

# Correlation between Berg Balance Scale rating and Triceps Surae Strength in an elderly population

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**Abstract. Background and Purpose:** Nearly one-third of all people over the age of 65 will suffer a fall each year; of those who do fall, one-third will suffer a moderate to severe injury limiting their independence. Currently, people over the age of 65 make up 12% of the population; by 2030 this number is expected to increase to 17%. The purpose of the study was to determine if a statistically significant correlation between the Berg Balance Scale (BBS) rating and triceps surae strength as measured with a hand held dynamometer in an elderly population existed. **Subjects:** Thirty-four self-perceived healthy independent ambulators residing at a local retirement community age 64-90 years. **Methods:** Upon receiving consent, subjects completed a health questionnaire and a two minute warm up walk. Triceps surae strength was then measured three times on each leg using a hand held dynamometer. Subjects' balance was then measured using the BBS. **Results:** Using the Pearson correlation coefficient, a significant direct relationship was found between triceps surae strength and BBS rating. **Discussion and Conclusion:** These findings indicate that triceps surae strength may play an important role in balance. By developing strengthening programs for the elderly population that include the triceps surae muscle, the risk of falls may be decreased.

## 1. Introduction

As we age we lose muscle strength, proprioception and balance, resulting in increased falls. Balance is the foundation for mobility and functional independence and is often taken for granted. For older adults, a decline in the ability to maintain their balance often leads to injuries and falls.[1] Causes of falls due to the loss of balance in the elderly population (65 years and older) are multifactorial, involving the interaction between many different body systems. Over the years, studies have looked at the effects of aging on structural changes within the muscle itself and the impact it has on functional mobility in the elderly.[2-4] Results of aging lead to decreased force production, function, and mobility.[4] Daubney and Culham found that strength in ankle plantar flexors is important in balance in older adults.[5] Ankle plantar flexors are recruited first in response to small perturbations of the base of support while standing. Therefore, increased calf strength is important to balance during ankle strategy. [6] Static and dynamic balance can be objectively measured using the BBS. [6] The purpose of the study was to determine if a relationship existed between the BBS rating and calf muscle strength as measured with a hand held dynamometer in an elderly population.

## 2. Experiment, Results, Discussion, and Significance

Subjects were volunteers from a Wichita senior residential community which offered four levels of care. This sample of convenience yielded 34 subjects, seven men and twenty-seven women between the ages of 64 and 90 years (mean age = 81.62 years, SD = 4.66). Twenty-one subjects resided in independent duplexes receiving only building and lawn maintenance and were otherwise independent with ADLs. These subjects are classified as independent living (IL). Thirteen subjects resided in an assisted living area, receiving services such as meals, nursing, housekeeping, and assistance with ADLs; these subjects were classified as assisted living (AL). All subjects signed an informed consent before being tested. These subjects completed a self-reported health status checklist, perceived themselves to be healthy, and ambulated independently during the two minute warm-up and for household distances.

The instruments chosen for this study include the Berg Balance Scale (BBS) and a hand held dynamometer (HHD). The BBS is a reliable and valid instrument for measuring functional balance. [7, 8] The BBS measures balance by having the subjects perform 14 different functional tasks. The HHD is a portable, easy to use, reliable instrument that objectively measures muscle strength. [9-11]

Subjects warmed up by walking for two minutes. Immediately after the warm-up, the subject was positioned prone on a plinth, and calf muscle strength was measured and recorded three times on each leg with a hand held dynamometer. After being tested with the HHD, the BBS was used to measure the subjects' balance.

All data analysis was performed using SPSS Professional Statistics version 13.0 for Windows. Descriptive statistics were calculated for the sample as a whole (Table 1). The average of the 6 trials using the HHD was used as strength in the Pearson Product Moment Correlation to determine if relationships existed between this variable and total BBS ratings and BBS functional balance categories .[6, 12, 13]

Significant relationships were found in all analyses (Table 2). As strength increased, so did the total BBS ratings as well as the ratings of the BBS functional balance categories.

Table 1. Characteristics of subjects (n=34)

	Static <sup>a</sup>	Mvtbase <sup>b</sup>	Mvtoutbas <sup>c</sup>	Mvtall <sup>d</sup>	Age	Strength <sup>e</sup>	BBS Score
Mean	19.09	18.12	10.03	28.15	81.62	19.66	47.24
Std Dev	3.2	2.0	2.1	3.8	4.7	4.8	6.6

a= Position Maintenance, BBS tasks #2, 3, 6, 7, 13, 14

b= Movement within BOS, BBS tasks #1, 4, 8, 9, 10

c= Movements out of BOS, BBS tasks # 5, 11, 12

d= Movements in and out of BOS, BBS # 1, 4, 5, 8, 9, 10, 11, 12

e= Mean strength of triceps surae

Table 2. Correlations between BBS scores and Triceps Surae strength.

	Overall Score	Static <sup>a</sup>	mvtbase <sup>b</sup>	mvtoutbase <sup>c</sup>	mvtall <sup>d</sup>
Mean Strength	.504**	.515**	.490**	.347*	.440**

\*\* p≤ .01 \*p≤ .05

a= Position Maintenance, BBS tasks #2, 3, 6, 7, 13, 14

b= Movement within BOS, BBS tasks #1, 4, 8, 9, 10

c= Movements out of BOS, BBS tasks # 5, 11, 12

d= Movements in and out of BOS, BBS # 1, 4, 5, 8, 9, 10, 11, 12

### 3. Conclusions

In this type of an elderly population, triceps surae strength appears to be related to the BBS score. Decreased triceps surae strength is reflected as a decreased rating on the BBS which is associated with an increased risk of falls. Results from this study need to be confirmed with a more diverse elderly population. Research investigating the effect on the BBS score of an exercise program to strengthen the triceps surae would also be beneficial.

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