functioning individuals were defined as those independent in ADLs and instrumental ADLs (IADLs); independence of subjects in ADLs and IADLs was judged from descriptions in the text.

For articles about non-Asian elderly individuals, relevant research articles were identified from electronic databases (PubMed and CINAHL) and systematic reviews that reported walking speed reference values. For database searching, the terms “gait speed”, “walking speed”, “normal”, “comfortable”, “usual”, “preferred”, and “self-selected” were used in combination. The inclusion criteria for non-Asian individuals were the same as those described above. In addition, articles that involved Asians, such as Chinese and Koreans, were excluded because these individuals may share similar characteristics with Japanese individuals.

After articles were identified, their titles and abstracts were screened, and articles not related to the main purpose of this study were excluded. The full texts of articles that passed the screening evaluation were then reviewed, and those that fulfilled the inclusion criteria were included. The retrieved articles were examined by two reviewers (MA, NK). The relevant research articles were summarized to obtain the source of the article, information on participants (age, gender, ethnicity [Japanese or non-Asian]), sample size, and means and SDs for 5-m or 10-m walking times. All information was tabulated and entered into a computer database. When multiple 5-m or 10-m walking times were reported in an article (e.g., data were reported by gender or data were reported by age group), the data of each group were entered into the database.

All walking time data that fulfilled the inclusion criteria were converted into 5-m walking times. If articles reported data on 10-m walking times, the data were divided by two and converted into 5-m walking times; this method was adopted according to methodology reported previously⁶⁾. The weighted means and 95% confidence intervals (CIs) of the 5-m walking time were calculated for both the Japanese sample data and the non-Asian sample data, using a random effects model. The weighted means were calculated by the DerSimonian-Laird method. The 95% CI values were calculated using the Knapp and Hartung adjustment. Furthermore, the effects of age, gender, and ethnicity (Japanese or non-Asian) on the reference values for the 5-m walking time were analyzed by meta-regression analysis. In the meta-regression analysis, 5-m walking time was the dependent variable, ethnicity (Japanese or non-Asian) was the independent variable, and age and gender were the adjusted variables. Statistical analysis was performed using the R programming language and environment (version 3.0.1)¹⁰⁾

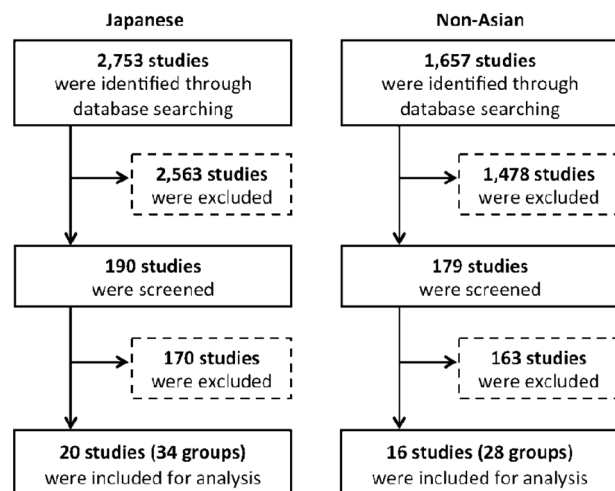


Fig. 1. Flow chart regarding selection of relevant research articles for meta-regression analysis

and the R package metafor (version 1.9-0)¹¹⁾. The significance level was set at 5%.

RESULTS

A total of 2,753 articles that contained data on Japanese elderly individuals were identified from electronic database searches. However, after checking the titles and abstracts, 2,563 articles that did not fulfill the inclusion criteria were excluded. After checking the full texts, 170 articles that were found to not fulfill the inclusion criteria were further excluded. Thus, 20 articles (34 groups)^{12–31)} were included in the meta-analysis for estimating the 5-m walking time of Japanese elderly individuals (Fig. 1). Studies with Japanese data involved 6,704 subjects (1,644 males, 4,481 females, 579 gender unknown; mean age range 65.7–81.4 years). The weighted mean 5-m walking time in Japanese individuals was estimated to be 4.15 sec (95% CI: 3.87–4.44 sec) (Table 1).

A total of 1,657 articles from electronic databases and systematic reviews were identified as containing data on non-Asian elderly individuals. However, after checking the titles and abstracts, 1,478 articles that did not fulfill the inclusion criteria were excluded. After checking the full texts, 163 articles that were found to not fulfill the inclusion criteria were further excluded. Thus, 16 articles (28 groups)^{32–47)} were included in the meta-analysis for estimating the 5-m walking time of elderly non-Asian individuals (Fig. 1). Studies with non-Asian data involved 12,322 subjects (2,580 males, 3,018 females; 6,724 gender unknown; mean age range 69.6–83.6 years). The weighted mean 5-m walking time of non-Asian individuals was estimated to be 4.24 sec (95% CI: 4.09–4.40 sec) (Table 1).

The distributions of age and gender differed in the Japanese elderly and non-Asian elderly samples. To adjust for the effects of age and gender, an estimate of the true difference in 5-m walking time between Japanese and non-Asian elderly individuals was necessary. Therefore, meta-regression analysis adjusted for age and gender was used to examine

Table 1. Characteristics of participants and weighted mean 5-m walking times (estimated by random effect model) in Japanese and non-Asians

	Japanese	non-Asians
Subjects	6,704 (1,644 males, 4,481 females, 579 gender unknown)	12,322 (2,580 males, 3,018 females, 6,724 gender unknown)
Mean age range	65.7–81.4 years	69.6–83.6 years
Weighted mean 5-m walking time [95% CI]	4.15 [3.87–4.44] sec	4.24 [4.09–4.40] sec

* $p < 0.05$ **Table 2.** Comparison between Japanese and non-Asian elderly individuals using meta-regression analysis

Variables	Unstandardized partial regression coefficient	95% CI
Intercept	-7.806 *	-11.601 to -4.011
Ethnicity (non-Asian)	0.402 *	0.031 to 0.773
Age	0.155 *	0.104 to 0.206
Gender (females)	0.377 *	0.054 to 0.699

* $p < 0.05$

Test for residual heterogeneity: QE (df = 28) = 1,205.8445 *

Dependent variable: 5-m walking time

Independent variable: ethnicity (as a dummy variable, Japanese=0 and non-Asian=1)

Adjusted variable: age and gender (as a dummy variable, males=0 and females=1)

the difference in 5-m walking times between Japanese and non-Asian elderly individuals. As result of meta-regression analysis, ethnicity (Japanese or non-Asian) was found to be significantly associated with 5-m walking time, adjusted for age and gender ($p < 0.05$). From the partial regression coefficient, the 5-m walking time of Japanese elderly individuals was 0.40 sec (95% CI: 0.03–0.77 sec) faster than that of non-Asian individuals (Table 2).

DISCUSSION

The goal of this study was to clarify ethnic differences in walking speed by comparing walking speed of both Japanese and non-Asian community-dwelling elderly individuals using meta-regression analysis. First, the weighted means of comfortable 5-m walking times were calculated for both Japanese and non-Asian elderly individuals using a random effects model. The difference in 5-m walking times between Japanese and non-Asian elderly individuals was approximately 0.09 seconds (4.15 sec for Japanese versus 4.24 sec for non-Asians). The 5-m walking time in Japanese elderly individuals tended to be faster than in non-Asian elderly individuals. Furthermore, using meta-regression analysis adjusted for age and gender, a significant difference in walking speed between Japanese and non-Asians was found. This result suggests that ethnic differences do exist in walking speed when adjusted for age and gender. A difference between Japanese and non-Asian (African Americans and Caucasians) elderly individuals has also been observed in the Timed Up and Go (TUG) test⁴⁸, a type of physical performance test. It was suggested in a previous study that

physical function shows ethnic differences⁹). The present results are in agreement with that previous study, and we therefore concluded that there is an ethnic difference in the 5-m walking time.

The difference in 5-m walking times between Japanese and non-Asian elderly individuals was 0.4 seconds. Morita et al. reported that the difference in 5-m walking time between individuals who experienced a fall and those who did not experience a fall was approximately 0.5 seconds in community-dwelling Japanese elderly⁴⁹). In addition, Shinkai et al. showed that the risk of ADL impairment was increased by a difference of approximately 0.4 seconds in 5-m walking time in a prospective cohort study of community-dwelling Japanese elderly individuals⁵⁰). Therefore, a difference of 0.4 seconds in 5-m walking time cannot be ignored.

The cause of ethnic differences in 5-m walking times could not be clarified based on the data and analyses of the present study. However, based on a previous study that suggested ethnic differences in the TUG test, some possible causes can be suggested⁴⁸). First, differences in body composition between Japanese and non-Asian individuals may be the cause of the ethnic difference. Takasaki et al. reported that fat-free mass density was possibly lower in Caucasians than in Japanese⁵¹). Since fat-free mass is strongly associated with whole body muscle mass, the generation of strength and power while walking may also be affected. Second, lifestyle may cause ethnic differences in 5-m walking times. For example, many Japanese elderly individuals sleep on a futon on tatami mats; this requires independent standing from the floor in everyday life. Therefore, use of a futon or tatami mats in everyday life may contribute to the development of

balance and lower limb function, and it may explain ethnic differences in 5-m walking times. In fact, Japanese elderly individuals who sleep on futons have a lower hip fracture risk than Japanese elderly people who sleep on a Western-type bed⁵²).

It was not possible to identify the results among black, white, Hispanic, and other peoples with regard to the sample of non-Asian elderly individuals in the present study, as sufficient information on ethnic groups in the relevant research articles could not be obtained. Therefore, data from non-Asian elderly individuals were consolidated as one group in this study. Though a difference in 5-m walking times between Japanese and non-Asian individuals was found, differences among black, white, Hispanic, and other peoples could not be assessed. Further, we cannot clarify whether differences in 5-m walking time among Asian elderly individuals exist or not; thus, these are limitations of the present study. In addition, ethnic differences in 5-m walking time at a comfortable pace were investigated in the present study. However, 5-m walking time at maximum effort is also measured in the clinical setting. In fact, maximum walking speed has been suggested to be closely related to bone strength in postmenopausal females⁵³). Therefore, in addition to comfortable walking speed, maximum walking speed is also a useful index. However, the presence of ethnic differences in 5-m walking times at maximum effort could be inferred from the data of the present study. Therefore, whether similar ethnic differences exist for walking speed at maximum effort is as yet unknown, and this is also a limitation of this study.

In conclusion, walking speed in Japanese community-dwelling elderly individuals appears to be faster than that for non-Asian community-dwelling elderly individuals. The present results thus demonstrate the existence of ethnic differences in walking speed between Japanese and non-Asian community-dwelling elderly individuals. Currently, with regard to diagnosis of sarcopenia, the same walking speed cutoff points are applied to both Asians and Europeans^{4, 5}). The results of this study suggest that careful consideration of ethnic differences is necessary for assessment of walking speed. When walking speed is measured to assess physical function in the elderly, consideration of ethnic differences may be necessary to estimate reference values. Walking speed reference values therefore need to be determined for each ethnic group.

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