International Journal of Gerontology xxx (2018) 1–5

Contents lists available at ScienceDirect

International Journal of Gerontology

journal homepage: www.ijge-online.com

Original Article

Correlation between Body Composition and Physical Performance in Aged People

Shih-Wei Huang [a, b, f, 1], Feng-Chi Hsieh [c, 1], Li-Fong Lin [a, g], Chun-De Liao [a, h], Jan-Wen Ku [d], Dun-Jen Hsiao [e], Tsan-Hon Liou [a, b *]

[a] Department of Physical Medicine and Rehabilitation, Shuang Ho Hospital, Taipei Medical University, Taipei, Taiwan, [b] Department of Physical Medicine and Rehabilitation, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan, [c] Department of Radiology, Yuan's General Hospital, Kaohsiung, Taiwan, [d] Department of Radiology, Shuang Ho Hospital, Taipei Medical University, Taipei, Taiwan, [e] School of Nutrition and Health Sciences, College of Nutrition, Taipei Medical University, Taipei, Taiwan, [f] Graduate Institute of Sports Science, National Taiwan Sport University, Taoyuan, Taiwan, [g] School of Gerontology and Health Management, Taipei Medical University, Taipei, Taiwan, [h] School and Graduate Institute of Physical Therapy, College of Medicine, National Taiwan University, Taiwan

ARTICLE INFO

Article history:
Received 11 October 2017
Received in revised form
23 January 2018
Accepted 9 February 2018
Available online xxx

Keywords:
aged population,
dual-energy X-ray absorptiometry,
bioelectrical impedance analysis,
physical performance,
association

SUMMARY

Background: With age, body composition often changes with functional limitations in elderly adults. What kind of body composition evaluation method had better correlation with physical capacity is unclear. The aim of this study was to investigate the correlation between body composition and physical capacity aged people.

Methods: 56 males (mean age, 63.60 ± 7.24 years) and 64 females (mean age, 63.27 ± 7.23 years) were enrolled in this cross-sectional study during January and December 2016. Body composition was measured by dual-energy X-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA). Physical performance was evaluated using the timed up-and-go, open eye single-leg stance, timed chair-rise, and 10-m walk speed tests. The association was analysed by Pearson test.

Results: In elderly female participants, the fat percentage obtained using DXA was found to be associated with the single-leg stance ($r = -0.306$, $p < 0.05$), timed chair-rise ($r = -0.318$, $p < 0.05$), and timed up-and-go ($r = 0.252$, $p < 0.05$) test results. Moreover, lean mass percentage obtained using DXA was associated with the single-leg stance ($r = 0.312$, $p < 0.05$) and timed chair-rise ($r = 0.294$, $p < 0.05$) tests. But no association was found between BIA body composition and physical performance. The body composition by BIA and DXA were unassociated with physical performance in male and total participants.

Conclusions: DXA analysis for body fat percentage is negatively associated and muscle mass percentage is positively associated with physical capacity in women older than 50 years, but not in their male counterparts.

1. Introduction

Body composition often changes with age, and previous studies have indicated that despite no change in body weight and physical activity, increased fat and decreased lean mass can be observed.[1] These changes in body composition with age could lead to functional limitations in the elderly adults.[2] Moreover, they can restrict daily activity participation and the ability to perform self-care tasks, thus leading to dependence. Therefore, elucidating the correlation between body composition and physical capacity in elderly people is essential.

To accurately estimate the body composition, various methods, such as magnetic resonance imaging (MRI), computed tomography (CT), dual-energy X-ray absorptiometry (DXA), and bioelectrical impedance analysis (BIA), have used.[3] However, MRI and CT are expensive and time-consuming. In addition, DXA is considered a gold standard measurement tool for body composition, particularly for fat and lean mass evaluation. BIA is considered one of the most practical methods for estimating body composition in different groups because of its ready accessibility, low cost, quick assessment

* Corresponding author. Department of Physical Medicine and Rehabilitation, Shuang Ho Hospital, Taipei Medical University, 291 Jhongjheng Rd, Jhonghe, New Taipei City, 235, Taiwan.
E-mail address: peter_liou@s.tmu.edu.tw (T.-H. Liou).

[1] Shih-Wei Huang and Feng-Chi Hsieh contributed equally to this work.

https://doi.org/10.1016/j.ijge.2018.02.011

Please cite this article in press as: Huang S-W, et al., Correlation between Body Composition and Physical Performance in Aged People, International Journal of Gerontology (2018), https://doi.org/10.1016/j.ijge.2018.02.011

procedures, and high validity against DXA as the reference method.[4] Besides, a recent study applied a leg-to-leg bioelectrical impedance analyser to estimate with abdominal visceral fat of the elderly, and they found highly positive correlated to CT scanning in Chinese elderly individuals.[5] Based on above reason, we choose BIA and DEXA for evaluation of body composition in this study.

Which body composition parameter changes and its impact on the physical capacity of elderly people remains debatable. With population ageing and the associated functional impairments and disability concerns, it is important to determine the influence of body composition changes and their correlations with physical function before frailty. As best of our knowledge, there was no relevant data of physical capacity and body composition among healthy elderly people in Taiwan. Based on above reason, we conducted a cross-sectional study to investigate the gender difference in the correlation between body composition and physical capacity in elderly people. Besides, which body composition evaluation is better associated with physical performance of elderly people is not well investigated. The secondary aim of our study was to analyse the association of physical capacity by BIA or DXA body composition assessment among different gender elderly people.

2. Methods

2.1. Participants and study design

The study participants were recruited from the local community around a university hospital in Taipei. The inclusion criteria were as follows: older than 50 years and younger than 80 years, living in community (not institutionalised), and independence in activities of daily living. The exclusion criteria were a history of severe musculoskeletal disorders or previous receipt of arthroplasty and artificial implants, which can influence the body composition due to muscle wasting; a history of endocrine disorders such as hypothyroidism and hyperthyroidism; current steroid use (in recent 6 months); a history of neurological injuries; and no tolerance for the physical capacity evaluation in this study. To account for the influence of sex and age on body composition in this cross-sectional study, we recruited 120 participants during January to December 2016. Body composition was measured through BIA and DXA. Physical capacity was evaluated using the single-leg stance test with or without the eyes closed, the number of sit-to-stand and stand-to-sit cycles in 30 s, timed-up-and-go test, and a 10-m walk test. This study was approved by the Institution Review Board of Taipei Medical University (IRB No. N201602035) and met the STROBE study guideline of cross-sectional studies. All the study procedures were explained to the participants before they signed an informed consent declaration.

2.2. Body composition evaluation

Initially, we measured the body composition of the participants with an eight-polar BIA device with a multifrequency current applied (Inbody™ 220, Biospace, Seoul, South Korea). The impedance was evaluated by applying two frequencies (20 and 100 kHz) to the four limbs and trunk. The examination process is detailed as follows: the participants stood upright with their bare feet placed on foot electrodes and their upper limbs abducted by gripping the hand electrode handles. Then, demographic data such as age, sex, and height were input into the machine. Data on the participants' body weight, body mass index, lean muscle mass, fat mass, and fat percentage are presented after the analysis results.

In addition to BIA, we adopted DXA for the body composition evaluation. Measurements in all the participants were performed through DXA by conducting whole-body scans using a Hologic Delphi densitometer (Hologic, Waltham, MA, USA). Data on the total lean muscle mass, lean muscle percentage, fat mass, fat percentage, T-score, Z-score, and bone mineral density (BMD) were analysed.

2.3. Physical capacity evaluation

We used the single-leg stance test to assess the balance ability of the participants. The participants were asked to stand on one leg without shoes with both hands on the hip and the heel of the other leg elevated to the calf height of the leg on which they were standing.[6] The test was performed two times with both legs with or without closed eyes, and the most efficient performance data were recorded. The timed chair-rise test was chosen to evaluate lower-extremity muscle strength. The participants were asked to sit with their arms folded on their chest in a straight-back chair with the back of the chair against a wall.[7] Subsequently, they were asked to stand upright from the seated position in a chair and then return to the seated position as many times as possible within 30 s. For the timed-up-and-go test, a line was drawn on the floor 3 m from a chair, and the height of the chair was between 40 and 45 cm above floor level. Participants were asked to rise from the chair with their hands on the armrest, walk at a self-determined and safe speed toward the line, and return to the previous seated position.[8] The time taken to perform the task was measured. Walking speed was evaluated using the 10-m walk test. Participants walked at their preferred speeds, and the time taken to traverse 10 m was recorded.[9]

2.4. Statistical analyses

Descriptive analysis was performed for both the male and female groups, and the means and standard deviations are presented. Pearson's test was performed to determine the association between the body composition variables and physical capacity variables. We hypothesized that DXA body composition and had better association for age people. And more fat composition had less physical capacity. Whereas more lean muscle mass aged people had better physical capacity. All data analyses were performed using IBM SPSS 20.0, with $P < 0.05$ considered statistically significant.

3. Results

A total of 56 male (mean age, 63.60 ± 7.24 years) and 64 female (mean age, 63.27 ± 7.23 years) participants were recruited. The BIA of male participants found 18.41 ± 5.1 Kg of body fat (26.29 ± 5.16%) and the DXA data of them were 20.32 ± 4.28 Kg (29.41 ± 3.42%) of body fat and 45.84 ± 4.87 Kg (66.42 ± 3.19%) of lean mass. With regards to physical function, the left leg stance test was 22.43 ± 9.86 s; the right leg stance test was 22.43 ± 9.45 s; the 30 s of timed chair-rise test was 16.77 ± 5.69 times; the timed-up-and-go test was 6.82 ± 1.73 s, and gait speed was 1.39 ± 0.26 m per second. For female participants, the BIA data was 20.88 ± 6.62 Kg (35.46 ± 6.86%) of fat and the DXA data for lean mass was 32.73 ± 4.03 Kg (56.88 ± 3.92%) of lean mass and 22.96 ± 5.13 Kg (39.62 ± 4.25%) of fat. In the physical function aspect, the left leg stance test was 22.63 ± 9.32 s; the right leg stance test was 22.74 ± 9.42 s; the 30 s of timed chair-rise test was 16.23 ± 4.36 times; the timed-up-and-go test was 6.67 ± 1.05 s, and gait speed was 1.45 ± 0.45 m per second (Table 1). No association was found of body composition by BIA and DXA, and physical capacity parameters of total participants (Table 2). There was positive association of body weight and timed-up-and-go test ($r = 0.269$, $p < 0.05$) but no significant association was observed between the body composition by both BIA and DXA and physical capability tests of the elderly

Please cite this article in press as: Huang S-W, et al., Correlation between Body Composition and Physical Performance in Aged People, International Journal of Gerontology (2018), https://doi.org/10.1016/j.ijge.2018.02.011